Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

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HSE Case Ref – 51134, Case 9

Final report of an investigation conducted into the circumstances surrounding the care, management and treatment delivered to the patient at Hospital 1 during the period from the antenatal care visit on 17th June 2009 to 3rd February 2010, the patient's admission to the hospital on the 9th February 2010 to the time of her baby's delivery on the 10th February and the period until the baby was transferred to the Special Care Unit at the hospital on 10th February 2010.

First Draft Report: November 2016

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Report commissioned by: Chief Clinical Director, Saolta University Health Care Group.

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Preface

This report has been prepared following a detailed systematic analysis of the events around the birth of your baby. Your clinical charts and other documentation have been reviewed. All possible key personnel involved at the time of your baby's birth, along with yourselves, were interviewed. The information from the documentation reviews and the interviews was collated and summarised into this systems analysis review report. This report outlines a detailed chronology of the events, key causal factors of the events (if found) and additional incidental findings. In its conclusion, the report has made recommendations to improve practice so that the likelihood of similar adverse events happening again can be reduced where possible.

I would like to unreservedly apologise for failings in the care provided to you and your baby. I am fully committed to implementing the recommendations and will ensure that there is a clear process for the communication of the work that is being undertaken for those who wish to be kept informed.

I would also like to apologise for the prolonged period it has taken to complete this review. I recognise the extreme frustration and additional upset this has caused and I am very sorry for it.

Dr. Pat Nash
Chief Clinical Director
Saolta University Health Care Group.

Acknowledgement

The investigation team would like to thank the patient and her husband for their participation in this investigation. The willingness of the patient to share her experience was invaluable in allowing this investigation to learn from her experience and in helping to make recommendations to improve the systems and processes in place at the hospital related to the delivery of Maternity Services.

The investigators would also like to thank all of the staff who participated in this investigation for their invaluable contribution.

Glossary of Terms

Term	
ALP	An Alkaline phosphatase test measures the amount of the enzyme ALP in the blood. ALP is made mostly in the liver and in bone with some made in the intestines and kidneys. It also is made by the placenta of a pregnant woman.
AMI	Amniotic Fluid Index
Amnisure ROM™ test	The Amnisure ROM™ test is approved for the diagnosis of rupture of membranes (ROM). Ref: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2744034/
Anoxic	Anoxic - relating to or marked by a severe deficiency of oxygen in tissues or organs (reference: http://www.thefreedictionary.com/anoxic)
Antepartum	Antepartum - occurring or existing before birth; "the prenatal period"; "antenatal care" (reference: http://www.thefreedictionary.com/Antepartum)
Antibodies	Antibody tests are done to find certain antibodies that attack red blood cells. Antibodies are proteins made by the immune system. Normally, antibodies bind to foreign substances, such as bacteria and viruses, and cause them to be destroyed (reference: http://www.webmd.com/a-to-z-guides/antibody-tests)
Apgar score	An objective score of the condition of a baby after birth. This score is determined by scoring the heart rate, respiratory effort, muscle tone, skin colour, and response to a catheter in the nostril. Each of these objective signs receives 0, 1, or 2 points. An Apgar score of 10 means an infant is in the best possible condition. The Apgar score is done routinely 60 seconds after the birth of the infant. A child with a score of 0 to 3 needs immediate resuscitation. The Apgar score is often repeated 5 minutes after birth, and in the event of a difficult resuscitation, the Apgar score may be done again at 10, 15, and 20 minutes. Ref:http://www.medicinenet.com/script/main/art.asp?articlekey=2303 Apgar Score: an index used to evaluate the condition of a newborn infant based on a rating of 0, 1, or 2 for each of the five characteristics of colour, heart rate, response to stimulation of the sole of the foot, muscle tone, and respiration with 10 being a perfect score. http://www.merriam-webster.com/dictionary/apgar%20score
APTT	Partial Thromboplastin Time is used when someone has unexplained bleeding or clotting. Along with the PT test (which evaluates the extrinsic and common pathways of the coagulation cascade), the aPTT is often used as a starting place when investigating the cause of a bleed or thrombotic (blood clot) episode. It is often used with recurrent miscarriages which may be associated with anticardiolipin or antiphospholipid antibodies. The aPTT and PT tests are also sometimes used as pre-surgical screens for bleeding tendencies, although numerous studies have shown that they are not useful for this purpose (reference; http://www.labtestsonline.org.uk/understanding/analytes/aptt/tab/test).
Artificial Rupture of Membranes (ARM)	An artificial rupture of the foetal membranes is usually performed to stimulate or accelerate the onset of labour (reference: http://medical-dictionary.thefreedictionary.com/amniotomy)
Assisted Birth	An assisted birth (sometimes called an instrumental or operative vaginal birth) uses instruments (either forceps or ventouse) that are attached to your baby's head so that s/he can be pulled out (reference: http://www.babycentre.co.uk/pregnancy/labourandbirth/labourcomplications/assisteddelivery/).
Baby Cooling / Brain Hypothermia	Brain Hypothermia, induced by cooling a baby to around 33 °C for three days after birth, is a treatment for hypoxic ischemic encephalopathy. It has recently been proven to be the only medical intervention which reduces brain damage, and improves an infant's chance of survival and reduced disability. Hypothermic neural rescue therapy is an evidence-based clinical treatment which increases a severely injured full term infant's chance of surviving

	without brain damage detectable at 18 months by about 50%, an effect which seems to be sustained into later childhood. (references: Edwards, AD; Brocklehurst, P; Gunn, AJ; Halliday, H; Juszczak, E; Levene, M; Strohm, B; Thoresen, M; Whitelaw, A; Azzopardi, D. (2010). "Neurological outcomes at 18 months of age after moderate hypothermia for perinatal hypoxic ischaemic encephalopathy: synthesis and meta-analysis of trial data". BMJ (Clinical research ed.) 340: c363. Shankaran, S; Pappas, A; McDonald, SA; Vohr, SR; Hintz, SR; Yolton, K; Gustafson, KE; Leach, TM; Green, C et al. (2012). "Childhood outcomes after hypothermia for neonatal encephalopathy". New England Journal of Medicine 366 (22): 2085–92. Guillet, R; Edwards, AD; Thoresen, M; CoolCap Trial Group (2011). "Seven- to eight-year follow-up of the CoolCap trial of head cooling for neonatal encephalopathy.". Pediatr Res 71 (2): 205–9. Rutherford, M; Ramenghi, LA; Edwards, AD; Brocklehurst, P; Halliday, H; Levene, M; Strohm, B; Thoresen, M et al. (2010). "Assessment of brain tissue injury after moderate hypothermia in neonates with hypoxic-ischaemic encephalopathy: a nested substudy of a randomised controlled trial". Lancet neurology 9 (1): 39–45. Robertson, NJ; Nakakeeto, M; Hagmann, C; Cowan, FM; Acolet, D; Iwata, O; Allen, E; Elbourne, D et al. (2008). "Therapeutic hypothermia for birth asphyxia in low-resource settings: a pilot randomised controlled trial". Lancet 372 (9641): 801–3.
Baseline Foetal Heart Rate (FHR)	Baseline foetal heart rate is the average fetal heart rate (FHR) rounded to increments of 5 beats per minute during a 10-minute segment, excluding periodic or episodic changes, periods of marked variability, or baseline segments that differ by more than 25 beats per minute. In any given 10-minute window, the minimum baseline duration must be at least 2 minutes, or else the baseline is considered indeterminate. In cases where the baseline is indeterminate, the previous 10-minute window should be reviewed and utilized in order to determine the baseline. A normal FHR baseline rate ranges from 110 to 160 beats per minute. If the baseline FHR is less than 110 beats per minute, it is termed bradycardia. If the baseline FHR is more than 160 beats per minute, it is termed tachycardia.
Baseline FHR Variability	Baseline FHR variability is based on visual assessment and excludes sinusoidal patterns. Variability is defined as fluctuations in the FHR baseline of 2 cycles per minute or greater, with irregular amplitude and inconstant frequency. These fluctuations are visually quantitated as the amplitude of the peak to trough in beats per minute. By visual assessment, acceleration is defined as an apparent abrupt increase in FHR above baseline, with the time from the onset of the acceleration to the acme of less than 30 seconds. Late deceleration is defined as an apparent gradual decrease and return to baseline FHR in association with a uterine contraction, with the time from onset of the deceleration to its nadir as 30 seconds or longer. Early deceleration is defined as an apparent gradual decrease and return to the baseline FHR in association with a uterine contraction, with the time from onset of the deceleration to its nadir as 30 seconds or longer. Variable deceleration is defined as an apparent abrupt decrease in FHR below the baseline, with the time from the onset of the deceleration to the nadir of the deceleration as less than 30 seconds. The decrease is measured from the most recently determined portion of the baseline. Variable decelerations may or may not be associated with uterine contractions. The decrease from baseline is 15 beats per minute or higher and lasts less than 2 minutes from onset to return to baseline. When variable decelerations occur in conjunction with uterine contractions, their onset, depth, and duration may vary with each successive uterine contraction (reference: Robinson B. (2008) A Review of NICHD Standardized Nomenclature for Cardiotocograph: The Importance of Speaking a Common Language When Describing Electronic Fetal Monitoring. Rev Obstet Gynecol, 2008 Spring; 1(2): 56-60 (Available from: http://medical-dictionary.thefreedictionary.com/premature+labor). http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2505172/).
BMI	Body Mass Index

BP	Blood Pressure
BPD	Biparietal diameter, the diameter of the fetal head as measured from one parietal bone to the other. The measurement is useful in dating the pregnancy and estimating fetal weight after about 13 weeks of pregnancy. (reference: The American Heritage® Medical Dictionary Copyright © 2007, 2004 by Houghton Mifflin Company. Published by Houghton Mifflin Company).
BPS	Biophysical Profile Score
Bradycardia	Bradycardia is a slow heart rate usually defined as less than 60 beats per minute (reference: http://www.medterms.com/script/main/art.asp?articlekey=2515)
Breech	Breech means that the baby is lying bottom first or feet first in the womb (uterus) instead of in the usual head first position. In early pregnancy, breech is very common. As pregnancy continues, a baby usually turns naturally into the head first position. Between 37 and 42 weeks (term), most babies are lying head first ready to be born. Three in every 100 (3%) babies are breech at the end of pregnancy (reference: http://www.rcog.org.uk/womens-health/clinical-guidance/breech-baby-end-pregnancy).
C&S	Culture and Sensitivity
Caesarean Section	There are two types of Caesarean Sections: the classical Caesarean Section, and the Lower Segment Caesarean Section. The classical section involves a midline longitudinal incision which allows a larger space to deliver the baby. The Lower Segment Caesarean Section, more commonly used today, involves a smaller transverse cut which results in less blood loss and is easier to repair (reference http://www.news-medical.net/health/Cesarean-Section-Types.aspx)
Cardiopulmonary Resuscitation	Cardiopulmonary resuscitation involves physical interventions to create artificial circulation through rhythmic pressing on the patient's chest to manually pump blood through the heart, called chest compressions, and usually also involves the rescuer exhaling into the patient (or using a device to simulate this i.e. an ambu bag and oxygen mask) to ventilate the lungs and pass oxygen in to the blood, called artificial respiration
Cardiotocography	In medicine (obstetrics), cardiotocography (CTG) is a technical means of recording (-graphy) the fetal heartbeat (cardio-) and the uterine contractions (-toco-) during pregnancy, typically in the third trimester. The machine used to perform the monitoring is called a cardiotocograph, more commonly known as an electronic fetal monitor (EFM).
Cephalic Presentation	A cephalic presentation is a situation at childbirth where the foetus is in a longitudinal lie and the head enters the pelvis first; the most common form is the vertex presentation where the occiput (back part of the head or skull) is the leading part (Reference: Hellman LM, Pritchard JA. Williams Obstetrics, 14th edition, Appleton-Century-Crofts (1971) Library of Congress Catalogue Card Number 73-133179. p. 322–2)
Cerclage	Stitch around the cervix in an attempt to close it and keep it closed to prevent miscarriage or preterm delivery.
Cervix	Neck of the Womb
Chorioamionitis	Chorioamnionitis is a condition that can affect pregnant women. In this condition, bacteria infects the chorion and amnion (the membranes that surround the fetus) and the amniotic fluid (in which the fetus floats). This can lead to infections in both the mother and fetus.
CMM	Clinical Midwife Manager
CNM	Clinical Nurse Manager
Coliform(s)	Coliform(s) is a term often applied to a broad group of Gram negative bacilli before they are fully identified to species level by the Microbiology laboratory.
CIS	The Clinical Indemnity Scheme (CIS) was established in 2002, in order to rationalise pre-existing medical indemnity arrangements by transferring to the State, via the Health Service Executive (HSE), hospitals and other health agencies, responsibility for managing clinical negligence claims and associated risks (Reference: http://www.stateclaims.ie/ClinicalIndemnityScheme/introduction.html). State Claims Agency (2009). The State Claims Agency Clinical Indemnity Scheme Incident Notification Requirements. Available from

	http://www.stateclaims.ie/ClinicalIndemnityScheme/publications/2009/SCACISIncidentNotificationReqs.pdf [accessed 7th March 2013].
Cord blood Ph	A low pH (less than 7.04 to 7.10) means there are higher levels of acids in the baby's blood. This might occur when the baby does not get enough oxygen during labor (Reference: http://www.nlm.nih.gov/medlineplus/ency/article/003403.htm).
CRL	Crown-rump length: The fetal crown rump length (CRL) is defined as the longest length excluding the limbs & yolk sac. It is the measurements between the top of the head to the area above where the legs begin.(reference: http://www.babymed.com/fetus-crown-rump-length-crl-measurements-ultrasound).
CRP	C-Reactive Protein, a measure of inflammation
CTG	CTG is a technical means of recording the foetal heartbeat and the uterine contractions during pregnancy, typically in the third trimester. (Reference: Macones GA, Hankins GD, Spong CY, et al. The 2008 National Institute of Child Health and Human Development workshop report on electronic foetal monitoring: update on definitions, interpretation, and research guidelines Obstet Gynecol (2008) 112:661-666) A 'Normal' CTG is indicated when all four features (foetal heart rate, baseline variability, acceleration and deceleration of the foetal heart rate and frequency and strength of contractions as recorded by the attending healthcare professional) fall within the reassuring category i.e. they fall within the normal ranges as outlined on page 16 of this report. A 'Suspicious' CTG is when one feature falls within the nonreassuring category and the remainder are reassuring. A 'Pathological' CTG is when two or more features fall within the nonreassuring category or one or more features fall within the abnormal category (reference: Regional Maternity Department, Midland Regional Hospital at Portlaoise: Foetal Heart Monitoring in the Maternity Department. Approval date: April 2011)
CX	Cervix
Cytotec	Cytotec makes the uterus contract and expel the pregnancy tissue (reference: http://www.whcoso.com/index.cfm/fuseaction/site.content/type/index.cfm/fuseaction/site.content/mode/dtl/type/45105/post/61678.cfm)
Doppler Sonography	This technique uses reflected sound waves to measure blood flow in different parts of the baby's body. Doppler assessment of the placental circulation assists screening for impaired placentation and its complications of pre-eclampsia, intrauterine growth restriction and perinatal death.
E. coli	*E. coli (Escherichia coli)* is one of several types of Gram negative bacilli bacteria that normally inhabit the intestine of humans. Some strains of *E. coli* are capable of causing disease under certain conditions.
ECG	Electrocardiogram
EDD	Estimated Date of Delivery
EEG	Electroencephalogram
Electronic Fetal Monitor (EFM)	In medicine (obstetrics), cardiotocography (CTG) is a technical means of recording (-graphy) the fetal heartbeat (cardio-) and the uterine contractions (-toco-) during pregnancy, typically in the third trimester. The machine used to perform the monitoring is called a cardiotocograph, more commonly known as an electronic fetal monitor (EFM)
Effacement	Effacement relates to the softening and shortening of the cervical canal from about 3cm long to less than 0.5cm long. (Reference: National Collaborating Centre for Women's and Children's Health 2008 ClinicalGuideline; Induction of Labour RCOG Press London)
Endotracheal Intubation	Endotracheal intubation is the insertion of a tube into the trachea for purposes of anesthesia, airway maintenance, aspiration of secretions, lung ventilation, or prevention of entrance of foreign material into the airway; the tube goes through the nose or mouth (reference : http://medical-dictionary.thefreedictionary.com/intubation)
Entenox	Entenox is used as an analgesia and can be self administered using a demand valve which is popular in obstetric practice (Reference: British National Formulary 2009)
Epidural	Epidural analgesia is a central nerve blockade technique, which involves the

Analgesia	injection of a local anaesthetic, with or without an opioid into the lower region of the spine close to the nerves that transmit painful stimuli from the contracting uterus and birth canal (reference: http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD009234.pub2/pdf).
ERPC	ERPC is an evacuation of retained products of conception (reference: http://www.nhs.uk/Conditions/Miscarriage/Pages/Treatment.aspx)
ESBL	Extended-Spectrum Beta-Lactamases ESBL-producing bacteria are bacteria that produce enzymes that may break down commonly used antibiotics.
EFW	Estimated Foetal Weight
External Cephalic Version	External Cephalic Version is when pressure is put on the tummy to try to turn the baby into a head-down (cephalic) position (reference: http://www.nhs.uk/conditions/pregnancy-and-baby/pages/breech-birth.aspx#close).
FH	Foetal Heart
FHR	Foetal Heart Rate
Foetal Biometric Parameters	Foetal biometric parameters are various antenatal ultrasound measurements that are used to indirectly assess the growth and well being of the foetus and in assessing dates - gestational age (reference: http://radiopaedia.org/articles/fetal-biometric-parameters)
Foetal Bradychardia	An abnormally slow fetal heart rate, usually below 100 beats/min. Ref Mosby's Medical Dictionary, 8th edition. © 2009, Elsevier.
Full Blood Count (FBC)	Full Blood Count (FBC) is used as a broad screening test to check for such disorders as anaemia, infection, and many other diseases. It is actually a panel of tests that examines different parts of the blood (reference: http://www.labtestsonline.org.uk/understanding/analytes/fbc/tab/test).
Fetal Scalp Electrode	An electrode that is attached to the baby's scalp and connected to the CTG machine so that a trace of the fetal heart can be recorded electronically
Fundal Height	Fundal height is the height of the fundus of the uterus, measured in centimetres from the top of the symphysis pubis to the highest point in the midline at the top of the uterus. Fundal height is measured at each prenatal visit with large blunt callipers or with a tape measure. From the twentieth to the thirty-second week of pregnancy the height in centimetres is equal to the gestation in weeks (reference: http://medical-dictionary.thefreedictionary.com/fundal+height).
Galfer FA	Galfer FA capsules contain two active ingredients, ferrous fumarate and folic acid. Ferrous fumarate is a form of iron and folic acid is a member of the B group of vitamins.(reference: http://www.netdoctor.co.uk/diet-and-nutrition/medicines/galfer-fa.html#ixzz38lT4hwU0).
GBS	Group-B Streptococcus
Gram negative bacilli	Gram negative bacilli are a type of bacteria. The name is derived from a type of staining called Gram staining where these particular bacteria do not retain the stain. This is characteristic of bacteria having a cell wall surface more complex in chemical composition than the gram-positive bacteria.
GTT	Glucose Tolerance Test
Hartmann's Solution	Solutions of electrolytes are given intravenously, to meet normal fluid and electrolyte requirements or to replenish substantial deficits or continuing losses, when the patient is nauseated or vomiting and in unable to take adequate amounts by mouth. Hartmann's Solution contains sodium chloride 0.6%, sodium lactate 0.25%, potassium chloride 0.04%, calcium chloride 0.027% (reference: British National formulary 2009).
H1N1	Swine influenza virus
Haemoglobin (Hb)	A conjugated protein, consisting of haem and the protein globin, that gives red blood cells their characteristic colour. It combines reversibly with oxygen and is thus very important in the transportation of oxygen to tissues (reference: http://www.thefreedictionary.com/haemoglobin). Low levels of haelmoglobin in pregnancy can indicate anaemia (reference: http://www.cyh.com/healthtopics/healthtopicdetails.aspx?p=438&np=459&id=2759#haemoglobin)
Haemagglutin	Haemagglutination inhibition test is a serologic technique useful in testing for

ation inhibition test	certain unknown soluble antigens. The unknown antigen is mixed with a known agglutinin. If a reaction occurs, the agglutinin can no longer adhere to the cells or particles that carry its corresponding antigen, and the unknown antigen is thus identified (reference: http://medical-dictionary.thefreedictionary.com/agglutination-inhibition+test)
HDU	High Dependency Unit
HR	Heart rate
HSE	Health Service Executive
Hypoxic Ischemic Encephalopathy	Hypoxic Ischemic Encephalopathy has many causes and is essentially the reduction in the supply of blood or oxygen to a baby's brain before, during, or even after birth. It is a major cause of death and disability, occurring in approximately 2-3 per 1000 births and causing around 20% of all cases of cerebral palsy. Hypoxic ischemic encephalopathy (HIE) is a condition that occurs when the entire brain is deprived of an adequate oxygen supply, but the deprivation is not total. While HIE is associated in most cases with oxygen deprivation in the neonate due to birth asphyxia, it can occur in all age groups, and is often a complication of cardiac arrest. Busl, K. M., Greer, D. M., "Hypoxic-ischemic brain injury: pathophysiology, neuropathology and mechanisms". NeuroRehabilitation. 2010 Jan;26(1):5-13. Allen K, Brandon D, 2011, Hypoxic Ischemic Encephalopathy: Pathophysiology and Experimental Treatments, *Newborn Infant Nurs Rev*. September 1; 11(3): 125–133.
ICU	Intensive Care Unit
Intermittent Auscultation	Intermittent auscultation employs listening to foetal heart sounds at periodic intervals to assess the foetal heart rate (FHR) using either a Pinard stethoscope or a hand held (Doppler) devise (reference: Regional Maternity Department MRH Mullingar and MRH Portlaoise Foetal Heart Monitoring in the Maternity Department. Approval date: April 2011)
IOL	Induction of Labour is a method of artificially or prematurely stimulating childbirth in a woman (Reference: National Collaborating Centre for Women's and Children's Health 2008 Clinical Guideline; Induction of Labour RCOG Press London)
Iron supplements	Routine iron supplementation is a common practice for preventing iron deficiency (ID) and iron deficiency anemia (IDA) in pregnancy, because the dietary iron intake of pregnant women often does not meet the recommended dietary intake (reference: http://www.ajcn.org/content/83/5/1112.full.pdf).
ISBAR	Identify, Situation, Background, Assessment, Recommendation.
Ischial spines	Ischial spines are two relatively sharp posterior bony projections into the pelvic outlet from the ischial bones that form the lower border of the pelvis (reference http://medical-dictionary.thefreedictionary.com/ischial+spines). The spines are the narrowest part of the pelvis and they are natural measuring point for the delivery progress. If the presenting part of the baby (the head, shoulder, buttocks or feet) lies above the Ischial spines, the foetal position is reported as a negative number from -1 to -5 (each number is a centimetre). If the presenting part lies below the Ischial spines, the station is reported as a positive number from +1 to +5. The baby is said to be 'engaged' in the pelvis when it is even with the Ischial spines at 0 station (reference: http://www.umm.edu/ency/article/002060.htm)
K2 Fetal Monitoring Training System	K2 Fetal Monitoring Training System is an interactive computer based training system covering a comprehensive spectrum of learning that can be accessed over the internet. (Reference: http://www.k2ms.com/products/fetal_monitoring_training_system_online.html#2).
Labour (stages)	The first stage of labour is the process of reaching full cervical dilatation. This begins with the onset of uterine labour contractions, and it is the longest phase of labour. The first stage is divided into three phases: latent, active, and deceleration. The second stage is the delivery of the infant. The third stage of labour is the passage of the placenta (reference: http://www.umm.edu/pregnancy/000126.htm#ixzz1x0x7XMI5).
Liquor	Liquor is amniotic fluid within the amniotic cavity produced by the amnion

	during the early amniotic period and later by the lungs and the kidneys. Amniotic fluid protects the embryo and foetus from injury. (Reference: Dorland's Illustrated Dictionary 31ed)
Lithotomy Position	Lithotomy position in which the patient is on their back with the hips and knees flexed and the thighs apart. The position is often used for vaginal examinations and childbirth (reference: http://www.medterms.com/script/main/art.asp?articlekey=25628)
LFTs	Liver Function Tests are used to evaluate how well the liver is working (liver function) (reference: http://www.nlm.nih.gov/medlineplus/ency/article/003436.htm).
LMP	Last Menstrual Period
Left occipitoposterior (LOP)	The occiput (back of baby's scull) faces posteriorly (behind) and towards left.
Macerated Stillbirth	A macerated stillbirth is defined as having degenerative skin changes as recorded by the delivering clinician and is presumed to have occurred 12 hours or more before delivery. A recent (fresh) stillbirth is defined as having no such skin changes and is presumed to have occurred within 12 hours of delivery, usually in labour (reference: http://journals.lww.com/greenjournal/Fulltext/2011/05000/Determinants_of_Stillbirth_in_Zambia.18.aspx)
Mané	The next morning
MCH	The average amount of hemoglobin in the average red cell. MCH is particularly important when testing for anaemia. http://www.babymed.com/laboratory-values/mean-corpuscular-hemoglobin-mch-whole-blood-during-pregnancy)
MCV	Mean Corpuscular Volume measures the size of an average red blood cell. Low mean corpus volume can be associated with anemia, thalassemias, iron deficiency and Shahidi-Nathan-Diamond syndrome. High mean corpus volume can be caused by vitamin B12 deficiency, impaired vitamin absorption, hyperthyroidism, celiac disease and deficient enzymes (reference: http://www.babymed.com/laboratory-values/mean-corpuscular-volume-mcv-whole-blood-during-pregnancy)
Meconium	Meconium is the greenish-black sticky material passed from the baby's bowels after birth. In some instances, the foetus will pass meconium into the amniotic fluid while still in the womb, indicated by the presence of meconium staining of the liquor after the membranes have ruptured. Meconium staining is more common approaching and after term. It may indicate the presence of foetal distress in labour, but not universally so (reference: http://www.nice.org.uk/nicemedia/live/12012/41255/41255.pdf)
Membrane (Cervical) Sweep	A membrane (cervical) sweep is a vaginal examination during which a finger is used to sweep the neck of the womb to try to separate the membrane from the cervix. This can encourage the body to release a hormone called Prostaglandins that work to soften and thin the cervix which might encourage labour to start naturally in the next 48 hours (reference: http://nhslocal.nhs.uk/story/features/membrane-sweeps-and-inductions).
Meninges	Meninges are the three membranes that enclose the vertebrate brain and spinal cord: the pia mater, arachnoid, and dura mater (reference: http://www.thefreedictionary.com/Meninges).
MOET	Managing Obstetric Emergencies and Trauma
MRSA	Multidrug Resistant *Staphylococcus aureus*
MSU test	Midstream Urine test
Multigravida	A woman who has 2 or more pregnancies.
NaCl	Sodium Chloride contains sodium chloride 0.9% (reference: British National Formulary 2009).
NAD	No Abnormality Detected
Neutrophil	A neutrophil is a type of mature (developed) white blood cell that is present in the blood. White blood cells help protect the body against diseases and fight infections (reference: http://www.medfriendly.com/neutrophil.html
Newborn hypoxic-	Newborn hypoxic-ischaemic brain injury differs from injury in the adult brain in several ways: NMDA receptor toxicity is much higher in the immature brain.

ischaemic brain injury	Apoptotic mechanisms including activation of caspases, translocation of apoptosis-inducing factor and cytochrome-c release are much greater in the immature than the adult. The inflammatory activation is different with less contribution from polymorphonuclear cells and a more prominent role of IL-18 whereas IL-1, which is critical in the adult brain, is less important. The anti-oxidant system is underdeveloped with reduced capacity to inactivate hydrogen peroxide. Wang, X.; Carlsson, Y.; Basso, E.; Zhu, C.; Rousset, C. I.; Rasola, A.; Johansson, B. R.; Blomgren, K. et al. (2009). "Developmental Shift of Cyclophilin D Contribution to Hypoxic-Ischemic Brain Injury". Journal of Neuroscience 29 (8): 2588–96. Ferriero, DM (2004). "Neonatal brain injury". The New England Journal of Medicine 351 (19): 1985–95.
NIMLT	National Incident Management and Learning Team
Nocte	At night
Nuchal Translucency	Nuchal Translucency is the collection of fluid under the skin at the back of the baby's neck. The nuchal is measured using ultrasound when the foetus is between 11 weeks and 13 weeks plus six days gestation. All foetuses will have some fluid; those with Down's Syndrome have an increased amount (reference: http://www.bmihealthcare.co.uk/treatment/treatmentsdetail?p_name=1%20-%20Nuchal%20translucency%20scan%20(11-13%20weeks)&p_treatment_id=415.
Occiput Posterior Position	The most common position for a baby during labour is head down with the back of the head (occiput) facing the front of the mother (anterior). When the back of the head is facing the back of the mother (posterior) the baby's position is called Occiput Posterior (reference: http://www.birthingnaturally.net/birth/challenges/posterior.html)
O&G	Obstetrics and Gynaecology
O/E	On examination
(O)EWS	(Obstetric) Early Warning Score
Operative vaginal delivery	Operative vaginal delivery refers to the application of either forceps or a vacuum device to assist the mother in effecting vaginal delivery of a fetus. Ali U and Norwitz E, 2009,Vacuum-Assisted Vaginal Delivery *Rev Obstet Gynecol.* Winter; 2(1): 5–17.
Os	The OS is the outlet of the cervix, which will stretch during labour from two to three millimetres up to ten centimetres to allow baby to emerge. Once the birth process has occurred, the OS changes in size and shape. The two descriptions given to the appearances are either a nullip's os, for a first pregnancy, or a multip's os for subsequent pregnancies. http://www.netdoctor.co.uk/ate/pregnancyandchildbirth/205040.html#ixzz31WTlfpx9
Para	Para is a woman who has produced one or more viable offspring, regardless of whether the child or children were living at birth (reference: http://medical-dictionary.thefreedictionary.com/para).
Partogram	A partogram provides an instant picture of the labour and its progress
PCR	Polymerase Chain Reaction
Perinatal	The World Health Organisation defines the perinatal period as commencing at 22 completed weeks (154 days) of gestation and ending seven completed days after birth. http://www.who.int/maternal_child_adolescent/topics/maternal/maternal_perinatal/en/
PET	Pre-eclamptic toxaemia (PET) is also called Toxemia of Pregnancy or pregnancy induced hypertension. This is a syndrome that develops after the 20th week of pregnancy. It is characterized by: •Persistent high blood pressure at or above 140/90mmHg. •Edema or swelling of the feet and ankles. •Proteinuria or presence of protein in the urine. Edema is usually the first sign to occur followed by high blood pressure and then by proteinuria. Ref: http://gynaeonline.com/PET.htm
PGE2	Prostaglandin E_2

Ph	A figure expressing the acidity or alkalinity of a solution on a logarithmic scale on which 7 is neutral, lower values are more acid and higher values more alkaline. A low pH (less than 7.04 to 7.10) means there are higher levels of acids in the baby's blood. This might occur when the baby does not get enough oxygen during labor (Reference: http://www.nlm.nih.gov/medlineplus/ency/article/003403.htm)
PPROM	Preterm Pre-labour Rupture of Membranes
PPV	Positive Pressure Ventilation
Presentation	Presentation of foetus: that part of the foetus lying over the pelvic inlet; the presenting body part of the fetus. **Vertex (VX) presentation:** Head presentation of the foetus during birth in which the upper back part of the foetal head is the presenting part. **Breech presentation:** presentation of the foetal buttocks or feet in labour; the feet may be alongside the buttocks (complete breech p.); the legs may be extended against the trunk and the feet lying against the face; or one or both feet or knees may be prolapsed into the maternal vagina. **Cephalic presentation**: presentation of any part of the foetal head in labour, whether the vertex, face, or brow. (reference: The American Heritage® Medical Dictionary, 2004 Published by Houghton Mifflin Company; Medical Dictionary for the Health Professions and Nursing © Farlex 2012)
Primagravida	Woman pregnant for the first time
Prostaglandin	Any of a group of naturally occurring, chemically related fatty acids that stimulate contractility of the uterine and other smooth muscle (Reference: The Free Dictionary. Available from http:medical-dictionary the free dictionary.com prostaglandin)
PTT	PTT (Partial Thromboplastin Time) is used when someone has unexplained bleeding or clotting. Along with the PT test (which evaluates the extrinsic and common pathways of the coagulation cascade), the PTT is often used as a starting place when investigating the cause of a bleed or thrombotic (blood clot) episode. It is often used with recurrent miscarriages which may be associated with anticardiolipin or antiphospholipid antibodies. The PTT and PT tests are also sometimes used as pre-surgical screens for bleeding tendencies, although numerous studies have shown that they are not useful for this purpose (reference; http://www.labtestsonline.org.uk/understanding/analytes/aptt/tab/test).
PV	Per Vaginam (Latin) meaning via/ through the vagina (Reference: Mosby's Medical Dictionary, 8th edition. © 2009, Elsevier)
RCOG	Royal College of Obstetricians and Gynaecologists
Resuscitaire	A resuscitaire is a device which combines an effective warming therapy platform along with the components needed for clinical emergency and resuscitation (reference: http://www.draeger.ae/AE/en_US/products/neonatal_care/)
Resuscitated Stillbirth	Resuscitated Stillbirth is where an infant is stillborn and, following active resuscitation, a heart beat is detected, the birth is required to be registered as a livebirth. If the infant subsequently dies up to 28 days of age registration as a neonatal death is necessary (Reference: Perinatal Society of Australian New Zealand (Perinatal Mortality Group) (2009) Clinical Practice Guidelines for Perinatal Mortality. Available from http://www.stillbirthalliance.org.au/doc/Section_1_Version_2.2_April_2009.pdf [accessed 8th March 2013].
SBAR	Situation, Background, Assessment, Recommendation.
Show	A 'show' is the passage of small quantities of blood-tinged mucus from the vagina at the onset of labour (reference: http://medical-dictionary.thefreedictionary.com/premature+labour)
Smear Test	A screening test for precancerous and cancerous cells on the cervix. This simple test is done during a routine pelvic exam and involves scraping cells from the cervix (reference: http://medical-dictionary.thefreedictionary.com/smear+test).
Sonicaid	Hand held ultrasound monitor that is used to detect fetal heart rate
SCBU	Special Care Baby Unit

SpR	Specialist Registrar
SROM	Spontaneous Rupture of Membranes
Stages of Labour	The first stage of labour is the process of reaching **full cervical dilatation**. This begins with the onset of uterine labour contractions, and it is the longest phase of labour. The first stage is divided into three phases: latent, active, and deceleration. The second stage is the **delivery of the infant**. The third stage of labour is the **passage of the placenta (reference:** http://www.umm.edu/pregnancy/000126.htm#ixzz1x0x7XMI5).
STAT	Medication given immediately as a single dose
Stillbirth	The definition recommended by WHO for international comparison is a baby born with no signs of life at or after 28 weeks' gestation. (http://www.who.int/maternal_child_adolescent/epidemiology/stillbirth/en/)
SVD:	Spontaneous Vaginal Delivery: a vaginal birth occurring without the mechanical assistance of obstetric forceps or vacuum aspirator. (reference Mosby's Medical Dictionary, 8th edition. © 2009, Elsevier)
Sweep	A membrane (cervical) sweep is a vaginal examination during which a finger is used to sweep the neck of the womb to try to separate the membrane from the cervix. This can encourage the body to release a hormone called Prostaglandins that work to soften and thin the cervix which might encourage labour to start naturally in the next 48 hours (reference: http://nhslocal.nhs.uk/story/features/membrane-sweeps-and-inductions).
Syntocinon	Syntocinon is administered to induce or augment labour, usually in conjunction with amniotomy (surgical rupture of the foetal membrane to induce labour) (reference British National Formulary 2008).
Syntometrine	An injection of Syntometrine is given in the third stage of labour, just after the birth of the child to facilitate delivery of the placenta and to prevent postpartum hemorrhage by causing smooth muscle tissue in the blood vessel walls to narrow, thereby reducing blood flow. (reference: http://www.netdoctor.co.uk/pregnancy/medicines/syntometrine.html)
Systems Analysis Investigation	A systems analysis investigation is a structured investigation that aims to identify the systems cause(s) of an incident or complaint and the actions necessary to eliminate the recurrence of the incident or complaint or where this is not possible to reduce the likelihood of recurrence of such an incident or complaint as far as possible. Healthcare services carry out incident investigations using systems analysis to find out what happened, how it happened, why it happened, what the organisation can learn from the incident and what changes the organisation should make to prevent it happening again.
Systolic Blood Pressure	Systolic blood pressure is the pressure exerted on the bloodstream by the heart when it contracts, forcing blood from the ventricles of the heart into the pulmonary artery and the aorta (reference: http://medical-dictionary.thefreedictionary.com/Systolic+blood+pressure)
Term	The normal duration of pregnancy is approximately 37 – 42 weeks, with the estimated due date at 40 weeks or 280 days from the first day of the last menstrual period (reference: http//www.uptodate.com/contents/post-term pregnancy-beyond-the-basics)
U&E	U&E is the abbreviation used for urea and electrolytes. These are a group of blood tests to measure the levels of salts in the blood (such as sodium and potassium), as well as the urea and creatinine levels, which show the kidney function as they are waste products. (reference: http://www.patient.co.uk/health/nephrotic-syndrome-leaflet)
U/S	Ultrasound. A pregnancy ultrasound is an imaging test that uses sound waves to create a picture of how a baby is developing in the womb. It is also used to check the female pelvic organs during pregnancy. http://www.medicinenet.com/script/main/art.asp?articlekey=9509
UBAC	Unassisted Birth after Caesarean
VE	Vaginal Examination
Ventouse Delivery	An apparatus sometimes used to assist the delivery of a baby, consisting of a cup which is attached to the fetal head by suction, and a chain by which traction can be exerted in order to draw out the baby

	http://dictionary.reference.com/browse/ventouse Ventouse, also known as vacuum-assisted vaginal delivery or vacuum extraction (VE), is a method to assist delivery of a baby using a vacuum device. It is used in the second stage of labour if it has not progressed adequately. It may be an alternative to a forceps delivery and caesarean section. It cannot be used when the baby is in the breech position or for premature births. eMedicine - Vacuum Extraction : Article by John P O'Grady Retrieved March 3rd 2015 http://emedicine.medscape.com/article/271175-overview Vacca, Aldo (2009). Handbook of Vacuum Extraction in Obstetric Practice, 3rd edition. Vacca Research.
Wessermann Reaction	Wessermann Reaction is diagnostic test for syphilis involving the fixation or inactivation of a complement by an antibody in a blood serum sample (reference: http://www.thefreedictionary.com/Wassermann+reactions)
Vx	Vertex
White Cell Count	A white cell count is a test to measure the number of white blood cells (WBCs) in the blood. EBCs help fight infections. They are also called leukocytes. There are five major types of white blood cells: Basophils, Eosinophils, Lymphocytes, (T cells and B cells), Monocytes, Neutrophils. Reference: http://www.nim.nih.gov/medicineplus/ency/article/003643.htm)

1.0 Executive Summary

In February 2015, a decision was made to commission a full review of the Maternity Service at this hospital; the decision was made on the basis of a preliminary review that was completed the previous December i.e. December 2014. An integral part of the full review that was commissioned was a review of the care of the women who were the subject of the preliminary review and of a number of other women's cases that were identified following conclusion of the preliminary review.

This is the report of the investigation conducted into the care of one of the affected women referenced above. The investigation examined the circumstances surrounding the care, management and treatment delivered to the woman at the hospital during the period from the first antenatal care visit on 17th June 2009 to the last visit on 3rd February 2010. The patient's admission to the hospital on 9th February 2010 to the time of her baby's delivery on 9th February 2010, the period until the baby was transferred to the Special Care Unit at the Hospital on 10th February 2010.

The aim of the investigation was to:

1. Undertake a review of the patient's perinatal care (from their presentation for care at the Maternity Unit to their immediate postnatal care). In addition the investigation will include a review of the initial neonatal care provided to the patient's baby. The investigation will focus on:
   - **a.** Establishing the factual circumstances leading up to the adverse perinatal event.
   - **b.** Identifying any key causal factors that may have occurred.
   - **c.** Identifying the contributory factors that led to the key causal factors.
   - **d.** Recommend actions that will address the contributory factors so that the risk of future harm arising from these factors is eliminated or if this is impossible, is reduced as far as is reasonably practicable.

The investigation was carried out by:

- Deirdre Carey, Quality Patient Safety, Acute Hospitals Division
- Aideen Quigley, Quality Patient Safety, Acute Hospitals Division

As part of this investigation; independent expert validation of the draft investigation report was sought by the Investigation Team from the Review Team that was established to conduct the full Review of the Maternity Service at the hospital as outlined in the Terms of Reference attached in Appendix 1 of this report.

The purpose of validating the first draft report was to ensure that:

- The investigation was robust, thorough and fair and that it was carried out in line with the requirements of the HSE Guidelines for the Systems Analysis of Incidents (December 2015)
- That the findings and recommendations contained in the report that related to clinical issues were appropriate and reasonable and that they were aligned to the relevant clinical standards and practices in place at the time of the events described in the report.

The Investigation Team worked in collaboration with the clinical experts in relation to specific clinical aspects and issues highlighted by the overall systems analysis investigation process. In this context the Investigation Team sought and was provided with specialist clinical input related to certain clinical/technical issues that arose during the course of the investigation.

At the time of the events described in this report the patient was a 29 year old lady who had three previous pregnancies. The patient's obstetric history included a previous caesarean section for placental abruption at 30 weeks gestation in 2008.

At 10.15hours on 9th February 2010, the patient at 39 weeks and 2 days gestation was admitted to the labour ward in Hospital 1 with contractions 1:3-4[1]. CTG[2] tracing was re-assuring[3] at that time.

At 13:00hours, the patient went to the maternity unit to await events.

At 14:30hours, the patient returned to the labour ward distressed with contractions. The patient was in established labour. The cervix on vaginal examination at that time was 4-5cms dilated. Station[4]:-4

At 15:00hours, the patient had an epidural[5] sited.

At 15:40hours, an artificial rupture of membranes (ARM) was carried out, liquor[6] showed the presence of meconium.[7]

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[1] 1 in 3-4minutes

[2] CTG is a technical means of recording the foetal heartbeat and the uterine contractions during pregnancy, typically in the third trimester. (Reference: Macones GA, Hankins GD, Spong CY, et al. The 2008 National Institute of Child Health and Human Development workshop report on electronic foetal monitoring: update on definitions, interpretation, and research guidelines Obstet Gynecol (2008) 112:661-666)

[3] All four features fall into the reassuring category (Appendix 2)

[4] Ischial spines are two relatively sharp posterior bony projections into the pelvic outlet from the ischial bones that form the lower border of the pelvis (reference http://medical-dictionary.thefreedictionary.com/ischial+spines). The spines are the narrowest part of the pelvis and they are natural measuring point for the delivery progress. If the presenting part of the baby (the head, shoulder, buttocks or feet) lies above the Ischial spines, the foetal position is reported as a negative number from -1 to -5 (each number is a centimetre). If the presenting part lies below the Ischial spines, the station is reported as a positive number from +1 to +5. The baby is said to be 'engaged' in the pelvis when it is even with the Ischial spines at 0 station (reference: http://www.umm.edu/ency/article/002060.htm)

[5] Epidural analgesia is a central nerve blockade technique, which involves the injection of a local anaesthetic, with or without an opioid into the lower region of the spine close to the nerves that transmit painful stimuli from the contracting uterus and birth canal (reference: http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD009234.pub2/pdf).

[6] Liquor is amniotic fluid within the amniotic cavity produced by the amnion during the early amniotic period and later by the lungs and the kidneys. Amniotic fluid protects the embryo and foetus from injury. (Reference: Dorland's Illustrated Dictionary 31ed)

[7] Meconium is the greenish-black sticky material passed from the baby's bowels after birth. In some instances, the foetus will pass meconium into the amniotic fluid while still in the womb, indicated by the presence of meconium staining of the liquor after the membranes have ruptured.

At 17:30hours, on vaginal examination the baby's head was still high, station = -3, cervix: 5cms dilated, loosely applied.

At 18:45hours, the patient was very distressed with pain. The CTG[8] tracing showed wandering baseline with decelerations[9], rise in baseline[10] fetal heart rate (FHR) from 130 to 160bpm.

At 20:00hours, the CTG tracing showed no variability[11], FHR varying from 72-202bpm.

At 20:30hours approx, the Consultant - on - call was contacted.

At 20:45hours approx, the patient was brought to theatre for trial of vacuum[12] or possibility of proceeding to Emergency Lower Segment Caesarean Section. CTG was non-reassuring, showing variable declarations, FHR 200bpm – 70-80bpm. At 21.15hours, a baby girl was delivered by emergency caesarean section, Apgar[13] score at the time of delivery was 0 at 1min and 0 at 5mins. The baby was resuscitated by the paediatric team.

At 21:45 hours, the baby was transferred to SCBU.[14]

At 00:50hours on 10th February, the baby was transferred to Hospital 2 for brain cooling/brain hypothermia[15] for Hypoxic Ischemic Encephalopathy[16] . The baby's condition remained critical and very sadly the baby passed away in the presence of her parents on the 15th February 2010.

The investigation of this adverse perinatal event involving the patient and her baby identified two Key Causal Factors:

1. **Failure to identify and respond to abnormal CTG tracings**
2. **Failure to follow the guideline that was in place in relation to the management of Vaginal Birth After Caesarean (VBAC)**

[8] CTG is a technical means of recording the foetal heartbeat and the uterine contractions during pregnancy, typically in the third trimester. (Reference: Macones GA, Hankins GD, Spong CY, et al. The 2008 National Institute of Child Health and Human Development workshop report on electronic foetal monitoring: update on definitions, interpretation, and research guidelines Obstet Gynecol (2008) 112:661-666)

[9] Uniform, repetitive, periodic slowing of FHR with onset early in the contraction and return to baseline at the end of the contraction (Reference: Guideline on FHR monitoring 2007, Hospital 1

[10] The mean level of FHR when this is sable, excluding accelerations and declarations. It is determined over a time period of 5 to 10 mins and expressed in bpm. Preterm foetuses tend to have values towards the upper end of this range. A trend to a progressive rise in the baseline is important as well as the absolute values.

[11] Normal variability – greater or equal to 5bpm between contractions

[12] An apparatus sometimes used to assist the delivery of a baby, consisting of a cup which is attached to the foetal head by suction, and a chain by which traction can be exerted in order to draw out the baby http://dictionary.reference.com/browse/ventouse

[13] An objective score of the condition of a baby after birth. This score is determined by scoring the heart rate, respiratory effort, muscle tone, skin colour, and response to a catheter in the nostril. Each of these objective signs receives 0, 1, or 2 points. An Apgar score of 10 means an infant is in the best possible condition. The Apgar score is done routinely 60 seconds after the birth of the infant. A child with a score of 0 to 3 needs immediate resuscitation. The Apgar score is often repeated 5 minutes after birth, and in the event of a difficult resuscitation, the Apgar score may be done again at 10, 15, and 20 minutes. Ref:http://www.medicinenet.com/script/main/art.asp?articlekey=2303

[14] Special Care Baby Unit

[15] Brain Hypothermia, induced by cooling a baby to around 33 °C for three days after birth, is a treatment for hypoxic ischemic encephalopathy. It has recently been proven to be the only medical intervention which reduces brain damage, and improves an infant's chance of survival and reduced disability. Hypothermic neural rescue therapy is an evidence-based clinical treatment which increases a severely injured full term infant's chance of surviving without brain damage detectable at 18 months by about 50%, an effect which seems to be sustained into later childhood

[16] Hypoxic ischemic encephalopathy (HIE) is a condition that occurs when the entire brain is deprived of an adequate oxygen supply, but the deprivation is not total.

The investigation aimed to identify the factors that contributed to the development of the Key Causal Factors and the recommendations required to prevent or to reduce the risk of recurrence of each Key Causal Factor.

This investigation identified the following recommendations:

Recommendation 1

It is recommended that routine audits of compliance with the Policies, Procedures & Guidelines in particular "Guidelines on Fetal Heart Rate Monitoring" within the maternity Unit are developed and carried out and the results of such audits are subject to review by the relevant governance committee.

Recommendation 2

It is recommended it is the responsibility of the obstetricians and unit manger to ensure that staff are aware of the current guideline in Hospital1 in relation to "Guidelines on Fetal Heart Rate Monitoring" and that it is implemented in practice.

Recommendation 3

It is recommended it is the responsibility of all staff to ensure they are aware of and comply with the current Guideline in Hospital1 in relation to "Fetal Heart Rate Monitoring" and the principles contained within.

Recommendation 4

Adhere to practice of one midwife being assigned to a patient as in place in the labour ward in accordance with "NICE No. 55, (2007)"

Recommendation 5

It is recommended it is the responsibility of the obstetricians and unit manger to ensure that staff are aware of the current guideline in Hospital1 in relation to Trial of Labour /VBAC and that it is implemented in practice.

Recommendation 6

It is recommended it is the responsibility of all staff to ensure they are aware of and comply with the current Guideline in Hospital1 in relation to Trial of Labour /VBAC and the principles contained within. In addition it is recommended that routine audits of compliance with this Guideline are developed and carried out and the results of such audits are subject to review by the relevant governance committee.

2.0 Methodology

This investigation was undertaken using the methodology for incident investigations outlined in the HSE Guideline for System Analysis Investigation[17] of Incidents 2015. This approach is an internationally recognised methodology for investigating adverse incidents in healthcare.

Prior to commencement of the investigation; consent was sought and gained from the patient to allow the Review Team (as outlined in the Terms of Reference for the Review: Appendix 1) to access her healthcare records.

This systems analysis investigation of the patient's case was carried out by the Investigation Team named in this report on behalf of the Review Team.

Details provided in this report have been obtained from a review of the relevant documentation and interviews with the patient and relevant personnel. Timings are based on records and the patient's and staff's recollection(s).

While carrying out this investigation the investigators examined relevant literature and documentation including the following:

- The patient's maternity healthcare record
- Relevant policies, procedures and guidelines
- Relevant literature including Clinical Guidelines and peer reviewed articles (References for the literature referred to in the report including policies, procedures and guidelines are available in Section 10.0 of the report).

In addition interviews were undertaken with staff members involved in the patient's care during the period covered by the scope of the Terms of Reference for the investigation.

A total of 14 people were interviewed as part of the investigation.
The following clinical staff were interviewed as part of the investigation:

- Staff Midwife1 was interviewed on the 23rd May 2016
- Staff Midwife2 was interviewed on the 23rd May 2016
- Theatre Staff Nurse1 was interviewed on the 23rd May 2016
- Theatre Staff Nurse2 was interviewed on the 23rd May 2016
- Staff Nurse Special Care Baby Unit (SCBU) was interviewed on the 23rd May 2016
- Clinical Midwife Manager1 A was interviewed on the 23rd May 2016
- Clinical Midwife Manager1 B was interviewed (phone) on the 5th July 2016
- Consultant Obstetrician1 was interviewed on the 24th May 2016

[17] A systems analysis investigation is a structured investigation that aims to identify the systems cause(s) of an incident or complaint and the actions necessary to eliminate the recurrence of the incident or complaint or where this is not possible to reduce the likelihood of recurrence of such an incident or complaint as far as possible. Healthcare services carry out incident investigations using systems analysis to find out what happened, how it happened, why it happened, what the organisation can learn from the incident and what changes the organisation should make to prevent it happening again.

- Consultant Obstetrician2 was interviewed on the 23rd May 2016
- Obstetric Registrar Consultant was interviewed on the 30th May 2016
- Obstetric Senior House Officer was interviewed on the 24th May 2016
- Anaesthetic Registrar2 was interviewed on the 24th May 2016
- Consultant Paediatrician was interviewed on the 23rd May 2016
- Paediatric Senior House Officer was interviewed (phone)on the 23rd May 2016

The investigation team met with the patient and her husband on 16th May 2016.

The interviews were conducted by the two investigators; the interviews were conducted in a manner that aimed to ensure that the optimal levels of information were obtained whilst ensuring that the individuals being interviewed were treated with dignity and respect.

All information gathered during the documentation/literature review and interview stages of the investigation process were treated confidentially. Information gathered was maintained securely.

On completion of the interview and documentation/literature review process a draft report was prepared; the draft report was shared with all of those individuals who were interviewed as part of the investigation to ensure that the report was factually accurate; amendments were made to correct any erroneous information contained in the report and to enhance the factual accuracy of the information contained in the report.

The patient and her partner were provided with a copy of the Draft Chronology Section and other relevant extracts of the report for their comments.

The investigators wish to highlight that Consultant Obstetrician2 outlined in the report has not reviewed and had the opportunity to review and comment on the first and second draft reports. The investigators' understanding is that Consultant Obstetrician2 is not expected to be in a position to review the reports in the foreseeable future.

The investigators wish to highlight that the Obstetric Registrar outlined in the report has not reviewed and had the opportunity to review and comment on the second/final draft report. The investigators' understanding is that the Obstetric Registrar is not expected to be in a position to review the report in the foreseeable future.

In order not to delay the investigation process indefinitely, it was necessary to conclude the report. In considering this report, account should be taken of the possibility that Consultant Obstetrician2 and/or the Obstetric Registrar might have been in a position to provide information which might have led to changes to this report.

The draft report identified recommendations to address those issues which were identified as contributing to the incident. The recommendations were developed based on consideration of the hierarchy of controls (see Appendix 3) which is a validated tool to identify control measures that would have the most effective outcome. Feedback was sought to ensure that the recommendations identified were a) specific, b) measurable, c) achievable, d) realistic and e) timely as far as was reasonably practicable.

On this basis the Final Report of the investigation was developed.

Limitations to the investigation:

The investigators acknowledge a length of time has elapsed since the incident occurred and this had an impact on staff recollections of the events.

Student Midwife1: This nurse no longer works in Hospital 1
The Human Resources department did not have any records with respect to contact details. Nurse Practice Development also were unable to provide details.

Student Midwife2: This nurse no longer works in Hospital 1
The Human Resources department did not have any records with respect to contact details. Nurse Practice Development also were unable to provide details.

The investigators are the third investigation team appointed to undertake this investigation. Due to extenuating circumstances, the previous two teams were not in a position to complete the investigation and finalise the report.

Through the feedback process, the patient and her husband outlined they went through two very emotionally difficult interviews.

The investigators acknowledge the process has been ongoing for period of time and as a result the impact this has had on all interviewees.

3.0 Background to the Incident

12th June 2009

The patient, a 29yr old lady was referred by her General Practitioner (GP) to Consultant Obstetrician1's Antenatal Outpatient Clinic at Hospital 1. This letter was received by Hospital 1 on 19th June 2009. The letter outlined the following information:

Antenatal 1st visit

Antenatal examination: antenatal 1st visit

Date: 12/06/2009

Last menstrual period (LMP): 06/05/2009

Expected date of delivery (EDD): 09/02/2010

Duration of pregnancy: 5.5

Number of pregnancies: 3

Number of deliveries: 1

Maternity number:

Menstrual cycle: normal

Hospital: Hospital 1

Blood: taken

Weight: 60

BMI[18]: 0

Systolic blood pressure: 121

Diastolic blood pressure: 73

Fundus (uterus): too early

Urine: negative

Comments: placental abruption[19] at 30 weeks 2008

Blood tests: Nursing Assessment General

Medical History:

Epilepsy

5th August 2009

The patient attended the Antenatal Outpatient Clinic in Hospital 1. The following has been documented in the patient's healthcare records under *"ANTE-NATAL RECORD"*

Date of booking: blank

L.M.P: 6/5/09

If referred by Doctor: blank

[18] Body Mass Index

[19] Placental abruption occurs when the placenta separates from the wall of the uterus prior to the birth of the baby. This can result in severe, uncontrollable bleeding (hemorrhage). (Reference - http://medical-dictionary.thefreedictionary.com/placental+abruption">placental abruption)

Estimate Date of Delivery: 13/2/10

Name and Address: GP details outlined

It has been documented the patient did not have any past medical history except for epilepsy and had been seizure free for three years. The patient was not taking any medications. It was noted the patient had no allergies and was taking Folic acid[20] at that time.

The following was documented under heading "*Previous Obstetrical History":*

- 1998 – miscarriage in first trimester[21]
- 2006 – vacuum delivery of a girl at term
- 2008 – Emergency Caesarean Section at 30 weeks gestation for massive placental abruption (tragically this infant was stillborn). Developed a coagulopathy[22] and post partum haemorrhage[23]

The following has been documented on the proforma at Antenatal Outpatient Clinic visit-

FUNDAL HEIGHT[24]: It has been documented the patient's fundal height was 13 weeks and equal to dates

GIRTH: -

PRES (baby Presentation)[25]: -

F.H - The foetal heart rate was documented as √[26]

B/P: Blood pressure: 120/60 milligrams of mercury (mmHg)

OEDEMA: -

URINE (Urinalysis) [27]:Nothing Abnormal Discovered (NAD)

WEIGHT: 60kgs

HB: blank

COMMENTS:

It is documented the patient's bloods were taken by her GP who was contacted to fax/send the results. The patient was advised to bring blood results at the next visit.

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[20] Folic acid, another form of which is known as folate, is one of the B vitamins. It is used as a supplement during pregnancy to prevent neural tube defects. It is also used to treat anemia caused by folic acid deficiency

[21] Pregnancy is measured in trimesters from the first day of last menstrual period, totaling 40 weeks. The first trimester of pregnancy is week 1 through week 12, or about 3 months. The second trimester is week 13 to week 27. And the third trimester of pregnancy spans from week 28 to the birth.

[22] A disorder in which blood is either too slow or too quick to coagulate (clot). Reference: "http://medical- <a href="http://medical-dictionary.thefreedictionary.com/coagulopathy">coagulopathy

[23] Post partum haemorrhage

[24] Fundal height is the height of the fundus of the uterus, measured in centimetres from the top of the symphysis pubis to the highest point in the midline at the top of the uterus. Fundal height is measured at each prenatal visit with large blunt callipers or with a tape measure. From the twentieth to the thirty-second week of pregnancy the height in centimetres is equal to the gestation in weeks (reference: http://medical-dictionary.thefreedictionary.com/fundal+height).

[25] Presentation of foetus: that part of the foetus lying over the pelvic inlet; the presenting body part of the fetus. Vertex (VX) presentation: Head presentation of the foetus during birth in which the upper back part of the foetal head is the presenting part. Breech presentation: presentation of the foetal buttocks or feet in labour; the feet may be alongside the buttocks (complete breech p.); the legs may be extended against the trunk and the feet lying against the face; or one or both feet or knees may be prolapsed into the maternal vagina. Cephalic presentation: presentation of any part of the foetal head in labour, whether the vertex, face, or brow. (reference: The American Heritage® Medical Dictionary, 2004 Published by Houghton Mifflin Company; Medical Dictionary for the Health Professions and Nursing © Farlex 2012)

[26] Present

[27] Urinalysis is a test that evaluates a sample of urine. Urinalysis is used to detect and assess a wide range of disorders, such as urinary tract infection, kidney disease and diabetes. Urinalysis involves examining the appearance, concentration and content of urine.

The patient was also seen by midwifery staff at this appointment for the first trimester visit. It has been documented on the "antenatal checklist" the following topics were discussed with the patient.

Topics	
Effects of pregnancy on your body:	*√*
Nutrition in pregnancy:	*Folic acid √*
General exercise:	*walking*
Smoking status:	*N*
Alcohol intake:	*N*
Pelvic floor exercises:	*√*
Information of infant feeding:	*-*
Social Worker referral:	*declined*
Analgesia in labour:	*-*
Impending signs of labour:	*-*
Reasons for coming into hospital	
Apart from labour:	*Bleeding √*

The following Laboratory reports in the patient's healthcare records dated 12th June 2009 and 15th June 2009 were sent by fax by the patient's GP:

Full Blood Count (FBC)[28]

Blood Group

Antibody Screen[29]

Rubella[30]

HIV antibody test[31]

Hepatitis B[32]

The patient's haemoglobin (HB) and blood group are noted by their GP. On that occasion the patient's FBC result:

HB[33]: 12.4g/dl (reference range 12-15).

Blood group: O Rhesus positive with no atypical antibodies.

[28] Full Blood Count (FBC) is used as a broad screening test to check for such disorders as anaemia, infection, and many other diseases. It is actually a panel of tests that examines different parts of the blood (reference: http://www.labtestsonline.org.uk/understanding/analytes/fbc/tab/test).

[29] Antibody tests are done to find certain antibodies that attack red blood cells. Antibodies are proteins made by the immune system. Normally, antibodies bind to foreign substances, such as bacteria and viruses, and cause them to be destroyed (reference: http://www.webmd.com/a-to-z-guides/antibody-tests)

[30] Exceeds 15 IU/mL. This level of antibody suggests immunity and is generally accepted as sufficient to protect against primary rubella virus infection and congenital rubella virus infection.

[31] Not detected

[32] Not detected

[33] A conjugated protein, consisting of haem and the protein globin, that gives red blood cells their characteristic colour. It combines reversibly with oxygen and is thus very important in the transportation of oxygen to tissues (reference: http://www.thefreedictionary.com/haemoglobin). Low levels of haemoglobin in pregnancy can indicate anaemia (reference: http://www.cyh.com/healthtopics/healthtopicdetails.aspx?p=438&np=459&id=2759#haemoglobin)

Following the Antenatal clinic visit, Consultant Obstetrician1 wrote to the patient's GP, letter dated 6th August 2009 advising s(he) was satisfied to share the patient's care with them. Consultant Obstetrician1 outlined they would see the patient in the Outreach Antenatal Outpatient Clinic at Site A in 10 weeks time.

14th October 2009

The patient attended her second Antenatal Outpatient Clinic appointment at the Outreach Clinic at Site A. The following has been documented on the proforma for this visit.

FUNDAL HEIGHT: It has been documented the patient's fundal height was 23 weeks gestation and equal to dates

GIRTH: -

PRES: Baby presentation, it is difficult to decipher

F.H - The foetal heart rate was documented as √

B/P: Blood pressure: 110/60 milligrams of mercury (mmHg)

OEDEMA: -

URINE: Protein ++, MSU (mid-stream urine)√[34]

WEIGHT: 65kgs

HB:-

COMMENTS:

The plan of care at that time was documented that the patient was to return to her GP in two weeks and was to return to the Antenatal Outpatient Clinic in four weeks.

The report of the MSU within the patient's healthcare records shows the following result:

Microscopy	
Pus, cells	Nil
Red cells	Nil
Organisms	Nil
Casts	Nil
Epithelial Cells	+
Debris	++
Bacterial count	< 10,000 cfu's/ml (negative)
Urine Culture	No significant growth

12th November 2009

The patient attended her third Antenatal Outpatient Clinic appointment. The proforma was completed as follows for this visit:

FUNDAL HEIGHT: It has been outlined the patient's fundal height was 27 weeks gestation and equal to dates

[34] Taken

GIRTH: -

PRES: The baby's presentation - Cephalic[35]

F.H - The foetal heart rate was documented as √

B/P: Blood pressure: 120/60 milligrams of mercury (mmHg)

OEDEMA: blank

URINE: Urinalysis showed protein, MSU √

WEIGHT: 67kgs

HB: blank

COMMENTS: It has been documented the patient was not having any urinary symptoms and it was noted not to be sleeping well.

The plan of care at that time was documented the patient was to return to her GP in three weeks and was to return to the Antenatal Outpatient Clinic in six weeks.

The report from the laboratory in relation to the MSU indicated the-

"Specimen leaked in transit and has been regrettably discarded. Please ensure all containers are properly tightly sealed prior to placing on the bag"

16th December 2009

The patient attended her fourth Antenatal Outpatient Clinic appointment. The proforma was completed as follows for this visit:

FUNDAL HEIGHT: It has been documented the patient's fundal height was 31 weeks + 5 days gestation and equal to dates weeks

GIRTH: -

PRES: The baby's presentation - Cephalic

F.H: The foetal heart rate was documented as √

B/P: Blood pressure: 118/60 milligrams of mercury (mmHg)

OEDEMA: nil

URINE: Urinalysis NAD

WEIGHT: 70kgs

HB:blank

COMMENTS: The placenta was documented as being posterior and upper.

The plan of care at that time was documented the patient was to return the Antenatal Outpatient Clinic in three weeks; it is difficult to decipher the time period the patient was to return to her GP.

6th January 2010

The patient attended her fifth Antenatal Outpatient Clinic appointment. The proforma was completed as follows for this visit:

[35] A cephalic presentation is a situation at childbirth where the foetus is in a longitudinal lie and the head enters the pelvis first; the most common form is the vertex presentation where the occiput (back part of the head or skull) is the leading part (Reference: Hellman LM, Pritchard JA. Williams Obstetrics, 14th edition, Appleton-Century-Crofts (1971) Library of Congress Catalogue Card Number 73-133179. p. 322–2)

FUNDAL HEIGHT: It has been documented the patient's fundal height 34 weeks + gestation and equal to dates

GIRTH: -

PRES: The baby's presentation - Cephalic

F.H - The foetal heart rate was documented as √

B/P: Blood pressure: 126/70 milligrams of mercury (mmHg)

OEDEMA: blank

URINE: Urinalysis - NAD

WEIGHT: 74kgs

HB: blank

COMMENTS:

The plan of care at that time was documented the patient was to return to the Antenatal Outpatient Clinic in two weeks.

15th January 2010

The patient was referred by her GP to Hospital 1 with severe lower abdominal pain and vomiting.

It was documented in the patient's healthcare records by the examining doctor that the patient presented with a history of feeling unwell. She reported she was feeling weak and dizzy with lower abdominal sharp pain. She vomited once and was feeling nauseous.

The patient's clinical observations at that time were as follows:

- Blood pressure: 125/69mmH
- Pulse rate: 72bpm
- Temperature: normal
- Urinalysis was NAD.

The patient was placed on a CTG[36] monitor, the reading was documented as √. Her abdomen was documented as being soft and she had no PV[37] loss. She was sent home with advice to attend the Ante Natal Clinic (ANC) the next Wednesday – 20th January 2010.

20th January 2010

The patient attended her sixth Antenatal Outpatient Clinic appointment. The proforma was completed as follows for this visit:

FUNDAL HEIGHT: It was documented the patient's fundal height is 36 weeks + gestation and equal to dates

GIRTH: -

PRES: The baby's presentation - Cephalic

[36] CTG is a technical means of recording the foetal heartbeat and the uterine contractions during pregnancy, typically in the third trimester. (Reference: Macones GA, Hankins GD, Spong CY, et al. The 2008 National Institute of Child Health and Human Development workshop report on electronic foetal monitoring: update on definitions, interpretation, and research guidelines Obstet Gynecol (2008) 112:661-666)

[37] PV - Per Vaginam (Latin) meaning via/ through the vagina (Reference: Mosby's Medical Dictionary, 8th edition. © 2009, Elsevier)

F.H - The foetal heart rate was documented as √

B/P: Blood pressure: 115/60 milligrams of mercury (mmHg)

OEDEMA: blank

URINE: Urinalysis – Ketones present

WEIGHT: 72.5kgs

HB: blank

COMMENTS:

The plan of care at that time was documented the patient was to return to the Antenatal Outpatient Clinic in two weeks.

3rd February 2010

The patient attended her seventh Antenatal Outpatient Clinic appointment. The proforma was completed as follows for this visit:

FUNDAL HEIGHT: It has been documented the patient's fundal height was equal to term[38] and equal to dates

GIRTH: -

PRES: The baby's presentation - unable to decipher text

F.H: The foetal heart rate was not documented

B/P: Blood pressure: 115/70 milligrams of mercury (mmHg)

OEDEMA: blank

URINE: Urinalysis – Ketones present

WEIGHT: 74kgs

HB:blank

COMMENTS:

The plan of care at that time was documented the patient was to return to the Antenatal Outpatient Clinic in one week.

The patient was also seen by midwifery staff at this appointment for the second trimester visit. It was documented on the "antenatal checklist" the following was discussed with the patient.

Topics

Effects of pregnancy on your body: √

Nutrition in pregnancy: *good, repeat HB*[39] √[40]

General exercise: *active*

Smoking status: *No*

[38] The normal duration of pregnancy is approximately 37 – 42 weeks, with the estimated due date at 40 weeks or 280 days from the first day of the last menstrual period (reference: http//www.uptodate.com/contents/post-term pregnancy-beyond-the-basics)

[39] A conjugated protein, consisting of haem and the protein globin, that gives red blood cells their characteristic colour. It combines reversibly with oxygen and is thus very important in the transportation of oxygen to tissues (reference: http://www.thefreedictionary.com/haemoglobin). Low levels of haemoglobin in pregnancy can indicate anaemia (http://www.cyh.com/healthtopics/healthtopicdetails.aspx?p=438&np=459&id=2759#haemoglobin)

[40] Complete

Alcohol intake:	*No*
Pelvic floor exercises:	*blank*
Information of infant feeding:	*completed*
Social Worker referral:	*blank*
Analgesia in labour:	*completed*
Impending signs of labour:	*blank*
Reasons for coming into hospital	
Apart from labour:	*completed*

At the top of the Antenatal Outpatient Clinic proforma page, the following has been documented – *"Aim for VBAC"*. There was no documentary evidence of a discussion that took place with the patient in relation to the benefits or risks to this approach at that time.

4.0 The chronology of events has been established as follows:

The sections in italics are direct entries from the patient's healthcare records.

Tuesday 9th February 2010

10:15hours

At 39 weeks and two days gestation[41], the patient presented to the labour ward within the maternity unit[42] in Hospital 1 with a history of contractions at ratio of 1:3-4[43]. Student Midwife1 documented in the patient's healthcare records s(he) assessed the patient who stated she had a small show[44] that morning and had no spontaneous rupture of membranes (SROM). The patient's medical history was noted and documented as follows:

- 2006: PET[45] – IOL[46] at 39 weeks, vacuum delivery
- 2008: Emergency Lower Caesarean Section, abruption[47] at 30 weeks, infant deceased

At interview, the patient outlined she had an uncomfortable night, the night of 8th February. She had no pain, was twisting and turning. She did not get much sleep. When she stood up at 08:20hours the contractions commenced. They were 5minutes apart.
The patient's husband contacted the hospital by phone at 08:30 to advise of her impending arrival and informed the midwife on the phone of the frequency of contractions which were less than five minutes apart. She got her daughter organised, went to her husband's parent's house. Then, they went straight to the labour ward.

It was recorded the patient's HB[48] (haemoglobin) = 9.1g/dl (Reference range 11.8-14.8).
The patient's clinical observations were recorded by Student Midwife1 as:

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41 Pregnancy

42 There are 33 beds (antenatal and postnatal sections) and 4 delivery single rooms (labour ward) in the maternity unit in Hospital 1. The labour ward is a ward off the main antenatal and postnatal sections.

43 1 in 3-4minutes

44 A 'show' is the passage of small quantities of blood-tinged mucus from the vagina at the onset of labour (reference: http://medical-dictionary.thefreedictionary.com/premature+labour)

45 Pre-eclamptic toxaemia (PET) is also called Toxemia of Pregnancy or pregnancy induced hypertension. This is a syndrome that develops after the 20th week of pregnancy. It is characterized by:

- Persistent high blood pressure at or above 140/90mmHg
- Edema or swelling of the feet and ankles.
- Proteinuria or presence of protein in the urine.

Edema is usually the first sign to occur followed by high blood pressure and then by proteinuria. (Ref: http://gynaeonline.com/PET.htm)

46 Induction of Labour is a method of artificially or prematurely stimulating childbirth in a woman (Reference: National Collaborating Centre for Women's and Children's Health 2008 Clinical Guideline; Induction of Labour RCOG Press London)

47 Placental abruption occurs when the placenta separates from the wall of the uterus prior to the birth of the baby. This can result in severe, uncontrollable bleeding (hemorrhage). (Reference - http://medical-dictionary.thefreedictionary.com/placental+abruption">placental abruption)

48 A conjugated protein, consisting of haem and the protein globin, that gives red blood cells their characteristic colour. It combines reversibly with oxygen and is thus very important in the transportation of oxygen to tissues (reference: http://www.thefreedictionary.com/haemoglobin). Low levels of haemoglobin in pregnancy can indicate anaemia (reference: http://www.cyh.com/healthtopics/healthtopicdetails.aspx?p=438&np=459&id=2759#haemoglobin)
The haematology[48] report in the patient's healthcare records outlined the FBC[48] sample was taken on 3rd February 2010 and the report was issued on 8th February 2010.

- Blood pressure: 139/89 milligrams of mercury (mmHg)
- Pulse rate: 95 beats per minute
- Temperature: 36.5 degress Celsius.

The patient's urinalysis[49] showed blood and protein++

Student Midwife1 recorded on palpation the patient's fundus[50] was = dates, she had a longitudinal lie[51], a cephalic presentation[52], 3/5 palpable[53], no scar tenderness and her abdomen was soft between contractions. At this time, CTG[54] monitoring was commenced. This entry was co-signed by Staff Midwife1.

At interview, Staff Midwife1 explained s(he) was supervising Student Midwife1 who was in the final stages of training and this was the rationale for their signature as a co-signature in the patient's healthcare record.

10:45hours

Student Midwife1 recorded the CTG tracing as follows:

- Baseline Foetal Heart (FHR)[55]:120 beats per minute (bpm)
- Variability: greater than 5 beats per minute (bpm)
- Accelerations: present
- Decelerations: none
- Contractions 1:3

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[49] Urinalysis is a test that evaluates a sample of urine. Urinalysis is used to detect and assess a wide range of disorders, such as urinary tract infection, kidney disease and diabetes. Urinalysis involves examining the appearance, concentration and content of urine.

[50] Fundus is the upper rounded extremity of the uterus above the openings of the uterine (fallopian) tubes (reference: http://medical-dictionary.thefreedictionary.com/premature+labour)

[51] Longitudinal lie a situation in which the long axis of the fetus is parallel to that of the mother; in PRESENTATION, either the head or breech presents first. (reference: http://medical-dictionary.thefreedictionary.com/premature+labour)

[52] A cephalic presentation is a situation at childbirth where the foetus is in a longitudinal lie and the head enters the pelvis first; the most common form is the vertex presentation where the occiput (back part of the head or skull) is the leading part (Reference: Hellman LM, Pritchard JA. Williams Obstetrics, 14th edition, Appleton-Century-Crofts (1971) Library of Congress Catalogue Card Number 73-133179. p. 322–2)

[53] The amount of descent and engagement of the head is assessed by feeling how many fifths of the head are palpable above the brim of the pelvis:
1. 5/5 of the head palpable mean that the whole head is above the brim of the pelvis.
2. 4/5 of the head palpable means that a small part of the head is below the brim of the pelvis and can be lifted out of the pelvis with the deep pelvic grip.
3. 3/5 of the head palpable means that the head cannot be lifted out of the pelvis. On doing the deep pelvic grip, your fingers will move outwards from the neck of the fetus, then inwards before reaching the pelvic brim.
4. 2/5 of the head palpable means that most of the head is below the pelvic brim, and on doing the deep pelvic grip, your fingers only splay outwards from the fetal neck to the pelvic brim.
5. 1/5 of the head palpable means that only the tip of the fetal head can be felt above the pelvic brim.
It is very important to be able to distinguish between 3/5 and 2/5 head palpable above the pelvic brim.
If only 2/5 of the head is palpable, then engagement has taken place and the possibility of disproportion at the pelvic inlet can be ruled out (reference: http://www.gfmer.ch/PEP/pdf-MCM-2006/MCM_SW-81-2006.pdf.

[54] Cardiotocography (CTG) is a technical means of recording the foetal heartbeat and the uterine contractions during pregnancy, typically in the third trimester. (Reference: Macones GA, Hankins GD, Spong CY, et al)

[55] Baseline foetal heart rate is the average fetal heart rate (FHR) rounded to increments of 5 beats per minute during a 10-minute segment, excluding periodic or episodic changes, periods of marked variability, or baseline segments that differ by more than 25 beats per minute. In any given 10-minute window, the minimum baseline duration must be at least 2 minutes, or else the baseline is considered indeterminate. In cases where the baseline is indeterminate, the previous 10-minute window should be reviewed and utilized in order to determine the baseline.
A normal FHR baseline rate ranges from 110 to 160 beats per minute. If the baseline FHR is less than 110 beats per minute, it is termed bradycardia. If the baseline FHR is more than 160 beats per minute, it is termed tachycardia.
Baseline FHR variability is based on visual assessment and excludes sinusoidal patterns. **Variability** is defined as fluctuations in the FHR baseline of 2 cycles per minute or greater, with irregular amplitude and inconstant frequency. These fluctuations are visually quantitated as the amplitude of the peak to trough in beats per minute. By visual assessment, **acceleration** is defined as an apparent abrupt increase in FHR above baseline, with the time from the onset of the acceleration to the acme of less than 30 seconds. **Late deceleration** is defined as an apparent gradual decrease and return to baseline FHR in association with a uterine contraction, with the time from onset of the deceleration to its nadir as 30 seconds or longer. **Early deceleration** is defined as an apparent gradual decrease and return to the baseline FHR in association with a uterine contraction, with the time from onset of the deceleration to its nadir as 30 seconds or longer. **Variable deceleration** is defined as an apparent abrupt decrease in FHR below the baseline, with the time from the onset of the deceleration to the nadir of the deceleration as less than 30 seconds. The decrease is measured from the most recently determined portion of the baseline. Variable decelerations may or may not be associated with uterine contractions. The decrease from baseline is 15 beats per minute or higher and lasts less than 2 minutes from onset to return to baseline. When variable decelerations occur in conjunction with uterine contractions, their onset, depth, and duration may vary with each successive uterine contraction (reference: Robinson B. (2008) A Review of NICHD Standardized Nomenclature for Cardiotocograph: The Importance of Speaking a Common Language When Describing Electronic Fetal Monitoring. Rev Obstet Gynecol, 2008 Spring; 1(2): 56-60 (Available from: http://medical-dictionary.thefreedictionary.com/premature+labor). http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2505172/).

The patient was coping well.

A vaginal examination (VE) was carried out. The findings were recorded as follows:

- Cervix[56] Position: Posterior[57]
- Consistency of Cervix: Thick
- Dilation: Admitting 1 fingertip
- Station[58]: not recorded

The plan of care was documented as follows:

- To mobilise the patient
- For half hourly monitoring of observations plus foetal heart rate (FHR)
- Recheck Blood Pressure (BP) = 131/81 milligrams of mercury (mmHg)

This entry was co-signed by Staff Midwife1.

At interview, Staff Midwife1 informed the investigators it was not normal practice to carry out half hourly clinical observations. The patient's blood pressure was high on admission and this was re-checked.

The patient through feedback on the draft chronology informed the investigators that she does not recall being informed that her blood pressure was high.

11:30hours

The patient's clinical observations were recorded by Student Midwife1 after a contraction as follows:

- Blood pressure: 128/71 milligrams of mercury (mmHg)
- Pulse rate: 93 beats per minute
- Temperature: 36.8 degress Celsius
- Foetal Heart Rate (FHR) rate: 135

This entry was co-signed by Staff Midwife1.

12:00hours

The patient's clinical observations were recorded by Student Midwife1 after contraction as:

- Blood pressure: 120/80 milligrams of mercury (mmHg)
- Pulse rate: 86 beats per minute
- Foetal Heart: (FH) 160 after contraction

Student Midwife1 documented the patient's abdomen as being soft between contractions, with no scar tenderness. The patient was requesting pain relief. Student

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[56] Cervix - Neck of the Womb

[57] Posterior Position – pointing towards back

[58] Ischial spines are two relatively sharp posterior bony projections into the pelvic outlet from the ischial bones that form the lower border of the pelvis (reference http://medical-dictionary.thefreedictionary.com/ischial+spines). The spines are the narrowest part of the pelvis and they are natural measuring point for the delivery progress. If the presenting part of the baby (the head, shoulder, buttocks or feet) lies above the Ischial spines, the foetal position is reported as a negative number from -1 to -5 (each number is a centimetre). If the presenting part lies below the Ischial spines, the station is reported as a positive number from +1 to +5. The baby is said to be 'engaged' in the pelvis when it is even with the Ischial spines at 0 station (reference: http://www.umm.edu/ency/article/002060.htm)

Midwife1 documented Pethidine[59] 100mgs and Stemetil[60] 12.5mgs was administered intramuscularly.

12:30hours

It has been documented by Student Midwife1 the patient's clinical observations after contraction were as follows:

- Blood pressure: 125/71 milligrams of mercury (mmHg)
- Pulse rate: 82 beats per minute
- Foetal Heart (FHR): 160

13:00hours

At interview, Clinical Midwife Manager1 A outlined, s(he) was in charge of the labour ward and supervising Student Midwife2.

Clinical Midwife Manager1 A documented the patient was distressed with regular contractions. S(he) examined the patient, palpated the contractions as being mild and mainly in the lower abdomen. The foetal heart rate was documented as 142 beats per minute (bpm) and regular. The presentation of the baby was cephalic[61] and 4/5[62] palpable.

Clinical Midwife Manager1 A documented that s(he) carried out a vaginal examination, the findings were recorded as follows:

- Cervix Position: Posterior Position[63] (PP)
- Consistency of Cervix: Soft
- Cervix Dilation: Tipped and fixed
- Station[64]: not recorded
- Multips OS[65]

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[59] Opioid Analgesia used for acute pain. In Obstetrics, 50–100 mg, then 50–100 mg after 1–3 hours if required; maximum 400 mg per day. (Reference – BNF, June 2016)

[60] Prevention and treatment for nausea and vomiting, dosage - 12.5 mg as required, to be followed if necessary after 6 hours by an oral dose. (Reference – BNF, June 2016)

[61] A cephalic presentation is a situation at childbirth where the foetus is in a longitudinal lie and the head enters the pelvis first; the most common form is the vertex presentation where the occiput (back part of the head or skull) is the leading part (Reference: Hellman LM, Pritchard JA. Williams Obstetrics, 14th edition, Appleton-Century-Crofts (1971) Library of Congress Catalogue Card Number 73-133179. p. 322–2)

[62] The amount of descent and engagement of the head is assessed by feeling how many fifths of the head are palpable above the brim of the pelvis:
1. 5/5 of the head palpable mean that the whole head is above the brim of the pelvis.
2. 4/5 of the head palpable means that a small part of the head is below the brim of the pelvis and can be lifted out of the pelvis with the deep pelvic grip.
3. 3/5 of the head palpable means that the head cannot be lifted out of the pelvis. On doing the deep pelvic grip, your fingers will move outwards from the neck of the fetus, then inwards before reaching the pelvic brim.
4. 2/5 of the head palpable means that most of the head is below the pelvic brim, and on doing the deep pelvic grip, your fingers only splay outwards from the fetal neck to the pelvic brim.
5. 1/5 of the head palpable means that only the tip of the fetal head can be felt above the pelvic brim. It is very important to be able to distinguish between 3/5 and 2/5 head palpable above the pelvic brim. If only 2/5 of the head is palpable, then engagement has taken place and the possibility of disproportion t the pelvic inlet can be ruled out (reference: http://www.gfmer.ch/PEP/pdf-MCM-2006/MCM_SW-8-1-2006.pdf).

[63] Posterior Position – pointing towards back

[64] Ischial spines are two relatively sharp posterior bony projections into the pelvic outlet from the ischial bones that form the lower border of the pelvis (reference http://medical-dictionary.thefreedictionary.com/ischial+spines). The spines are the narrowest part of the pelvis and they are natural measuring point for the delivery progress. If the presenting part of the baby (the head, shoulder, buttocks or feet) lies above the Ischial spines, the foetal position is reported as a negative number from -1 to -5 (each number is a centimetre). If the presenting part lies below the Ischial spines, the station is reported as a positive number from +1 to +5. The baby is said to be 'engaged' in the pelvis when it is even with the Ischial spines at 0 station (reference: http://www.umm.edu/ency/article/002060.htm)

[65] The OS is the outlet of the cervix, which will stretch during labour from two to three millimetres up to ten centimetres to allow baby to emerge. Once the birth process has occurred, the OS changes in size and shape. The two descriptions given to the appearances are either a nullip's os, for a first pregnancy, or a multip's os for subsequent pregnancies. http://www.netdoctor.co.uk/ate/pregnancyandchildbirth/205040.html#ixzz31WTlfpx9

Clinical Midwife Manager1 A documented the patient will have a bath and rest. The patient was not in active labour[66] at that time. It was documented the patient returned to the maternity ward to await events.

Staff Midwife1 indicated at interview, the practice on the labour ward is that a midwife is assigned to a patient. There could have been a number of possibilities why the patient's care was re-assigned to Clinical Midwife Manager1 at 13:00hours.

14:25hours

Clinical Midwife Manager1 A has documented in the patient's healthcare record that the patient was transferred to the labour ward distressed with contractions and CTG monitoring was commenced. A partogram[67] proforma was commenced at that time. It was documented the patient's cervix was 4-5cms dilated and effacing[68]. Onset of labour was spontaneous.

14:30hours

It was documented in the maternity ward healthcare notes – the patient was not at their bedside at this time. The patient had been transferred to the labour ward.

14:30hours

It has been documented by Clinical Midwife Manager1 A the patient was anxious for an epidural[69] and the anaesthetist was contacted. Clinical Midwife Manager1 A documented they carried out a vaginal examination. The findings were recorded as follows:

- PP (Presenting part) = -4 fixed
- Consistency of Cervix: not documented
- Cervix Dilation: 4-5 cms dilated
- Station: -4
- Intact membrane

15:00hours

Clinical Midwife Manager1 A documented in the patient's healthcare record the CTG was within normal limits[70].

The epidural was being sited by Anaesthetic Registrar1 at this time.

It has been recorded on the "Epidural Pain Relief during labour Information Sheet" by Anaesthetic Registrar1 consent was obtained from the patient prior to insertion of the

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66 The first stage of labour is the process of reaching full cervical dilatation. This begins with the onset of uterine labour contractions, and it is the longest phase of labour. The first stage is divided into three phases: latent, active, and deceleration. The second stage is the delivery of the infant. The third stage of labour is the passage of the placenta (reference: http://www.umm.edu/pregnancy/000126.htm#ixzz1x0x7XMI5).

67 A partogram provides an instant picture of the labour and its progress

68 Thinning of cervix

69 Epidural analgesia is a central nerve blockade technique, which involves the injection of a local anaesthetic, with or without an opioid into the lower region of the spine close to the nerves that transmit painful stimuli from the contracting uterus and birth canal (reference: http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD009234.pub2/pdf).

70 A 'Normal' CTG is indicated when all four features (foetal heart rate, baseline variability, acceleration and deceleration of the foetal heart rate and frequency and strength of contractions as recorded by the attending healthcare professional) fall within the reassuring category. (reference: Regional Maternity Department, Midland Regional Hospital at Portlaoise: Foetal Heart Monitoring in the Maternity Department. Approval date: April 2011)

epidural cannula[71]. The "patient has read and understood the information sheet" was completed. The "Obstetric Epidural Analgesia Record" proforma was partially completed by Anaesthetic Registrar1.

An intravenous (IV) cannula[72] was also inserted by Anaesthetic Registrar1 for intravenous fluids at that time.

The "Epidural Pain Relief during labour Information Sheet" at that time outlined that an epidural may cause a drop in blood pressure so drip/intravenous fluids are maintained. The first litre of Hartmanns[73] was commenced.

The following clinical observations were recorded by Clinical Midwife Manager1 on partogram proforma as follows:

- Blood pressure: 108/70 mmHg
- Pulse rate: 90 beats per minute (bpm)
- No temperature recorded
- Contractions per 15 minutes 1:3

15:10hours

Clinical Midwife Manager1 A recorded the epidural was sited and the CTG monitoring was recommenced as this was removed during insertion of the epidural.

15:30hours

It has been documented in the patient's healthcare record by Student Midwife2 and co-signed by Clinical Midwife Manager1 A that the CTG tracing indicated the following:

- Baseline FHR: 110 beats per minute (bpm)
- Variability: 5-15
- Contractions 1-2:10[74]

It was recorded the patient was comfortable in the left lateral position.

15:40hours

It has been documented in the patient's healthcare record by Student Midwife2 and co-signed by Clinical Midwife Manager1 A, that the patient had a catherisation[75] and vaginal examination (VE) with consent. The findings of the vaginal examination were recorded as follows:

- Cervix Dilation: 5 cms dilated
- Bulging membranes were felt.

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[71] Small hollow needle is inserted between bones of the lower back by an anaesthetist and advanced until the epidural space is located. Then a plastic catheter (thin tube) is inserted through the needle into this narrow space. (Reference- Epidural Pain Relief during labour Information Sheet Hospital 1)

[72] A peripheral IV cannula is a small plastic tube that is inserted through the skin into one of the small veins in your hand or arm. They are used to give many different types of medications, for example antibiotics or fluids. (Reference www.buckshealthcare.nhs.uk)

[73] Solutions of electrolytes are given intravenously, to meet normal fluid and electrolyte requirements or to replenish substantial deficits or continuing losses, when the patient is nauseated or vomiting and in unable to take adequate amounts by mouth. Hartmann's Solution contains sodium chloride 0.6%, sodium lactate 0.25%, potassium chloride 0.04%, calcium chloride 0.027% (reference: British National formulary 2009).

[74] One to two contractions every 10 minutes

[75] Urinary catheterisation is a medical procedure used to drain and collect urine from the bladder.A thin flexible tube, known as a catheter, is inserted into the body, usually along the tube through which urine passes (the urethra) or through a hole in the abdomen. The catheter is then guided into the bladder, allowing urine to flow through it and into a drainage bag. (reference www.hse.ie, provided by NHS Choices & adapted by Health A-Z)

- An artificial rupture of membranes (ARM)[76] was carried out and the cervix was central and effaced[77].
- Liquor[78]: Meconium[79]

Clear urine was seen draining in the urinary catheter.

The following was documented in relation to the CTG tracing:

- Baseline FH: 110bpm beats per minute
- Variability: Good variability
- Contractions: Contracting 1-2: 10[80]

16:10hours

The following was documented by Student Midwife2 in relation to the CTG tracing:

- Baseline rate: FH 120 bpm beats per minute
- Variability: good variability
- Decelerations: Early Decelerations[81] (decreasing) 80 noted with good recovery
- Contractions: Contracting 2-3:10

This entry was co-signed by Clinical Midwife Manager1 A

It has been documented by Student Midwife2 on partogram proforma the patient's clinical observations were as follow:

- Blood pressure: 129/70 mmHg,
- Pulse rate: 88 bpm
- Temperature: 36.1 degress Celsius
- It was documented NO for section Oxytocin[82] mls per Hour as the patient was not commenced on Oxytocin.

It has been documented by Student Miwdiefe2 the patient was comfortable in the right lateral position; the epidural was infusing at 10.0 mls per hour.

16:30hours

The patient's clinical observations were recorded by Student Midwife2 as follows:

- Blood pressure: 134/66 mmHg,
- Pulse rate: 85 bpm.

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[76] An artificial rupture of the foetal membranes is usually performed to stimulate or accelerate the onset of labour (reference http://medical-dictionary.thefreedictionary.com/amniotomy)

[77] Effacement relates to the softening and shortening of the cervical canal from about 3cm long to less than 0.5cm long. (Reference: National Collaborating Centre for Women's and Children's Health 2008 Clinical Guideline; Induction of Labour RCOG Press London)

[78] Liquor is amniotic fluid within the amniotic cavity produced by the amnion during the early amniotic period and later by the lungs and the kidneys. Amniotic fluid protects the embryo and foetus from injury. (Reference: Dorland's Illustrated Dictionary 31ed)

[79] Meconium is the greenish-black sticky material passed from the baby's bowels after birth. In some instances, the foetus will pass meconium into the amniotic fluid while still in the womb, indicated by the presence of meconium staining of the liquor after the membranes have ruptured. Meconium staining is more common approaching and after term. It may indicate the presence of foetal distress in labour, but not universally so (reference: http://www.nice.org.uk/nicemedia/live/12012/41255/41255.pdf

[80] Contracting one to two every 10 minutes

[81] Uniform, repetitive, periodic slowing of FHR with onset early in the contraction and return to baseline at the end of the contraction

[82] Oxytocin is a synthetic hormone, which stimulates the smooth muscle of the uterus to produce rhythmic contractions. As pregnancy progresses, the uterine muscle becomes increasingly sensitive to the contractile effects of the drug. Oxytocin (Syntocinon TM) is used to induce or augment labour and to accelerate suboptimal cervical dilation. Risks associated with the use of oxytocin include hypercontractility, uterine rupture, fluid retention and foetal compromise. (Reference University College London Hospitals, NHS 2009)

It has been documented by Student Midwife2 the patient was not complaining of scar tenderness at that time and was feeling contractions. The CTG reading was documented as follows:

- Baseline rate: FHR 130 beats per minute
- Variability: 5-15 bpm
- Contractions: 3-4:10

16:40hours

It has been documented by Student Midwife2 a second litre of intravenous Hartmann solution[83] was commenced. The patient's epidural infusion was increased to 12.0mls per hour. It has been documented blood stained liquor was draining and the patient's pads were changed.

17:00hours

The following clinical observations were recorded by Student Midwife2 on partogram proforma as being taken at 17:00hours as follows:

- Blood pressure: 134/70 mmHg,
- Pulse rate: 102bpm
- No temperature recorded
- Liquor: blood stained
- Contractions: 3-4:10

17:10hours

Clinical Midwife Manager1 A co-signed Student Midwife2 entry at 16:40hours.

17:30hours

Documentation completed in the patient's healthcare record by Clinical Midwife Manager1 A indicated a vaginal examination was carried out. The findings were recorded as follows:

- Cervix Position: Not recorded
- Consistency of Cervix: not recorded
- Cervix Dilation: 5 cms dilated, loosely applied
- Station: -3
- Effacement: yes

The documentation indicates the CTG monitor was in place to monitor the foetal heart. It has been recorded, the patient was feeling some pressure and blood stained liquor was draining.

[83] Solutions of electrolytes are given intravenously, to meet normal fluid and electrolyte requirements or to replenish substantial deficits or continuing losses, when the patient is nauseated or vomiting and in unable to take adequate amounts by mouth. Hartmann's Solution contains sodium chloride 0.6%, sodium lactate 0.25%, potassium chloride 0.04%, calcium chloride 0.027% (reference: British National formulary 2009).

17:45hours

Documentation completed in the patient's healthcare record by Clinical Midwife Manager1 A indicated that the patient had top up of the epidural infusion of Marcaine[84] 0.33% 6ml. It was recorded, the patient was sitting up. The patient's blood pressure was recorded as (1) 110/62 mmHg. BP (2) 115/61 mmHg.

18:00hours

The following clinical observations were recorded by Clinical Midwife Manager1 A on the partogram proforma as being taken at 18:00hours as follows:

- Blood pressure: 118/61 mmHg,
- Pulse rate: 78bpm
- Temperature:36.1 degress Celsius
- Contractions: 1:3-4
- Liquor:NIL

18:15hours

Clinical Midwifery Manager1 A has documented the following in relation to the CTG tracing:

- Decelerations: Shallow early decelerations
- Variability: good variability

The patient was feeling a lot of pressure. Clinical Midwife Manager1 A documented s(he) contacted Anaesthetics Registrar2 to administer further top up of the epidural infusion. It has been documented the patient was using Entenox[85] at this time.

At interview, the patient indicated the pain she experienced was not just contraction pains; the pain was all over her tummy. She recalled looking at the clock at the time, it was 18:00hours and thought of asking for a section then as the pain was so severe. The patient indicated she couldn't explain how bad the pain was. She did not know there was anything wrong with her baby or that there was any risk to her baby. She didn't see what was going on.

18:30hours

It has been documented by Clinical Midwife Manager1 A in the patient's healthcare record the patient was very distressed with pressure. The patient was using entonox for pain relief. There was no show. Clinical Midwife Manager1 A has documented s(he) asked the Obstetric Registrar to review the patient.

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84 It is a long - acting local anaesthetic. It blocks initiation and transmission of nerve impulses at the site of application by stabilizing the neuronal membrane. (Reference: The WHO Essential Medicines and Health Products Information Portal was designed and is maintained by Human Info NGO). At interview, Clinical Midwife Manager1 A informed the investigators the epidural infusion can be increased to a maximum of 15mls per hr. The rate is adjusted according to the patient's level of pain. Midwifery staff are allowed to administer two top-ups. If further pain relief is required, the Anaesthetist must be contacted.

85 Entenox is used as an analgesia and can be self administered using a demand valve which is popular in obstetric practice (Reference: British National Formulary 2009)

Through feedback on the report, the Obstetric Registrar outlined that his/her recollection was that he/she was not contacted by Clinical Midwife Manager1 A but was contacted by Anaesthetic Registrar2.

19:00hours

The following clinical observations were recorded by Clinical Midwife Manager1 A on the partogram proforma as being taken at 19:00hours as follows:

- Blood pressure: 120/63mmHg,
- Pulse rate: 116 bpm
- Temperature: 37.7 degress Celsius
- Contractions per 15mins - 1:3
- Liquor – Nil

19:00hours

Obstetric Registrar reviewed the patient and has documented in the patient's healthcare record s(he) performed a vaginal examination. The findings were recorded as follows:

- Cervix Dilation: 7cms dilated
- Station: 0[86]

An ultrasound scan was carried out. It has been documented by the Obstetric Registrar that the plan for the patient was to continue the same plan of care at that time.

At interview, Obstetric Registrar indicated everything was satisfactory at that time.

- Normal CTG
- Normal vaginal & abdominal examination

The assessment ended at 19:10hours

19:00hours

It was documented in the patient's healthcare record by Anaesthetic Registrar2 they were on-call. S(he) was called to review the patient because of abdominal pain. The epidural was in place since 14.00hours and was working fine. The patient was complaining of contraction pains within the previous hour.

Anaesthetic Registrar2 documented that *Obstetric Registrar has reviewed the patient and is confident there is no obstetric problem*.

Anaesthetic Registrar2 documented s(he) gave a top up of Lignocaine 2%[87] - 12mls and Fentanyl[88] 50mcgs.

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[86] Where 0 station is in line with the plane of the maternal ischial spines.

[86] Ischial spines are two relatively sharp posterior bony projections into the pelvic outlet from the ischial bones that form the lower border of the pelvis (reference http://medical-dictionary.thefreedictionary.com/ischial+spines). The spines are the narrowest part of the pelvis and they are natural measuring point for the delivery progress. If the presenting part of the baby (the head, shoulder, buttocks or feet) lies above the Ischial spines, the foetal position is reported as a negative number from -1 to -5 (each number is a centimetre). If the presenting part lies below the Ischial spines, the station is reported as a positive number from +1 to +5. The baby is said to be 'engaged' in the pelvis when it is even with the Ischial spines at 0 station (reference: http://www.umm.edu/ency/article/002060.htm)

[87] Is a local anesthetic. This means that it reduces sensation or pain in the area of the body where it is injected and does not affect other areas. (Reference: British National Formulary 2009)

[88] Fentanyl is a potent, synthetic opioid analgesic with a rapid onset and short duration of action (Reference: British National Formulary 2009)

At interview, Anaesthetic Registrar2 indicated the pain described by the patient was different. Usually when an epidural starts to wear off or is not working the patient feels contractions. In this case, the patient was feeling pain in her lower abdomen. Anaesthetic Registrar2 indicated s(he) waited to discuss the patient's care with the Obstetric Registrar as s(he) wanted to ensure the pain was not obstetric related.

At interview, the Obstetric Registrar informed the investigators that Anaesthetic Registrar2 called them to review the patient as s(he) wished to ensure nothing was amiss.

19:10hours – exact time not legible

It has been documented by staff midwife in the maternity unit (floor) the patient was in labour ward at that time, was 6-7cms dilated and an epidural was in situ.

19:30hours

It has been documented by Clinical Midwife Manager1 A in the patient's healthcare record that the patient was feeling more comfortable and the CTG tracing was showing good variability at baseline.

The patient through feedback on the draft chronology advised the investigators at no time over the course of the evening did the patient feel at all comfortable and was in extreme pain. At no point from 17:30hours; once the first epidural wore off, did the pain improve.

Clinical Midwife Manager1 A has documented s(he) administered Paralink[89]1g per rectum (PR) to the patient. Clinical Midwife Manager1 A has documented in the patient's healthcare records clear liquor drained at that time.

20:00hours

Documentation completed in the patient's healthcare record by Clinical Midwife Manager1 A indicated that a vaginal examination was carried out. The findings were recorded as follows:

- Cervix Position: Not recorded
- Consistency of Cervix: not recorded
- Cervix Dilation: 8-9cms dilated
- Station: 0

It was documented the patient was very distressed at that time, was complaining of pressure and upper abdominal pain, had no scar tenderness. Anaesthetic Registrar2 was contacted. It was recorded that Obstetric Registrar was present. The Obstetric Registrar through feedback on the draft chronology indicated s(he) was not present at that time.

The patient's clinical observations were recorded as follows:

[89]Paralink Suppositories contain the active ingredient paracetamol. Paracetamol is a pain killer and can reduce high temperatures (fever). Strength - 500mgs suppositories, dose 1-2 (Reference BNF June 2016)

- Blood pressure: 114/67 mmHg,
- Pulse rate: 118 bpm
- Temperature: 37.6degress Celsius

The following was documented in relation to the CTG tracing:

- Variable decelerations noted
- Tracing of 200 bpm decreasing to 70-80 bpm.

The clinical observations above were recorded on the partogram proforma as being taken at 20:00hours. It was documented the patient's pulse rate = 110bpm, there was no temperature recorded.

At interview, the patient and her husband outlined that there was difference of opinion in relation to the CTG tracings between Clinical Midwife Manager1 A and the Obstetric Registrar. The Registrar was of the opinion that the CTG was normal. S(he) kept pacing the room continuously while there. S(he) didn't speak. The patient and her husband were of the opinion Clinical Midwife Manager1 A did not seem satisfied with the readings.

Through feedback on the report, the Obstetric Registrar outlined that his/her recollection was the difference of opinion was in relation to the terbutaline[90] not the CTG, that the CTG was abnormal with hyperactivity of the uterus.

20:10hours

An unsigned entry in the healthcare record states – "called to see patient distressed"

20:15hours

It has been documented by Staff Midwife2 in the patient's healthcare records s(he) received a handover from Clinical Midwife Manager1 A. Staff Midwife2 recorded that the patient was distressed in pain and awaiting review by the Anaesthetist. Staff Midwife2 recorded that entonox gas was commenced. The patient's vital signs were checked and recorded by Staff Midwife2 as follows:

- Blood pressure: 114/67 mmHg,
- Pulse rate: 110 bpm

The CTG was showing no variability at that time.

- Foetal heart varying from 72-202 bpm.
- Contracting: 1:1-2 minutes.

It has been documented by Staff Midwife2 that they were waiting on the Obstetric Registrar to review the patient.

At interview, the Obstetric Registrar indicated s(he) was called by two midwives. First call was in relation to the patient's pain that was similar to pain earlier. While Obstetric

[90] A synthetic compound with bronchodilator properties, used especially in the treatment of asthma. Terbutaline injection is also sometimes used for a short period of time (less than 48 to 72 hours) to treat premature labor in pregnant women who are in a hospital.

Registrar was on their way to the labour ward, s(he) received another call with regards to the baby's erratic heartbeat.

20:20hours

It has been documented by the Obstetric Registrar in the patient's healthcare record that the patient was distressed despite epidural infusion and had constant pains. The Obstetric Registrar through feedback on draft chronology indicated there was no break between the contractions, coming one after the other. S(he) observed this for a few minutes.

The Obstetric Registrar carried out a vaginal examination and the findings were recorded by the Obstetric Registrar as follows:

- Dilation: 9cm dilated
- Station: The foetal head was documented as being at 0.
- Liquor: Nil

It has been documented by the Obstetric Registrar their diagnosis was the patient had a previous LSCS[91] with hyperactivity of the uterus. The plan of care has been documented to administer terbutaline[92] 0.25mgs. This was charted as stat[93] dose, for administration subcutaneously [94](S.C). Clinical Midwife Manager1 B[95] has recorded in the "Maternity/Paediatric Drug Record Sheet" s(he) administered the terbutaline.

At interview, Obstetric Registrar indicated terbutaline is a standard treatment for hyperactivity of the womb with abnormal CTG tracing. There were variable decelerations[96], rate varying from 200bpm-80bpm. At interview, Obstetric Registrar indicated after the administration of terbulatine, the CTG returned to normal again.

20:20hours

Staff Midwife2 documented the Obstetric Registrar was present in the room. The S.C terbutaline prescribed was administered by Clinical Midwife Manager1 B at 20:25hours.

It has been documented by Staff Midwife2 Consultant Obstetrician2 was contacted by Clinical Midwifery Manager1 A.

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91 The Lower Segment Caesarean Section, more commonly used today, involves a smaller transverse cut which results in less blood loss and is easier to repair (reference http://www.news-medical.net/health/Cesarean-Section-Types.aspx)

92 A synthetic compound with bronchodilator properties, used especially in the treatment of asthma. Terbutaline injection is also sometimes used for a short period of time (less than 48 to 72 hours) to treat premature labor in pregnant women who are in a hospital.

93 Medication given immediately as a single dose

94 Injection beneath the skin. Typical sites include the abdomen, upper or outer arm, and the thigh. (Reference: medical-ictionary.thefreedictionary.com/subcutaneous+injection

95 At interview (telephone), Clinical Midwife Manager1 B informed the investigators s(he) was on day duty on 9th February. S(he) does not recall how they became involved in the case. Clinical Midwife Manager1 B indicated it was not unusual to be asked to administer terbutaline. It was not something that was used very regularly but has been used in the event when someone was hyper contracting to try and relax the uterus, to try and space out the contractions. Clinical Midwife Manager1 B outlined s(he) had administered the medication before but it was not something they used on a regular basis.

96 Variable, intermittent periodic slowing of FHR with rapid onset and recovery. Time relationships with contractions cycle are variable and they may occur in isolation. Sometimes they resemble other types of deceleration patterns in timing and shape.

20:30hours

The Obstetric Registrar documented in the patient healthcare records that the CTG tracing improved and the patient's pain was settling. S(he) has documented a vaginal examination was carried out and the findings were recorded as follows:

- Dilation: cervix 9cms dilated
- Station: 0

It has been documented by the Obstetric Registrar Consultant Obstetrician2 was contacted by Clinical Midwifery Manager1 A.

20:30hours

A retrospective note by Clinical Midwife Manager1 A outlined they spoke to Consultant Obstetrician2 who stated they were coming into the hospital.

At interview, Clinical Midwife Manager1 A indicated s(he) knew the patient needed to go to theatre so rang Consultant Obstetrician2 and gave a brief synopsis of the patient's status. At interview, Clinical Midwife Manager1 A informed the investigators that Consultant Obstetrician2 advised the Clinical Midwife Manager1 A to bring the patient to theatre and s(he) would meet them there.

Clinical Midwife Manager1 A outlined at interview, s(he) stayed with the patient and another staff member organised theatre. A colleague asked if Clinical Midwife Manager1 A "wanted a second theatre team brought in" to which Clinical Midwife Manager1 A replied "yes".

At interview, Consultant Obstetrician2 indicated s(he) gave an instruction to Clinical Midwife Manager1 A to bring the patient to theatre immediately and s(he) would meet them there. S(he) rang the labour ward twice reiterating the instruction to take mum to theatre. S(he) went straight to theatre but the patient had not arrived, s(he) then went to the labour ward.

Through feedback on the draft report, Clinical Midwife Manager1 A outlined that it was his/her recollection that s(he) was involved in preparing the patient for theatre and transferred her to the operating theatre trolley; the CTG was discontinued in anticipation of transferring the patient to theatre; CTG was recommenced when the patient was on the theatre trolley.

At interview, the Obstetric Registrar indicated s(he) outlined Clinical Midwifery Manager1 A advised him/her, s(he) rang Consultant Obstetrician2 who indicated to take the patient to theatre. The Obstetric Registrar outlined at interview, at that stage Consultant Obstetrician2 instructions were being followed.

20:30hours

Staff Midwife2 has documented in the patient's healthcare records that the patient felt the pain had eased and the CTG tracing was improved.

The patient through feedback on the draft chronology advised the investigators; although the contractions had evened out and were no longer overlapping the patient was still in extreme pain.

20:40 – 21:00hours

It has been documented by Staff Midwife2 the patient was prepared for theatre for trial of vacuum or emergency lower segment caesarean section. The CTG monitoring was discontinued. The patient was transferred onto the theatre trolley. It has been documented by Staff Midwife2 that Consultant Obstetrician2 was to attend the ward at that time and review the patient before transfer to theatre. The CTG was recommenced. Consultant Obstetrician2 documented a retrospective note in the patient's healthcare records that s(he) made at this time (no time entered) that at this time (**20:30hours-21:00hours**) s(he) was called to see the patient by Clinical Midwifery Manager1 A as the CTG was unsatisfactory. The findings of a vaginal examination were recorded as follows:

- Dilation: 9cms dilated
- Station: Vx[97] high (-1/-2)
- Cervix position: anterior
- Cervix consistency: thick

At interview, Consultant Obstetrician2 outlined on vaginal examination the cervix was thick; this indicated the patient was unsuitable for vaginal delivery.

It has been documented by Consultant Obstetrician2 the patient required urgent transfer to theatre for delivery. It has been documented by Consultant Obstetrician2 this was explained by him/her to the couple.

It has been documented by Staff Midwife2, the CTG was discontinued again and the patient was transferred from the labour ward to the operating theatre for trial of vacuum[98] or possibility of proceeding to Emergency Lower Segment Caesarean Section (LSCS).

At interview, Staff Midwife2 indicated s(he) alerted paediatrics about the emergency section and accompanied the patient to theatre.

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[97] Vertex (Vx) presentation**:** Head presentation of the foetus during birth in which the upper back part of the foetal head is the presenting part. (reference: The American Heritage® Medical Dictionary, 2004 Published by Houghton Mifflin Company; Medical Dictionary for the Health Professions and Nursing © Farlex 2012)

[98] An apparatus sometimes used to assist the delivery of a baby, consisting of a cup which is attached to the foetal head by suction, and a chain by which traction can be exerted in order to draw out the baby http://dictionary.reference.com/browse/ventouse

20:50hours

Clinical Midwife Manager1 A has documented on the "Pre-operative/Intra-operative and Recovery Room Record" proforma s(he) administered the following pre-medications[99] at that time:

- Sodium Citrate[100]
- Maxolon IM[101]
- Zantac IM[102]

The dose of each medication administered has not been documented.

The section indicating the pre-medications were checked by another staff member has not been completed.

Other sections on this record are as follows, requiring circle Yes or No

- Ward: Maternity
- Consent signed: Not completed
- Proposed Operation: EM LSCS[103]
- Food/drink last consumed: 12:00hours today. ¾ glass in last hour.
- Intravenous Therapy: not completed
- Cortisone Therapy: not completed
- Other drugs given: not completed
- Identity band: Yes – circled
- Dentures removed: No circled and N/A[104] included
- Urinalysis – Last passed urine – Time: not completed
- Weight: not completed
- Dental caries crowns/bridges: No circled
- Jewellery removed: No circled
- Drug/Food Allergies: NKA[105]
- Group and X Match: not completed
- Rhesus Factor: Pos[106]. Circled
- Hx of previous Back injury/problem: not completed
- Subcutaneous Heparin Type: not completed
- Visited by Clergyman: not completed
- Operation site marked: not completed
- Care of valuables as per policy: not completed
- Nail Polish/Make-up removed: Yes circled
- Any prosthesis : No – circled
- Any Contact Lens: No – circled
- Bath: not completed

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[99] Administration of drugs before anaesthesia to allay apprehension, produce sedation, and facilitate the administration of anaesthesia. (Reference: www.medicaldictionary.thefreedictionary.com/pre-medications)

[100] Sodium citrate is licensed for use as a prophylaxis of acid aspiration (Reference; British National Formulary 2008).

[101] To prevent aspiration of stomach acid during anaesthesia and other digestive problems. Maxolon 10mg/2ml solution for injection ampoules, Metoclopramide hydrochloride 5 mg per 1 ml – Anti-emetic, BNF 2016 Online

[102] To prevent aspiration of stomach acid during anaesthesia and other digestive problems. Zantac 50mg/2ml solution for injection (BNF 2016 online)

[103] The Lower Segment Caesarean Section, more commonly used today, involves a smaller transverse cut which results in less blood loss and is easier to repair (reference http://www.news-medical.net/health/Cesarean-Section-Types.aspx

[104] Not applicable

[105] No known allergies

[106] Positive

- Skin Prep: not completed
- Gown: Yes circled
- Section To Theatre with patient: not completed

It was not recorded what staff member completed this form and who accompanied the patient to theatre.

21:00hours

It has been documented in the "Nurses Operation Record Sheet" the patient entered the Anaesthetic room at 21:00hours.

The Obstetric Registrar through feedback on the draft chronology indicated the patient was connected to the anaesthetic monitor in the operating theatre at 20:58hours. There was no anaesthetic room.

21:00hours

At interview, Theatre Staff Nurse1 indicated s(he) was called in to open the second theatre. It was practice to leave a theatre set up for an Emergency Section. There was another theatre operating at the time. Theatre Staff Nurse1 recalled the patient was in a lot of pain when she arrived to theatre.

At interview, Theatre Staff Nurse2 outlined s(he) was called in to open the second theatre also. A theatre is left set up and ready for a section.

The "Time Out Procedure" proforma was incomplete and the "Consent Form" was not completed.

There were two entries on the "Operating Chart" dated 9th February 2010.

It has been documented by Consultant Obstetrician2 in the "Operation Chart" proforma s(he) carried out a vaginal examination. The findings were recorded as follows:

- Dilation: 9cms dilated
- Station: Vx[107] above spine
- Cervix consistency: thick anterior lip & oedematous
- Liquor: meconium

It has been documented by Consultant Obstetrician2 that the patient was not suitable for a trial vacuum.

It was documented by Staff Midwife2 in the patient's healthcare records the patient was in theatre at this time, the patient was reviewed by Consultant Obstetrician2. The foetal heart rate was 80 bpm with Sonicaid[108]. Consultant Obstetrician2 decided the patient required emergency LSCS.

[107] Vx-Vertex, head presentation of the foetus during birth in which the upper back part of the foetal head is the presenting part. (Reference: The American Heritage® Medical Dictionary Copyright ©2007, 2004 by Houghton Mifflin Company)

[108] Hand held ultrasound monitor that is used to detect foetal heart rate

At interview, Obstetric Senior House Officer outlined when s(he) arrived to the operating theatre, s(he) was immediately asked to go and inform the patient's husband the team were giving his wife a general anaesthetic and that therefore, he would not be able to come into the operating theatre area. Obstetric Senior House Officer1 informed the investigators s(he) advised the patient's husband of this and returned to the operating theatre.

The operation notes outline that the Obstetric Registrar and Consultant Obstetrician2 carried out the operation and Obstetric Senior House Officer assisted.

The Obstetric Registrar through feedback on the draft chronology indicated Consultant Obstetrician2 did not carry out the caesarean section. Consultant Obstetrician2 starting assisting during the closure of the first uterine layer. The Obstetric Registrar was then asked to review another patient by Consultant Obstetrician2.

It has been documented in the patient's healthcare records by the Obstetric Registrar that the patient's abdomen was opened through the old scar. It has been documented in the patient's healthcare records by the Obstetric Registrar there was uterine dehiscence[109] of the scar noted. A baby girl was delivered; cord loops which appeared tight were removed from around the neck. The baby was given to the midwife and to the care of the paediatricians. The placenta was delivered through the abdominal cavity. It has been documented by the Obstetric Registrar that Consultant Obstetrician2 was present and took over when the first layer of the uterus was closed.

It has been documented by Obstetric Registrar in a retrospective note on a second "Operating Chart" proforma dated 10th February 2010 that at this time (21:30aprox) the patient was transferred to theatre for a trial of vacum or Lower Segment Caesarean Section (LSCS).

The Obstetric Registrar has documented s(he) was asked to do a LSCS by Consultant Obstetrician2 after Consultant Obstetrician2 performed a vaginal examination, the patient was not suitable for instrumental vaginal delivery.

The abdomen was opened through the old scar. The baby was delivered. There was umbilical cord x 2 around the neck which looked tight. The cord loops were removed from the neck and the cord was clamped and cut. The baby was given to the midwife.
The placenta was delivered completely by CCT[110]. The membranes were mildly meconium stained (partially light greenish). There were no signs of extra or intrauterine bleeding before, during and after the delivery of the baby. Consultant Obstetrician2 was constantly present in theatre. S(he) took over at this stage of the procedure.

[109] A bursting open, splitting, or gaping along natural or sutured lines. (Reference:www.medicaldictionary.thefreedictionary.com/dehisence)
[110] CCT – Controlled Cord Traction

The Obstetric Registrar recorded s(he) left the theatre.

It has been documented in the patient's healthcare records by Consultant Obstetrician2; the operation performed was an Emergency Lower Segment Caesarean Section (LSCS) due to unsatisfactory CTG. It has been documented in the patient's healthcare records by Consultant Obstetrician2 the the patient had thrombo-embolic[111] stockings applied as a method of thromboprophylaxis[112]. The patient received prophylactic antibiotic-Augmentin 1.2g[113] intravenously during induction of anaesthesia. The patient had a general anaesthetic[114].

It has been documented in the patient's healthcare records by Consultant Obstetrician2; the patient had a ruptured[115] lower uterine segment[116] extending down in the vagina. It has been documented in the patient's healthcare records by Consultant Obstetrician2; the uterus was closed and the peritoneum was closed. It has been documented in the patient's healthcare records by Consultant Obstetrician2; the ovaries and tubes were intact. It has been documented in the patient's healthcare records by Consultant Obstetrician2; staples were applied onto the skin.

At interview, the Obstetric Registrar indicated there was no tear or rupture of the uterus. S(he) made the incisions and sutured. The muscular layer was intact, the lower segment was intact. There was no blood present.

Through feedback on the draft chronology, the Obstetric Registrar indicated there was no opening in the uterus before s(he) opened it.

At interview, Consultant Obstetrician2 indicated there was no rupture[117], but a dehiscence[118] was present.

Consultant Obstetrician2 has documented the following plan of care post-operatively for the patient in the healthcare records. The patient required the following bloods taken on return to the ward:

- Full Blood Count[119]
- Coagulation screen[120]

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111 Thrombo-embolic deterrent stockings

112 Any preventive measure or medication that reduces the likelihood of the formation of blood clots. (Reference:http://medicaldictionary.thefreedictionary.com/thromboprophylaxis)

113 Augmentin (amoxicillin/clavulanate) is a combination antibiotic used to treat bacterial infections. (Reference: BNF June 2016)

114 General anesthesia is the induction of a state of unconsciousness with the absence of pain sensation over the entire body, through the administration of anesthetic drugs. It is used during certain medical and surgical procedures. (Reference: http://medical-dictionary.thefreedictionary.com/general+anesthesia">general anesthesia"

115 Tear or break of an organ or tissues (Reference: http://medical-dictionary.thefreedictionary.com/rupture)

116 The inferior portion or isthmus of the uterus, the lower extremity of which joins with the cervical canal and, during pregnancy, expands to become the lower part of the uterine cavity. This is not the active contracting portion of the uterus.(Reference: http://medical-dictionary.thefreedictionary.com/lower+uterine+segment")

117 Tear or break of an organ or tissues (Reference: http://medical-dictionary.thefreedictionary.com/rupture)

118 A bursting open, splitting, or gaping along natural or sutured lines. (Reference:www.medicaldictionary.thefreedictionary.com/dehisence

119 Full Blood Count (FBC) is used as a broad screening test to check for such disorders as anaemia, infection, and many other diseases. It is actually a panel of tests that examines different parts of the blood (reference: http://www.labtestsonline.org.uk/understanding/analytes/fbc/tab/test).

- Urea and Electrolytes[121]

Urinary Catheter to remain in place until the following day.

Haembate and Syntometrine[122] were administered intramuscularly intra-operatively.

For Cytotec[123] 800mg per rectum (PR).

At interview, Theatre Staff Nurse2 Theatre Staff Nurse2 recalled a greenish discolouration was present when the caesarean section was performed.

It has been documented by Staff Midwife2 on the "Maternal Summary" proforma the meconium was graded as Grade 2.

21:15hours

It has been documented by Staff Midwife2 that the Paediatric Senior House Officer was present in theatre. The baby was brought to the resuscitaire[124] and to the Paediatric Senior House Officer.

The baby was flat[125]; the Paediatric Registrar was contacted by Staff Midwife2 on the emergency bleep.

At interview, Paediatric Senior House Officer indicated that on arrival to theatre s(he) checked paediatric equipment which was kept in the anaesthetic room. The Midwife brought the baby straight to him/her. The baby was completely flat with AGPAR[126] score = 0 at 1 minute. Paediatric Senior House Officer indicated s(he) started resuscitation immediately including ventilation and CPR[127].

Staff Midwife2 documented the following on the "Summary of Labour" proforma:

- There was no induction of labour.

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120 Testing is performed to determine if a person has a sufficient amount of coagulation activity in order to control the blood clotting process. It is used by health care providers to determine if the level of a factor is low or absent (below the detectable limit), associated with reduced clot formation and bleeding, or too high, sometimes associated with too much clot formation and thrombosis. (reference: http://www.labtestsonline.org.uk/understanding/analytes/fbc/tab/test).

121 U&E is the abbreviation used for urea and electrolytes. These are a group of blood tests to measure the levels of salts in the blood (such as sodium and potassium), as well as the urea and creatinine levels, which show the kidney function as they are waste products. (reference: http://www.patient.co.uk/health/nephrotic-syndrome-leaflet)

122 An injection of Syntometrine is given in the third stage of labour, just after the birth of the child to facilitate delivery of the placenta and to prevent postpartum hemorrhage by causing smooth muscle tissue in the blood vessel walls to narrow, thereby reducing blood flow. (reference: http://www.netdoctor.co.uk/pregnancy/medicines/syntometrine.html)

123 Cytotec makes the uterus contract and expel the pregnancy tissue (reference: http://www.whcoso.com/index.cfm/fuseaction/site.content/type/index.cfm/fuseaction/site.content/mode/dtl/type/45105/post/61678.cfm)

124 A resuscitaire is a device which combines an effective warming therapy platform along with the components needed for clinical emergency and resuscitation (reference: http://www.draeger.ae/AE/en_US/products/neonatal_care/)

125 An objective score of the condition of a baby after birth. This score is determined by scoring the heart rate, respiratory effort, muscle tone, skin colour, and response to a catheter in the nostril. Each of these objective signs receives 0, 1, or 2 points. An Apgar score of 10 means an infant is in the best possible condition. The Apgar score is done routinely 60 seconds after the birth of the infant. A child with a score of 0 to 3 needs immediate resuscitation. The Apgar score is often repeated 5 minutes after birth, and in the event of a difficult resuscitation, the Apgar score may be done again at 10, 15, and 20 minutes. Ref:http://www.medicinenet.com/script/main/art.asp?articlekey)
Apgar Score: an index used to evaluate the condition of a newborn infant based on a rating of 0, 1, or 2 for each of the five characteristics of colour, heart rate, response to stimulation of the sole of the foot, muscle tone, and respiration with 10 being a perfect score.
http://www.merriam-webster.com/dictionary/apgar%20score

126 An objective score of the condition of a baby after birth. This score is determined by scoring the heart rate, respiratory effort, muscle tone, skin colour, and response to a catheter in the nostril. Each of these objective signs receives 0, 1, or 2 points. An Apgar score of 10 means an infant is in the best possible condition. The Apgar score is done routinely 60 seconds after the birth of the infant. A child with a score of 0 to 3 needs immediate resuscitation. The Apgar score is often repeated 5 minutes after birth, and in the event of a difficult resuscitation, the Apgar score may be done again at 10, 15, and 20 minutes. Ref:http://www.medicinenet.com/script/main/art.asp?articlekey)
Apgar Score: an index used to evaluate the condition of a newborn infant based on a rating of 0, 1, or 2 for each of the five characteristics of colour, heart rate, response to stimulation of the sole of the foot, muscle tone, and respiration with 10 being a perfect score.
http://www.merriam-webster.com/dictionary/apgar%20score

127 Cardiopulmonary resuscitation involves physical interventions to create artificial circulation through rhythmic pressing on the patient's chest to manually pump blood through the heart, called chest compressions, and usually also involves the rescuer exhaling into the patient (or using a device to simulate this i.e. an ambu bag and oxygen mask) to ventilate the lungs and pass oxygen in to the blood, called artificial respiration

- Artificial rupture of membranes was the method used to accelerate labour.
- The monitoring was external and continuous.
- The liquor was meconium stained.
- The pain relief included entonox, pethidine and an epidural.
- The delivery was an Emergency Caesarean Section due to non-reassuring CTG.
- The foetal presentation at delivery was occipito-anterior position[128].
- The third stage of labour[129] the placenta and the membranes were complete.
- The method of expulsion was CCT[130], the placenta was not sent for histology.
- No blood sample was taken from the umbilical cord.

It was recorded by Staff Midwife2 the patient entered the delivery suite at 10:15hrs on the morning of 9th February 2010; was transferred to theatre at the end of the first stage of labour[131] at 20:55hours. The remaining sections were not completed. The sections under Perineal Repair were also not completed.

The following was documented on "Infants Record" section by Staff Midwife2 as follows:

Reg Number: included

SEX: Female ✓

Weight ... 3.70kg

The baby's Apgar Score [132] was recorded as follows:

Sign	*1min.*	*2min.*
Heart rate	*0*	*0*
Respiration	*0*	*0*
Tone	*0*	*0*
Stimulation	*0*	*0*
Colour	*0*	*0*
Total	*0*	*0*

Under heading "Resuscitation" the following sections were completed by Staff Midwife2:

- *Mucus extraction ✓*
- *Oxygen ✓*

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128 The Occipito-Anterior position is ideal for birth – it means that the baby is lined up so as to fit through the pelvis as easily as possible. The baby had down, facing the spine, with his/her back on one side of the front of the tummy. In this position, the baby's chin is tucked onto the chest, so that the smallest part of his/her had will be applied to the cervis first. The position is usually 'Left Occiput Anterior' or LOA – occasionally the baby may be 'Right Occiput Anterior' or ROA. (Reference:http://www.homebirth.orguk/ofp.htm)

129 The third stage of labour is the passage of the placenta (reference: http://www.umm.edu/pregnancy/000126.htm#ixzz1x0x7XMI5).

130 CCT – controlled cord traction (method of expulsion of placenta)

131 The first stage of labour is the process of reaching full cervical dilatation. This begins with the onset of uterine labour contractions, and it is the longest phase of labour. The first stage is divided into three phases: latent, active, and deceleration. The second stage is the delivery of the infant. The third stage of labour is the passage of the placenta (reference: http://www.umm.edu/pregnancy/000126.htm#ixzz1x0x7XMI5).

132 An objective score of the condition of a baby after birth. This score is determined by scoring the heart rate, respiratory effort, muscle tone, skin colour, and response to a catheter in the nostril. Each of these objective signs receives 0, 1, or 2 points. An Apgar score of 10 means an infant is in the best possible condition. The Apgar score is done routinely 60 seconds after the birth of the infant. A child with a score of 0 to 3 needs immediate resuscitation. The Apgar score is often repeated 5 minutes after birth, and in the event of a difficult resuscitation, the Apgar score may be done again at 10, 15, and 20 minutes. Ref:http://www.medicinenet.com/script/main/art.asp?articlekey=2303.
Apgar Score: an index used to evaluate the condition of a newborn infant based on a rating of 0, 1, or 2 for each of the five characteristics of colour, heart rate, response to stimulation of the sole of the foot, muscle tone, and respiration with 10 being a perfect score.
http://www.merriam-webster.com/dictionary/apgar%20score

- *Intubation √*
- *Cord visualised √*

"Nuchal Cord[133]" x 2 tight - yes √

21:16hours

Staff Midwife2 recorded in the patient's healthcare records that the staff in the Special Care Baby Unit (SCBU) were contacted to come to theatre.

The "Maternal Summary**"** proforma was completed by Staff Midwife2 as follows:

[133] Loop(s) of umbilical cord around the foetal neck, posing risk of intrauterine hypoxia, foetal distress, or death. Reference : http://medical-dictionary.thefreedictionary.com/nuchal+cord)

Hospital Name: Hospital 1		Mother's name:	completed
Hospital Number: Completed		DOB:	completed
Consultant:	Consultant Obstetrician1	Age:	completed
GP Name: Not completed		Marital Status:	Married
Address: Not completed		Telephone:	Completed
Phone No: Not completed		Mobile:	Completed
		E.D.D[134]:	3/02/2010

GP & Antenatal	
PARITY:	2
BLOOD GROUP:	0 Rh Positive
ANTIBODIES:	No
RUBELLA – Status:	RUBELLA IMMUNE
Hb. – (most recent: result	9.1
H.I.V. Status:	H.I.V. antibody negative
VDRL Status:	Negative
Hep B Status:	Negative
Hep C Status:	Unknown
Sickle Cell Status:	Test – Not indicated
PAST OBSTETRIC Hx[135]:	Specify:vacuum extraction 2006, em.c/s@30weeks placental abruption, baby R.I.P. 2008
MEDICAL Hx.	Specify: epilepsy – no meds
ALLERGIES:	No Known Allergies
Patient booked in Hospital1:	Yes
TYPE OF CARE:	Combined GP/A/N Clinic
ETHNIC ORIGIN:	Caucasian
Main maternal: Diseases or conditions Affecting fetus or Infant	Other

Labour	
ONSET of LABOUR:	Spontaneous
MODE of DELIVERY:	EMERGECNY L.S.C.S
Membranes Ruptures:	A.R.M.
Liquor:	MECONIUM –Grade 2
Emergency LSCS:	Non-Reassuring CTG
Indication:	
ARM/SROM:	09/02/2010 15:00:00
SYNTOCINON:	No Syntocinon used
INTRA-PARTUM COMP:	Non-Reassuring CTG
DRUGS:	Bricanyl S/C
INTRA-PARTUM:	
DURATION OF LABOUR:	12:00:00
Pain Relief/Anaes.:	General Anaesthetic

[134] EDD- Expected date of delivery

[135] Hx-History

Third stage

OXYTOCIC Rx. 3rd Stage:	Syntometrine I.V,: Other Other, intubated
Placenta:	Placenta Complete
P/PARTUM PROBLEMS:	No problems post partum
Est. Bld Loss (approx mls):	800
PERINEUM:	
TRANSFERED TO:	Maternity Ward
Comments – Labour/3rd stage:	No

Baby Details

SURNAME:	
DATE/TIME – DELIVERY:	09/02/2010 21:15:00
MODE of DELIVERY:	EMERGENCY L.S.C.S
NUMBER OF BABIES BORN:	Singleton
SEX:	FEMALE
GESTATION:	39+3
WEIGHT:	3.70
Anti D Immug:	Not indicated
TYPE of BIRTH:	LIVE
APGAR@ 1 min.:	0
APGAR@ 5 mins.:	0
RESUSCITATED:	Yes, Resusitated with Apgars of 0 at 1 minute and 5 minutes, suction/bag & mask, intubated and adrenaline via E/T tube, chest compressions
TIME OF DEATH:	
FEEDING:	Breastfeeding
BREASTFED:	Other
KONAKION:	
I.D. Bands:	Yes
PLACE of BIRTH:	Hospital
TRANSFERRED TO:	S.C.B.U.
Skin/Skin contact:	No-Emergency Transfer to SCBU
COMMENTS:	Yes; clear liquor on transfer to OT, mec. at delivery
Baby – MRN[136]:	xxxxx
Midwife attending Delivery:	Staff Midwife2
Completed by:	Staff Midwife2

[136] MRN-Medical Record Number

21:15hours (Information taken from retrospective note written at 21:45hrs)

Staff Nurse Special Care Baby Unit (SCBU) documented in a retrospective note that s(he) made at 21:45hours that at this time (i.e. 21:15hours), (s)he was called to the operating theatre.

It has been documented by Staff Nurse (SCBU) that the baby was flat on delivery. It has been documented by Staff Nurse (SCBU) when s(he) arrived to theatre the baby was receiving bag & mask ventilation and cardiac massage at 4 mins of age. It has been documented by Staff Nurse (SCBU) the baby had no heart rate and there was no respirations. It has been documented by Staff Nurse (SCBU) a size 3mm Endo Tracheal Tube[137] (ETT) was sited and 0.3ml adrenaline[138] was given via the ETT, Positive Pressue Ventilation[139] (PPV) was continued with cardiac massage, there was meconium stained secretions from the ETT, this was suctioned. It has been documented by Staff Nurse (SCBU) another ETT was sited and 2nd dose of adrenaline 0.3mls was given. It has been documented by Staff Nurse (SCBU) at this stage, the baby's heart rate was greater than 100bpm, there was no respiratory effort. Positive Pressue Ventilation[140] (PPV) was continued and cardiac massage was stopped. It has been documented by Staff Nurse (SCBU) an intravenous cannula was sited. The baby had 35 mls NACL[141] bolus given stat[142]. The baby was brought to SCBU.

At interview, Staff Nurse (SCBU) indicated the baby was transferred to SCBU in transport incubator so was getting full ventilation during transfer.

22:00hours

The Consultant Paediatrician has documented in the baby's healthcare records s(he) arrived to theatre the baby was 12-13mins of age. S(he) documented that the baby girl was on the resuscitaire, and that an Endo Tracheal Tube (ETT) was in place. The baby was ventilating well. The baby's colour was pink and pale. There was no spontaneous breathing. The baby's heart rate was greater than 100bpm. The baby had two intravenous cannula's[143] in place.

The baby's AGPAR[144] score=

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137 Endotracheal intubation is the insertion of a tube into the trachea for purposes of anesthesia, airway maintenance, aspiration of secretions, lung ventilation, or prevention of entrance of foreign material into the airway; the tube goes through the nose or mouth (reference : http://medical-dictionary.thefreedictionary.com/intubation)

138 Adrenaline is administered following a cardiac arrest associated with ventricular fibrillation, pulseless ventricular tachycardia, asystole and electromechanical dissociation (Reference: British National Formulary 2009)

139 Any of numerous types of mechanical ventilation in which gas is delivered into the airways and lungs under positive pressure, producing positive airway pressure during inspiration. It may be done via either an endotracheal tube or a nasal mask. (Reference: http://medical-dictionary.thefreedictionary.com/positive+pressure+ventilation)

140 Any of numerous types of mechanical ventilation in which gas is delivered into the airways and lungs under positive pressure, producing positive airway pressure during inspiration. It may be done via either an endotracheal tube or a nasal mask. (Reference: http://medical-dictionary.thefreedictionary.com/positive+pressure+ventilation)

141 Sodium Chloride contains sodium chloride 0.9% (reference: British National Formulary 2009).

142 Medication given immediately as a single dose

143 A peripheral IV cannula is a small plastic tube that is inserted through the skin into one of the small veins in your hand or arm. They are used to give many different types of medications, for example antibiotics or fluids. (Reference www.buckshealthcare.nhs.uk)

144 An objective score of the condition of a baby after birth. This score is determined by scoring the heart rate, respiratory effort, muscle tone, skin colour, and response to a catheter in the nostril. Each of these objective signs receives 0, 1, or 2 points. An Apgar score of 10 means an infant is in the best possible condition. The Apgar score is done routinely 60 seconds after the birth of the infant. A child with a score of 0 to 3 needs immediate

0 at 1 minute

0 at 5 minutes

4 at 10 minutes

The Consultant Paediatrician has documented the baby was born by Emergency Caesarean Section; there was rupture of the uterus and cord around the baby's neck x 2. It has been documented by the Consultant Paediatrician; the infant needed CPR[145] at delivery. An ETT tube was sited, adrenaline[146] was given via the Endo Tracheal Tube (ETT). The Registrar, Senior House officer and neonatal nurse were present. The baby was transferred to SCBU.

22:25hours

It has been documented in the patient's healthcare records the patient arrived to the recovery room at 22:25hours. An unsigned entry on the "Intra/Post Operative Record" proforma indicated the following were in situ:

- Oxygen 40%
- An ECG monitor
- Pulse oximetry[147]

The patient's clinical observations were recorded as follows-

- Blood pressure: 142/77 mmHg
- Pulse rate:138 beats per minute
- Respiratory rate: 14
- Pulse Oximetry: 97%

At interview, the patient informed the investigators that while in the recovery room, the midwife told her she had a baby girl. The patient indicated at interview that she felt so excited at this time. The patient informed the investigators at interview that the midwife did not tell her anything about the baby's condition at this time.

At interview, the patient's husband informed the investigators that he was waiting outside the theatre. He informed the investigation team that the staff were running, he had a sense there were problems. The patient's husband informed the investigators he recalled the Paediatric doctor informed him several attempts were made to revive their

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resuscitation. The Apgar score is often repeated 5 minutes after birth, and in the event of a difficult resuscitation, the Apgar score may be done again at 10, 15, and 20 minutes. Ref:http://www.medicinenet.com/script/main/art.asp?articlekey=2303
Apgar Score: an index used to evaluate the condition of a newborn infant based on a rating of 0, 1, or 2 for each of the five characteristics of colour, heart rate, response to stimulation of the sole of the foot, muscle tone, and respiration with 10 being a perfect score.
http://www.merriam-webster.com/dictionary/apgar%20score

[145] Cardiopulmonary resuscitation involves physical interventions to create artificial circulation through rhythmic pressing on the patient's chest to manually pump blood through the heart, called chest compressions, and usually also involves the rescuer exhaling into the patient (or using a device to simulate this i.e. an ambu bag and oxygen mask) to ventilate the lungs and pass oxygen in to the blood, called artificial respiration

[146] Adrenaline is administered following a cardiac arrest associated with ventricular fibrillation, pulseless ventricular tachycardia, asystole and electromechanical dissociation (Reference: British National Formulary 2009)

[147] Pulse oximetry is a test used to measure the oxygen level (oxygen saturation) of the blood. It is an easy, painless measure of how well oxygen is being sent to parts of your body furthest from your heart, such as the arms and legs.A clip-like device called a probe is placed on a body part, such as a finger or ear lobe. The probe uses light to measure how much oxygen is in the blood. (Reference: www.hopkinsmedicine.org/healthlibrary/test)

baby. The patient's husband informed the investigators that their baby was put in an incubator to be brought to SCBU and that he had a minute to see their baby as she was passing in the hall outside the theatre.

22:30-22:55hours

The patient's clinical observations ranged between the following parameters during this period of time-

- Blood pressure: 135/78 - 157/90 mmHg
- Pulse rate: 103- 126bpm
- Oxygen Saturations[148]: 99%

23:00hours

It has been documented in the patient's healthcare records by Consultant Obstetrician2 that s(he) explained the events with the patient and with the patient's family.

23:00-23:15hours

The patient's clinical observations ranged between the following parameters during this period of time-

- Blood pressure: 147/88 – 148/92 mmHg
- Pulse rate: 102 - 113bpm
- Oxygen Saturations: 99%

The following was documented on "Intra/Post Operative Record" proforma. This was not signed at the time.

Wound Observations:

Unable to decipher first word *"Insitu-minimal PV blood*
Pressure dressing – dry and intact"
U catheter in situ, draining clear urine
22:40 PV minimal. Wound dressing dry"

Drugs – administration Recovery Room:

(Haembate and Syntometrine given intramuscularly (IM)
Cytotec 800mg per rectum (PR) post-op

Comments and Instructions to Ward Nurses:

"23:00 PV loss minimal. Pressure dressing NAD[149]
Drowsy but rousable".

Unable to decipher next sentence

Vomiting: *No* circled

Recovery Nurse Signed: Not completed

[148] Oxygen saturation is the amount of oxygen bound to hemoglobin in the blood, expressed as a percentage of the maximal binding capacity.
[149] NAD-No abnormalities detected

The time the patient left the recovery room was not recorded and the signature of the staff member in the receiving ward/unit the care of the patient was not entered.

At interview, the patient's husband informed the investigators that his wife was brought out from recovery and that the doctor explained that their baby was stable but that she would have to be moved to Hospital 2 by ambulance. At interview, the patient informed the investigators she said to her husband we can't lose another baby.

Wednesday 10th February 2010

00:00hours

It has been documented in the "Mother's Report" in the healthcare record that the patient returned from theatre at this time following Lower Segment Caesarean Section (LSCS) for non re-assuring CTG.

It was outlined the patient had the following:

- A urinary catheter in place
- PCA[150] activated
- Wound pressure dressing in place
- Lochia[151] was minimal

It has been documented in the patient's healthcare record that the patient was alert and orientated and was pain free at that time. The patient's clinical observations were recorded as follows:

- Blood pressure: 138/78mmHg
- Pulse rate: 88-97bpm
- Oxygen Saturations: 98% on room air

It has been documented in the patient's healthcare record that the patient was visited by her family.

It has been documented in the patient's healthcare record that Consultant Obstetrician2 spoke with the patient.

It has been documented in the "Baby's Report" proforma that the baby was fully ventilated in SCBU; the baby was on Sodium Bicarbonate[152] and Phenobarbiatone[153] for seizures. It has been documented in the "Baby's Report" proforma that Mum visited her baby in SCBU on return to the ward. The patient's husband was present. It has been documented that Consultant Paediatrician explained the treatment and that the baby was for transfer to Hospital 2 for head cooling therapy[154].

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150 PCA – patient controlled analgesia

151 The normal discharge from the uterus after childbirth.

152 To correct severe and persistent metabolic acidosis (Metabolic acidosis is a pH imbalance in which the body has accumulated too much acid and does not have enough bicarbonate to effectively neutralize the effects of the acid. (Reference: //medical-dictionary.thefreedictionary.com/metabolic+acidosis)

153 Used for all forms of epilepsy except typical absence seizures Dose: Initially 20 mg/kg, dose to be administered at a rate no faster than 1 mg/kg/minute, then 2.5–5 mg/kg 1–2 times a day. (Reference: BNF Oct 2016)

154 Brain Hypothermia, induced by cooling a baby to around 33 °C for three days after birth, is a treatment for hypoxic ischemic encephalopathy. It has recently been proven to be the only medical intervention which reduces brain damage, and improves an infant's chance of survival and reduced disability. Hypothermic neural rescue therapy is an evidence-based clinical treatment which increases a severely injured full term infant's chance of surviving without brain damage detectable at 18 months by about 50%, an effect which seems to be sustained into later childhood. (references: Edwards, AD; Brocklehurst, P; Gunn, AJ; Halliday, H; Juszczak, E; Levene, M; Strohm, B; Thoresen, M; Whitelaw, A; Azzopardi, D. (2010). "Neurological outcomes at 18 months of age after moderate hypothermia for perinatal hypoxic ischaemic encephalopathy: synthesis and meta-analysis of trial data". BMJ (Clinical research ed.) 340: c363. Shankaran, S; Pappas, A; McDonald, SA; Vohr, SR; Hintz, SR; Yolton, K; Gustafson, KE; Leach, TM; Green, C et al. (2012). "Childhood outcomes after hypothermia for neonatal encephalopathy". New England Journal of Medicine 366 (22): 2085–92. Guillet, R; Edwards, AD; Thoresen, M; CoolCap Trial Group (2011). "Seven- to eight-year follow-up of the CoolCap trial of head cooling for neonatal encephalopathy.". Pediatr Res 71 (2): 205–9. Rutherford, M; Ramenghi, LA; Edwards, AD; Brocklehurst, P; Halliday, H; Levene, M; Strohm, B; Thoresen, M et al. (2010). "Assessment of brain tissue injury after moderate hypothermia in neonates with hypoxic-ischaemic encephalopathy: a nested substudy of a randomised controlled trial". Lancet neurology 9 (1): 39–45. Robertson, NJ; Nakakeeto, M; Hagmann, C; Cowan, FM; Acolet, D; Iwata, O; Allen, E; Elbourne, D et al. (2008). "Therapeutic hypothermia for birth asphyxia in low-resource settings: a pilot randomised controlled trial". Lancet 372 (9641): 801–3.

At interview, the Consultant Paediatrician informed the investigators the baby's blood capillary blood test[155] indicated metabolic acidosis[156] as opposed to respiratory acidosis[157] in view of PH, PCO2 and bicarbonate result.

Result	**Reference Range**
PH = 6.76	(7.35-7.45)
PC02 = 7.34 kPa	(4.67-6.00)
P02 = 18.16 kPa	(10.67-13.33)
Base Excess[158] (BE) = -28.9 mmol/L	
Bicarbonate[159] (HC03) = 7.7mmol/L	

It has been documented in the "Baby's Report" proforma; a lay blessing was undertaken by the staff in SCBU at the patient's request. It has been documented in the "Baby's Report" proforma; the staff in SCBU visited the patient in relation to the transfer of her baby. It has been documented in the "Baby's Report" proforma The patient to express later.

The patient and her husband through feedback on the draft chronology indicated they have no recollection of any lay blessing being offered or performed.

It has been documented in "Mother's Report" proforma; the *patient's husband accompanied their baby on transfer to Hospital 2.*

The patient had blood samples taken for HB[160], Coag[161], U&E[162] and Group and save[163]. The following blood results were within the patient's healthcare records for these blood samples dated 10th February 2010:

FBC Result

Test	Result	Units	Reference Ranges

155 Defined as obtaining an arteriovenous sample from a peripheral body site, such as the heel, finger, or other transcutaneous site. (Reference://medical-dictionary.thefreedictionary.com/capillary+blood+sample")

156 Metabolic acidosis is a pH imbalance in which the body has accumulated too much acid and does not have enough bicarbonate to effectively neutralize the effects of the acid. Metabolic acidosis occurs when the body has more acid than base in it. Chemists use the term "pH" to describe how acidic or basic a substance is. Based on a scale of 14, a pH of 7.0 is neutral. A pH below 7.0 is an acid; the lower the number, the stronger the acid. A pH above 7.0 is a base; the higher the number, the stronger the base. Blood pH is slightly basic (alkaline), with a normal range of 7.36-7.44. (Reference: //medical-dictionary.thefreedictionary.com/metabolic+acidosis)

157 Respiratory acidosis is a condition in which a build-up of carbon dioxide in the blood produces a shift in the body's pH balance and causes the body's system to become more acidic. (Reference: medical-dictionary.thefreedictionary.com/respiratory+acidosis)

158 Base excess is the amount of acid needed to maintain the pH at a normal level with Carbon Dioxide at standard value. (WWW.RN.ORG)

159 Bicarbonate is produced by a reaction of carbon dioxide and water. (WWW.RN.ORG)

160 A conjugated protein, consisting of haem and the protein globin, that gives red blood cells their characteristic colour. It combines reversibly with oxygen and is thus very important in the transportation of oxygen to tissues (reference: http://www.thefreedictionary.com/haemoglobin). Low levels of haelmoglobin in pregnancy can indicate anaemia (reference: http://www.cyh.com/healthtopics/healthtopicdetails.aspx?p=438&np=459&id=2759#haemoglobin)

161 Testing is performed to determine if a person has a sufficient amount of coagulation activity in order to control the blood clotting process. It is used by health care providers to determine if the level of a factor is low or absent (below the detectable limit), associated with reduced clot formation and bleeding, or too high, sometimes associated with too much clot formation and thrombosis. (reference: http://www.labtestsonline.org.uk/understanding/analytes/fbc/tab/test).

162 U&E is the abbreviation used for urea and electrolytes. These are a group of blood tests to measure the levels of salts in the blood (such as sodium and potassium), as well as the urea and creatinine levels, which show the kidney function as they are waste products. (reference: http://www.patient.co.uk/health/nephrotic-syndrome-leaflet)

163 Group and save (or hold) Anticipating that there may be a requirement for blood but not routinely for this procedure, the patient's blood type is identified and held, pending a possible (later) request for units of blood or blood products. (reference: http://www.labtestsonline.org.uk/understanding/analytes/fbc/tab/test).

Haemoglobin	6.8	g/dl	11.8-14.8
Red Cells	2.96	x10^12/l	3.88-4.99
HCT[164]	0.209	L/L	0.36-0.44
MCV[165]	70.8	fl	82-99
MCH[166]	22.9	pg	27.3-32.6
MCHC	32.4	g/dl	30.0-36.0
Platelet count	191	x10 9/l	137-347
White cell count[167]	25.1	x10^9/l	3.9-11.1
Neutrophils	23.6	x10^9/l	1.7-7.5
Lymphocytes	0.5	x10^9/l	1.0-3.2
Monocytes	0.8	x10^9/l	0.2-0.6
Eosinophils	0.0	x10^9/l	0.03-0.46
Basophils	0.0	x10^9/l	0.02-0.09
LUC	0.1	x10^9/l	0.00-0.4
Blood Film:	Neutrophil leucocytosis		

Coag Result

Test	Result	Units	Reference Ranges
Prothrombin Time	15.7	sec.[168]	12-16 sec.
INR	1.2	INR	
APTT[169]	42.5	sec	25-35 sec.
APTT[170] Ratio	1.4	Ratio	
Fibrinogen	2.4	g/L	1.17 – 4.0 g/L

U&E RESULT

Test	Result	Units	Reference Ranges
Urea	2.8	mmol/l	2.1-7.8
Sodium	136	mmol/l	136-145
Potassium	4.3	mmol/l	3.5-5.3
Creatitine	46	umol/l	44-80

164 Hematocric

165 Mean Corpuscular Volume measures the size of an average red blood cell. Low mean corpus volume can be associated with anemia, thalassemias, iron deficiency and Shahidi-Nathan-Diamond syndrome. High mean corpus volume can be caused by vitamin B12 deficiency, impaired vitamin absorption, hyperthyroidism, celiac disease and deficient enzymes (reference: http://www.babymed.com/laboratory-values/mean-corpuscular-volume-mcv-whole-blood-during-pregnancy)

166 The average amount of hemoglobin in the average red cell. MCH is particularly important when testing for anaemia. http://www.babymed.com/laboratory-values/mean-corpuscular-hemoglobin-mch-whole-blood-during-pregnancy

167 A white cell count is a test to measure the number of white blood cells (WBCs) in the blood. EBCs help fight infections. They are also called leukocytes. There are five major types of white blood cells: Basophils, Eosinophils, Lymphocytes, (T cells and B cells), Monocytes, Neutrophils. Reference: http://www.nim.nih.gov/medicineplus/ency/article/003643.htm)

168 Sec. - seconds

169 Partial Thromboplastin Time is used when someone has unexplained bleeding or clotting. Along with the PT test (which evaluates the extrinsic and common pathways of the coagulation cascade), the aPTT is often used as a starting place when investigating the cause of a bleed or thrombotic (blood clot) episode. It is often used with recurrent miscarriages which may be associated with anticardiolipin or antiphospholipid antibodies. The

170 APTT and PT tests are also sometimes used as pre-surgical screens for bleeding tendencies, although numerous studies have shown that they are not useful for this purpose (reference; http://www.labtestsonline.org.uk/understanding/analytes/aptt/tab/test).

It has been documented in "Mother's Report" proforma; that the patient's HB = 6.8 g/dl, reference range = 11.8-14.8 g/dl; Consultant Obstetrician2 was aware of this result.
It has been documented in "Mother's Report" proforma; the plan of care was to transfuse with 2 units of blood stat[171] and review mané[172]. It has been documented in "Mother's Report" proforma; lochia remains minimal, the patient's uterus was very tender, the midwifery staff were unable to palpate.

04:25hours

It was documented on the "Transfusion Documentation and Patient Monitoring" proforma, the first unit RBC's[173] was commenced.
The patient's clinical observations were recorded as follows at this time:

- Blood pressure: 125/80mmHg
- Pulse rate: 105beats per minute
- Respiratory rate: 20
- Temperature: 37.2 degress Celsius

04:40hours

The patient's clinical observations were recorded as follows at that time:

- Blood pressure: 120/70mmHg
- Pulse rate: 94beats per minute
- Respiratory rate: 20
- Temperature: 36.8 degress Celsius

05:40hours

The patient's clinical observations were recorded as follows at that time:

- Blood pressure: 120/70mmHg
- Pulse rate: 90 beats per minute
- Respiratory rate: not recorded
- Temperature: 36.9 degress Celsius

06:40hours

The patient's clinical observations were recorded as follows at that time:

- Blood pressure: 120/80mmHg
- Pulse rate: 90beats per minute
- Respiratory rate: not recorded
- Temperature: 36.7degress Celsius

It was documented the patient's maternal observations were satisfactory, lochia minimal, pads changed. The patient did not wish to change out of the gown at that time.

07:40hours

The patient's clinical observations were recorded as follows at that time:

[171] Medication given immediately as a single dose
[172] mané - The next morning
[173] RBC'S – Red Blood Cells

- Blood pressure: 119/70mmHg
- Pulse rate: 88beats per minute
- Respiratory rate: not recorded
- Temperature: 37degress Celsius

08:55hours

The following was documented in the "Mother's Report":

1st unit of blood still in progress. Observations stable.

The patient's clinical observations were recorded as follows at that time:

- Blood pressure: 120/75mmHg
- Pulse rate: 74beats per minute
- Respiratory rate: not recorded
- Temperature: 36degress Celsius

The following has been documented in the patient's healthcare records:

- PCA in progress and activated
- Lochia loss minimal
- Wound dressing dry
- Urinary catheter draining concentrated urine

09:15hours

The patient's clinical observations were recorded as follows at that time:

- Blood pressure: 120/80mmHg
- Pulse rate: 80beats per minute
- Respiratory rate: not recorded
- Temperature: 36degress Celsius

09:30hours

It has been documented in the "Mother's Report" the patient was reviewed by Consultant Obstetrician2 who discussed the events with the patient. The plan of care was as follows at that time:

- To leave urinary catheter until later in the afternoon before removing
- For repeat FBC[174] tomorrow

09:55hours

The first unit RBC[175] transfused.

10:00hours

The second unit RBC was commenced. The patient's clinical observations were stable and recorded as follows:

- Blood pressure: 128/70mmHg

[174] Full Blood Count (FBC) is used as a broad screening test to check for such disorders as anaemia, infection, and many other diseases. It is actually a panel of tests that examines different parts of the blood (reference: http://www.labtestsonline.org.uk/understanding/analytes/fbc/tab/test).

[175] RBC- Red Blood Cells

- Pulse rate: 80beats per minute
- Respiratory rate: 20
- Temperature: 36.4degress Celsius

The patient had Difene[176] (PR) given for soreness.

10:15hours

The patient's clinical observations were recorded as follows at that time:

- Blood pressure: 120/70mmHg
- Pulse rate: 80beats per minute
- Respiratory rate: not recorded
- Temperature: 36.4degress Celsius

10:30hours

The patient's clinical observations were recorded as follows at that time:

- Blood pressure: 120/70mmHg
- Pulse rate: 80beats per minute
- Respiratory rate: not recorded
- Temperature: 36.4degress Celsius

10:45hours

The patient's clinical observations were recorded as follows at that time:

- Blood pressure: 120/70mmHg
- Pulse rate: 80beats per minute
- Respiratory rate: not recorded
- Temperature: 36.5degress Celsius

11:15hours

The patient's clinical observations were recorded as follows at that time:

- Blood pressure: 120/70mmHg
- Pulse rate: 80beats per minute
- Respiratory rate: not recorded
- Temperature: 36.5degress Celsius

11:45hours

This time was entered, however, no set of clinical observations were entered for this time.

12:00hours

The following was documented in the"Mother's report":

- Observations stable

[176] Difene contains diclofenac sodium as the active ingredient, which is a non-steroidal anti-inflammatory drug (NSAID). It can also be of use in the management of post operative pain and inflammation in orthopaedic. For rectal use only.
Adults: The usual dosage is 100 mg (Reference: http://www.medicines.ie/medicine/11067/SPC/Difene+100mg+Suppositories/

- Temp: 36.0 degress Celsius
- Pulse: 74
- BP/Blood pressure: 120/74

The patient's pain had eased. The PCA was effective. The second unit of blood was in progress. The urinary catheter was emptied at that time. The patient was reviewed by Consultant Obstetrician1.

The following was documented in the "Baby's Report":

The Consultant Paediatrician spoke with the patient. Her baby was critical but stable in Hospital 2.

14:00hours

The following was documented in the "Mother's Report":

The patient was comfortable at that time. The PCA remained, the patient declined other analgesia. The second unit blood transfused. 1Litre Hartmans was in progress at that time.

15:00hours

The following was documented in the "Baby's Report":

The patient expressed breasts every 3 hours, unable to obtain any milk.

16:40hours

The following was documented in the "Mother's Report":

- Wound dressing dry
- Lochia minimal
- Patient was comfortable and pain free
- Urinary catheter draining and emptied
- The patient was taking small amounts of diet and fluids

17:10hours

The following was documented in the "Mother's report":

The patient received paralink[177] 1g for soreness

18:00hours

The following was documented in the "Baby's report":

The patient expressed again, nil obtained

19:00hours

The following was documented in the "Mother's report":

The patient feels much better. The urinary catheter was removed at 17:30hours. The patient had a shower, the wound dressing was removed. The wound was clean and healing with staples in place. It was recorded the patient had not passed urine from the time the catheter was removed at 17:30hours. Lochia was minimal. The PCA was in

[177] Paralink Suppositories contain the active ingredient paracetamol. Paracetamol is a pain killer and can reduce high temperatures (fever). Strength - 500mgs suppositories, dose 1-2 (Reference BNF June 2016)

place and effective for the patient. The patient was for repeat FBC the following morning. It has been documented in the patient's healthcare records –a request card was completed & left out.

The following was documented in the "Baby's Report":

The patient indicated the baby had no seizures since that morning in Hospital 2, had passed urine and meconium. The baby was on 50% oxygen.

23:00hours

The following was documented in the "Mother's report":

- Temp: 36.4degress Celsius
- Pulse: 80bpm
- Blood pressure: not recorded

The patient passed urine following removal of the catheter. Lochia average. The wound site was clean and healing with staples in place. The patient's breasts were comfortable at that time. The PCA remained in place, the patient received paralink PR also.

Thursday 11th February 2010

04:30hours

The following was documented in the "Mother's report":

The patient was assisted to the toilet and passed urine. Lochia minimal.

07:00hours

The following was documented in the "Mother's report":

The patient "slept well", was apyrexial[178], had panadol x 2 administered, the patient looked "pale".

AM, time not recorded

The following was documented in the "Mother's report":

- Blood pressure: 130/78mmHg
- Pulse rate: 80beats per minute
- Respiratory rate: not recorded
- Temperature: 36.9degress Celsius

"FBC card out - √"

- Abdomen soft and not tender
- Clips were in place to the wound which was clean, dry and healing well
- Lochia average, and the patient's breasts felt comfortable
- The patient was able to express a few mls
- PCA was providing pain relief. The intravenous site had been leaking a little; this was tightened.
- The patient was taking light diet and fluids
- The patient did not require analgesia

Hospital 2 contacted the maternity unit in Hospital 1 and indicated that they wished for the patient to be transferred to Hospital 2 as the baby was critical. It has been documented in the patient's healthcare records that the patient's family were present at this time.

The following was documented in the "Baby's report":

Baby remains critical in Hospital 2, the patient's husband was with the baby.

11:00hours

The following was documented in the "Mother's report":

The patient had a shower. The PCA was removed. TEDS[179] √

12:10hours

The following was documented in the "Mother's report":

The laboratory phoned the maternity unit with the patient's HB result.

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[178] Apyrexial – Having normal temperature (Reference: http://medical-dictionary.thefreedictionary.com/apyrexial)

[179] TEDS: Thromboembolic deterrent stockings

This was =7.7g/dl. (Reference range = 11.8-14.8)

The patient had swabs (nose, wound and axilla) taken for MRSA[180] screening as per protocol. The reports are within the patient's healthcare records and indicate "No MRSA isolated".

The patient was discharged to be close to her baby who was critical in Hospital 2.

A discharge summary was sent to the patient's GP - "General Practitioner Report" proforma outlining a summary of the pregnancy, labour and puerperium[181] as follows:

[180] Multi Resistant Staphylococcus Aureus

[181] The time after childbirth

"**General Practitioner Report**"

Hospital Name	:	Mother name	:
Hospital Number	:	DOB	:
Consultant	:	Age	:
GP Name	:	Home address:	

Antenatal/Labour/third stage	
PARITY:	2
BLOOD GROUP:	O RH POSITIVE
TYPE OF CARE:	combined G.P. /A.N Clinic
RUBELLA – Status:	RUBELLA IMMUNE
VDRL Status:	Negative
H.I.V. Status:	H.I.V. antibody negative
ONSET of LABOUR:	**Spontaneous**
Emergency LSCS-: Indication	**Non-Reassuring CTG**
MODE OF DELIVERY:	**EMERGECNY L.S.C.S.**
Pain Relief/Anaes:	**Epidural; General Anaesthetic**
PACENTA – Delivery:	L.S.C.S -Removed at time of delivery
PLACENTA:	Placenta complete
PERINEUM:	Intact
Comments–Labour/3rd Stage:	No

Baby 1 – Delivery Report	
DATE/TIME –Delivery:	09/02/2010 21:15
MODE OF DELIVERY:	**EMERGECNY L.S.C.S.**
GESTATION:	39+3
NUMBER OF BABIES:	Singleton
TYPE of BIRTH:	LIVE
SEX:	FEMALE
WEIGHT? (Kgs):	3.70
APGAR@1 min:	0
APGAR@5 min:	0
Feeding:	Breastfeeding
Comments:	Yes, clear liquor on transfer to OT, mec 2 at delivery CPN x2 tight

Baby 1 – Discharge Report	
Discharged with mother:	**Transferred to other hospital**
Main disease/condition Of infant:	**Other, intubated**
Comments: baby critical in Hospital 2	Yes,

Mother PostNatal	
Discharge date:	11/02/2010
Post-natal Haemoglobin:	**Discharge Hgb:7.7**
Blood Transfusion:	Yes, 2 units 10/02/2010
Rubella Vaccine:	Not indicated
Anti D Immug:	Not indicated
Perineum:	Intact
Abdominal Wound:	Clean, healing
P/N Problems:	**Anaemia**
Medication on Discharge:	Analgesia, Iron
Appointments:	P/N[182] Clinic – Hospital 1: PHN
Comments:	**Yes, discharged day 2 to Hospital 2** **To be close to baby, clips to wound, on iron**

[182] P/N- Post-Natal Clinic

5.0 Aftermath of Incident

Tuesday 9th February 2010

21:45hours

Following transfer to the Special care Delivery Unit (SCBU), the baby was connected to a ventilator and attached to a cardio-respiratory monitor.

- The baby's oxygen saturations[183] = 99%
- Heart Rate (HR) = 156bpm
- Blood pressure =78/31mmHg
- Respiratory Rate (RR) = 30
- Temperature (per rectum) = 36.8 Celsius
- Haemacue[184] = 7.3mmols

Vitamin k[185] was administered.

The baby was making no self ventilatory effort, was very hypotonic[186]. Intravenous Dextrose[187] 10% was administered via peripheral cannula[188].

A photo of the baby was given to mum.

The baby's Capillary Blood Gas[189] (CBG) result =

Result	**Reference Range**
PH = 6.76	(7.35-7.45)
PC02 = 7.34 kPa	(4.67-6.00)
P02 = 18.16 kPa	(10.67-13.33)

Base Excess (BE) = -28.9 mmol/L

Bicarbonate (HC03) = 7.7mmol/L

It has been documented in the baby's healthcare records that the baby required Sodium bicarbonate[190] infusion according to CBG[191] result. It has been documented in the baby's

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183 Oxygen saturation is the amount of oxygen bound to haemoglobin in the blood, expressed as a percentage of the maximal binding capacity

184 Point-of-care testing of blood glucose

185 Vitamin K is a substance that is found naturally in the body. The liver needs Vitamin K in order to make proteins, which are essential to help blood clotting. Newborn babies have low levels of Vitamin K in their blood which can occasionally cause bleeding problems. www.hse.ie/eng/health/az/V/**Vitamin**s,-minerals.../**VitaminK**.html

186 Hypotonia, commonly known as floppy baby syndrome, is a state of low muscle tone, (the amount of tension or resistance to stretch in a muscle), often involving reduced muscle strength. Hypotonia is not a specific medical disorder, but a potential manifestation of many different diseases and disorders that affect motor nerve control by the brain or muscle strength.

187 Concentrated source of carbohydrate calories for intravenous infusion.

188 A peripheral IV cannula is a small plastic tube that is inserted through the skin into one of the small veins in your hand or arm. They are used to give many different types of medications, for example antibiotics or fluids. (Reference www.buckshealthcare.nhs.uk)

189 Defined as obtaining an arteriovenous sample from a peripheral body site, such as the heel, finger, or other transcutaneous site. Reference://medical-dictionary.thefreedictionary.com/capillary+blood+sample")

190 To correct severe and persistent metabolic acidosis (Metabolic acidosis is a pH imbalance in which the body has accumulated too much acid and does not have enough bicarbonate to effectively neutralize the effects of the acid. (Reference: //medical-dictionary.thefreedictionary.com/metabolic+acidosis)

191 Capillary Blood gas

healthcare records that the baby required Umbilical Venous Catheter (UVC)[192] and Umbilical Arterial Catheter (UAC) [193]

22:20hours

It has been documented that an Umbilical Venous Catheter (UVC) was inserted under aseptic technique. The team were unable to site the Umbilical Arterial Catheter. It has been documented an x-ray was required to confirm the position of the ETT[194] and the UVC position.

22:55hours

It has been documented that the baby had the x-ray taken to confirm the position of the ETT[195] and the UVC position.

The baby was for transfer to Hospital 2.

23:00hours

It has been documented the baby had continuous twitching movements of both limbs noted. These were not associated with desaturation[196] or bradycardia[197]

Oxygen Saturation[198] = 98-99%.

It has been documented the baby was beginning to make some respiratory effort above the ventilator, colour was pale, the baby was hypotonic[199], blood pressure = 71/36mmHg

23:05hours

It has been documented the endo-tracheal tube[200] (ETT) was pulled back 0.5cms and locked at 10cms at lips. The Umbilical Venous Catheter (UVC) was pulled back 4cms. It has been documented that the Sodium Bicarbonate infusion was to commence through the UVC line.

23:20hours

It has been documented the baby commenced on:

- Sodium Bicarbonate infusion 3.7mmols via UVC
- Commenced Phenobarbitone[201] infusion 20mg/Kg via peripheral[202] line

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[192] A catheter placed in the umbilical vein of an infant to facilitate administration of medicines parenterally or to do an exchange transfusion. (Reference: umbilical vein catheter

[193] A catheter is a long, soft, hollow tube. It is passed into an umbilical artery, An umbilical artery catheter (UAC) allows blood to be taken from an infant at different times, without repeated needle sticks.. (Reference: medical-dictionary.thefreedictionary.com/umbilical+artery+catheter)

[194] Endotracheal intubation is the insertion of a tube into the trachea for purposes of anesthesia, airway maintenance, aspiration of secretions, lung ventilation, or prevention of entrance of foreign material into the airway; the tube goes through the nose or mouth (reference : http://medical-dictionary.thefreedictionary.com/intubation)

[195] Endotracheal intubation is the insertion of a tube into the trachea for purposes of anesthesia, airway maintenance, aspiration of secretions, lung ventilation, or prevention of entrance of foreign material into the airway; the tube goes through the nose or mouth (reference : http://medical-dictionary.thefreedictionary.com/intubation)

[196] A decrease in oxygen concentration in the blood resulting from any condition that affects the exchange of carbon dioxide and oxygen. (Reference: http://medical-dictionary.thefreedictionary.com/oxygen+desaturation)

[197] Slowness of the heart rate (Reference: http://medical-dictionary.thefreedictionary.com/bradycardia)

[198] Oxygen saturation is the amount of oxygen bound to hemoglobin in the blood, expressed as a percentage of the maximal binding capacity.

[199] Decreased muscle tone.

[200] Endotracheal intubation is the insertion of a tube into the trachea for purposes of anesthesia, airway maintenance, aspiration of secretions, lung ventilation, or prevention of entrance of foreign material into the airway; the tube goes through the nose or mouth (reference : http://medical-dictionary.thefreedictionary.com/intubation)

[201] Used for all forms of epilepsy except typical absence seizures Dose: Initially 20 mg/kg, dose to be administered at a rate no faster than 1 mg/kg/minute, then 2.5–5 mg/kg 1–2 times a day. (Reference: BNF Oct 2016)

Seizure activity continued and lasted 20 mins, was worse with handling. Colour pink.

23:30hours

It has been documented that both parents visited the baby and that a photo of the baby was given to them. It has been documented that the Consultant Paediatrician spoke in detail to the parents in relation to the baby's condition and the need to transfer the baby to Hospital 2 that night. It has been documented that the baby's father decided to go with the baby to Hospital 2.

23:45hours

It has been documented the baby's capillary blood gas[203] result was as follows:

Result	**Reference Range**
PH =7.107	(7.35-7.45)
PC02 =5.21 kPa	(4.67-6.00)
P02 =9.72 kPa	(10.67-13.33)
Base Excess = -16.9 mmol/L	
HCO3/Bicarbonate = 12.0 mmol/L	

It has been documented that the Consultant Paediatrician spoke with Hospital 2; plan of care for the baby; further Sodium Bicarbonate infusion at this time.

Haemacue = 13.3mmol, IV fluids changed to Dextrose 5% at 40mls/kg over 24hrs.

[202] A peripheral IV cannula is a small plastic tube that is inserted through the skin into one of the small veins in your hand or arm. They are used to give many different types of medications, for example antibiotics or fluids.

[203] Defined as obtaining an arteriovenous sample from a peripheral body site, such as the heel, finger, or other transcutaneous site. (Reference://medical-dictionary.thefreedictionary.com/capillary+blood+sample")

Wednesday 10th February 2010

00:30hours

It has been documented that the 2nd half of Sodium Bicarbonate correction infusion commenced via UVC over 30minutes.

Phenobarbitone 10mg/Kg infusion over 30minutes commenced via peripheral cannula.

It has been documented the baby's capillary blood gas[204] result was as follows:

Result	**Reference Range**
PH = 7.054	(7.35-7.45)
PC02 = 6.95 kPa	(4.67-6.00)
P02 = 9.23 kPa	(10.67-13.33)

Base Excess = -16.6mmol/L

HCO3/Bicarbonate = 14.2 mmol/L

It has been documented; the baby was transferred to a closed incubator with Phenobarbitone and Sodium Bicarbonate infusions in progress. Once the baby settled, the seizure activity settled.

00:50hours

The baby left SCBU at that time. The baby was transferred to Hospital 2 for ongoing Intensive Care and therapeutic hypothermia[205].

The baby's condition remained critical. On 15th February, the baby's neurological examination was grossly abnormal. She had an MRI brain scan[206] in Hospital 3. Following the scan, the baby's condition was discussed with her parents by the Consultant Neonatologist in Hospital 2. It was decided that continued Intensive Care was not in her best interests and she was extubated[207] on the afternoon of the 15th of February 2010. Eight hours later she died peacefully in her parent's arms.

12th February 2010

It has been documented, the patient's GP surgery was informed of the patient's and her baby's transfer to Hospital 2.

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204 Defined as obtaining an arteriovenous sample from a peripheral body site, such as the heel, finger, or other transcutaneous site. (Reference://medical-dictionary.thefreedictionary.com/capillary+blood+sample")

205 Brain Hypothermia, induced by cooling a baby to around 33 °C for three days after birth, is a treatment for hypoxic ischemic encephalopathy. It has recently been proven to be the only medical intervention which reduces brain damage, and improves an infant's chance of survival and reduced disability.
Hypothermic neural rescue therapy is an evidence-based clinical treatment which increases a severely injured full term infant's chance of surviving without brain damage detectable at 18 months by about 50%, an effect which seems to be sustained into later childhood. (references:
Edwards, AD; Brocklehurst, P; Gunn, AJ; Halliday, H; Juszczak, E; Levene, M; Strohm, B; Thoresen, M; Whitelaw, A; Azzopardi, D. (2010). "Neurological outcomes at 18 months of age after moderate hypothermia for perinatal hypoxic ischaemic encephalopathy: synthesis and meta-analysis of trial data". BMJ (Clinical research ed.) 340: c363.

Hypoxic Ischemic Encephalopathy has many causes and is essentially the reduction in the supply of blood or oxygen to a baby's brain before, during, or even after birth. It is a major cause of death and disability, occurring in approximately 2-3 per 1000 births and causing around 20% of all cases of cerebral palsy. Hypoxic ischemic encephalopathy (HIE) is a condition that occurs when the entire brain is deprived of an adequate oxygen supply, but the deprivation is not total. While HIE is associated in most cases with oxygen deprivation in the neonate due to birth asphyxia, it can occur in all age groups, and is often a complication of cardiac arrest. Busl, K. M., Greer, D. M., "Hypoxic-ischemic brain injury: pathophysiology, neuropathology and echanisms". NeuroRehabilitation. 2010 Jan;26(1):5-13. Allen K, Brandon D, 2011, Hypoxic Ischemic Encephalopathy: Pathophysiology and Experimental Treatments, *Newborn Infant Nurs Rev*. September 1; 11(3): 125–133.

206 Magnetic resonance imaging (MRI) is a test that uses a magnetic field and pulses of radio wave energy to take pictures of the head. In many cases, MRI gives information that can't be seen on an X-ray, ultrasound, or computed tomography (CT) scan.

207 Removal of the endotracheal tube, (Reference: http://medical-dictionary.thefreedictionary.com/extubation)

16th February 2010

It has been documented that Consultant Obstetrician1 contacted the patient's GP surgery advising of the baby's passing in Hospital 2 the previous night.

5th March 2010

There is a letter dated 5th March 2010 from Consultant Obsterician1 to the patient's GP in the patient's healthcare records. The patients' GP was on leave during the time of the baby's delivery and on the date the baby passed away on 15th February. Consultant Obsterician1 advised the patient's GP in this letter that s(he) spoke with the patient's husband two weeks previously. Consultant Obsterician1 advised the GP in this letter that s(he) had invited the patient and her husband to see them if this suited and that s(he) had advised the patient and her husband that s(he) also understood if they were not able to do so.

10th March 2010

The patient's GP indicated to Consultant Obsterician1 that returning to the Hospital would be too emotionally painful for the patient and her husband at that time.

6.0 Key Causal Factors, Contributory Factors & Linked Recommendations

Key Causal Factors are issues that arose in the process of delivering and managing health services which the investigators considered had an effect on the eventual adverse outcome.

The examination of the circumstances surrounding the care, management and treatment delivered to the patient in Hospital 1 from the date of the first antenatal care visit of 17th June 2009 to the last visit on 3rd February 2010. The patient's admission to the hospital on 9th February 2010 to the time of her baby's delivery on 9th February 2010 and the period until the baby was transferred to the Special Care Unit at Hospital 1 on 10th February 2010 identified the following Key Causal Factors:

- **Key Causal Factor 1:** Failure to identify and respond to abnormal CTG findings
- **Key Causal Factor 2:** Failure to follow the guideline that was in place in relation to the management of Vaginal Birth After Caesarean (VBAC)

The Key Causal Factors identified were analysed by the investigators to identify the 'Contributory Factors'.

Contributory Factors are considered to be the hazards and potential causes of harm, if not mitigated (through appropriate recommendations being put in place).

The list of Contributory Factors outlined within the Contributory Factors Framework used to analyse each Key Causal Factor identified by this investigation is included in Appendix 3 of this report.

The following sections of this report analyses the Key Causal Factor and the contributory factors identified.

- **Key Causal Factor 1:** Failure to identify and respond to abnormal CTG tracings

Individual (Staff) Factors

Knowledge and skills/competence – education, training, supervision

At interview, Clinical Midwife Manager1 A informed the investigators s(he) has been working in the area of obstetrics for over 20years with significant experience in the speciality.

Clinical Midwife Manager1 A had training in April 2010 on CTG monitoring

Clinical Midwife Manager1 A was mentor/preceptor to Student Midwife2 at this time. This was the rationale for his/her co – signature in the patient healthcare records for the entries made by Student Midwife2.

At interview, the Obstetric Registrar outlined s(he) has 15years experience in Obstetrics.

It is outlined in "Guidelines on Fetal Heart Rate Monitoring" (2007) continuous electronic fetal monitoring should be offered and recommended for High Risk Pregnancies (Appendix 2)

At **14:25hours,** Clinical Midwife Manager1 A documented in the patient's healthcare record that the patient was transferred to the labour ward distressed with contractions and CTG monitoring was commenced. At this time, the baseline[208] was normal with good variability[209].

At **16:10hours,** the following was documented by Student Midwife2 in relation to the CTG tracing:

- Baseline rate: FH 120 bpm beats per minute
- Variability: good variability
- Decelerations: Early Decelerations (decreasing) 80 noted with good recovery
- Contractions: Contracting 2-3:10

The patient had no scar tenderness.
This entry was co-signed by Clinical Midwife Manager1 A

As part of the investigation, the Investigation Team sought the input of a Clinical expert (Obstetrician) nominated from the membership of the Clinical Review Team. S(he) outlined decelerations appearing early and recurrent with contractions in a low risk pregnancy is not a concern. This patient was considered high risk due to her previous history of caesarean section with an adverse outcome. It would have been reasonable to have called the obstetric team at that stage to review the patient.

[208] Normal baseline FHR: 110-160beats per minute

[209] Baseline variability is the minor fluctuation in baseline FHR occurring at three to five cycles per minute. It is measured by estimating the difference on beats per minute between the highest peak and lowest trough of fluctuation in a one-minute segment of the trace. Greater or equal to 5bpm between contractions.

At **17:30hours/17:40hours,** there was a fall in the FHR baseline from 130 to 100 beats per minute. This recovers but is complicated by a number of decelerations[210].

At **18:15hours,** Clinical Midwifery Manager1 A has documented the following in relation to the CTG tracing:

- Decelerations: Shallow early decelerations[211]
- Variability: good variability

Clinical expert (Obstetrician) outlined decelerations appearing early and recurrent with contractions in a low risk pregnancy is not concern. This patient was considered at risk patient with history of caesarean section with an adverse outcome. It would have been reasonable to escalate to a member of the Obstetric team at that time.

At **19:00hours**, the CTG trace was very abnormal, rise in baseline to 160bpm, the tracing was developing tachycardia; there was wandering baseline with decelerations.

As part of the investigation, the Investigation Team sought the input of a Clinical expert (Obstetrician) nominated from the membership of the Clinical Review Team. The expert indicated the CTG does not settle from **18:45hours** onwards. S(he) outlined the CTG was significantly abnormal at **19:20hours**.

Clinical expert (Midwifery) nominated from the membership of the Clinical Review Team indicated the CTG tracing at **19:20hours, 19:30hours** and **19:40hours** showed late decelerations[212], the CTG was abnormal / pathological indicating possible foetal distress.

At **19:00hours**, the patient was being reviewed by the Obstetric Registrar in relation to her "severe" abdominal pain.

At interview, Obstetric Registrar indicated everything was satisfactory at that time.

- Normal CTG
- Normal vaginal & abdominal examination

The assessment ended at 19:10hours

The Obstetric Registrar has documented in the patient's healthcare record s(he) performed a vaginal examination. The findings were recorded as follows:

- Cervix Dilation: 7cms dilated
- Station: 0[213]

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[210] Transient episodes of slowing of FHR below the baseline level of more than 15bpm and lasting 15seconds or more (Reference: Guideline on FHR monitoring 2007, Hospital 1)

[211] Uniform, repetitive, periodic slowing of FHR with onset early in the contraction and return to baseline at the end of the contraction (Reference: Guideline on FHR monitoring 2007, Hospital 1)

[212]

[213] Where 0 station is in line with the plane of the maternal ischial spines.

[213] Ischial spines are two relatively sharp posterior bony projections into the pelvic outlet from the ischial bones that form the lower border of the pelvis (reference http://medical-dictionary.thefreedictionary.com/ischial+spines). The spines are the narrowest part of the pelvis and they are natural measuring point for the delivery progress. If the presenting part of the baby (the head, shoulder, buttocks or feet) lies above the Ischial spines, the foetal position is reported as a negative number from -1 to -5 (each number is a centimetre). If the presenting part lies below the Ischial spines, the station is reported as a positive number from +1 to +5. The baby is said to be 'engaged' in the pelvis when it is even with the Ischial spines at 0 station (reference: http://www.umm.edu/ency/article/002060.htm)

An ultrasound scan was carried out; AFI[214] – normal

Through feedback on the draft report, the Obstetric Registrar indicated that his/her recollection was the scan was undertaken to establish the thickness of the lower segment.

At **19:30hours,** the following clinical observations were documented in the patient's healthcare records by Clinical Midwife Manager1 A:

- Blood pressure: 120/63mmHg,
- Pulse rate: 116 bpm a
- Temperature: 37.7 degress Celsius
- Contractions per 15mins - 1:3
- Liquor – Nil

The patient received paralink Ig[215] per rectum (PR) for temperature.

At **19:30hours,** documentation completed in the patient's healthcare record by Clinical Midwife Manager1 A indicated that the patient was feeling more comfortable, the CTG tracing was showing good variability at baseline, clear liquor drained at that time.

There was a failure to interpret the CTG tracings accurately.

At **20:00hours,** it has been documented in the patient's healthcare record by Clinical Midwife Manager1 A the patient was very distressed at that time, was complaining of pressure and upper abdominal pain, had no scar tenderness. Anaesthetic Registrar2 was contacted. It was recorded that Obstetric Registrar was present. The Obstetric Registrar through feedback on the draft chronology indicated s(he) was not present at this time.

The patient's clinical observations were recorded as follows:

- Blood pressure: 114/67 mmHg,
- Pulse rate: 118 bpm
- Temperature: 37.6degress Celsius

The following was documented in relation to the CTG tracing:

- Variable decelerations noted
- Tracing of 200 bpm decreasing to 70-80 bpm.

20:15hours

Staff Midwife2 recorded in the patient's healthcare records they received a handover from Clinical Midwife Manager1 A. The patient was distressed in pain and awaiting review by the Anaesthetist. Entonox gas was commenced. The patient's vital signs were checked and recorded as follows:

- Blood pressure: 114/67 mmHg,

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214 Amniotic Fluid Index

215 Paralink Suppositories contain the active ingredient paracetamol. Paracetamol is a pain killer and can reduce high temperatures (fever). Strength - 500mgs suppositories, dose 1-2 (Reference BNF June 2016)

- Pulse rate: 110 bpm

The CTG was showing no variability at that time.

- Foetal heart varying from 72-202 bpm.
- Contracting: 1:1-2 minutes.

It has been documented, waiting on the Obstetric Registrar to review the patient.

At **20:20hours**, the Obstetric Registrar indicated at interview, s(he) was called by two midwives. First call was in relation to the patient's pain that was similar to pain earlier. While Obstetric Registrar was on their way to the labour ward, s(he) received another call with regards to the baby's erratic heartbeat. S(he) has documented in the patient's healthcare record the patient was distressed despite epidural infusion and had constant pains.

The Obstetric Registrar through feedback on draft chronology indicated there was no break between the contractions, coming one after the other. S(he) observed and witnessed this for a few minutes.

The findings of a vaginal examination were recorded as follows:

- Dilation: 9cm dilated
- Station: The foetal head was documented as being at 0.
- Liquor: Nil

At interview, the patient and her husband outlined that there was difference of opinion in relation to the CTG tracings between Clinical Midwife Manager1 A and the Obstetric Registrar.

Through feedback on the report, the Obstetric Registrar outlined that his/her recollection was the difference of opinion was in relation to the terbutaline[216] not the CTG, that the CTG was abnormal with hyperactivity of the uterus.

At **20:30hours,** Clinical Midwife Manager1 A contacted Consultant Obstetrician2 and gave him/her an outline of the patient's status.

At interview, Clinical Midwife Manager1 A outlined the decelerations were very difficult to describe, they were very abnormal.

It has been documented by the Obstetric Registrar his/her diagnosis was the patient had a previous LSCS[217] with hyperactivity of the uterus. The plan of care has been

[216] A synthetic compound with bronchodilator properties, used especially in the treatment of asthma. Terbutaline injection is also sometimes used for a short period of time (less than 48 to 72 hours) to treat premature labor in pregnant women who are in a hospital.

[217] The Lower Segment Caesarean Section, more commonly used today, involves a smaller transverse cut which results in less blood loss and is easier to repair (reference http://www.news-medical.net/health/Cesarean-Section-Types.aspx

documented to administer terbutaline[218] 0.25mgs. This was charted as stat[219] dose, for administration subcutaneously[220] (S.C)

At interview, the Obstetric Registrar indicated terbutaline is a standard treatment for hyperactivity of the womb with abnormal CTG tracing. There were variable decelerations varying from 200-80. After administration of terbutaline, the CTG returned to normal again.

At interview (telephone), Clinical Midwife Manager1 B informed the investigators s(he) was on day duty on 9th February. S(he) does not recall how they became involved in the case. Clinical Midwife Manager1 B indicated it was not unusual to be asked to administer terbutaline. It was not something that was used very regularly but has been used in the event when someone was hyper contracting to try and relax the uterus, to try and space out the contractions. Clinical Midwife Manager1 B outlined s(he) had administered the medication before but it was not something they used on a regular basis.

At interview, Consultant Obstetrician1 advised terbutaline should not have been used in this case with the other symptoms that were present. S(he) would not agree with slowing down contractions when the patient was 9cms dilated. S(he) indicated they have never used terbutaline in labour.

At **20:40hours** approx, Consultant Obstetrician2 assessed and examined the patient and reviewed the CTG tracing on the ward. Consultant Obstetrician2 decided to bring the patient to theatre for trial of vaccum or possibility of proceeding to Emergency Lower Segment Caesarean section (LSCS)

At **20:50hours** approx, the patient was brought to theatre for caesarean section.

At **21:00hours**, it was documented by Staff Midwife2 in the patient's healthcare records the patient was in theatre at this time, the patient was reviewed by Consultant Obstetrician2. The foetal heart rate was 80 bpm with Sonicaid[221]. Consultant Obstetrician2 decided the patient required emergency LSCS.

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[218] A synthetic compound with bronchodilator properties, used especially in the treatment of asthma. Terbutaline injection is also sometimes used for a short period of time (less than 48 to 72 hours) to treat premature labor in pregnant women who are in a hospital.

[219] Medication given immediately as a single dose

[220] Injection beneath the skin. Typical sites include the abdomen, upper or outer arm, and the thigh. (Reference: medical-dictionary.thefreedictionary.com/subcutaneous+injection

[221] Hand held ultrasound monitor that is used to detect foetal heart rate

Actions taken since February 2010:

- The following areas of training are mandatory fields for Midwifery staff, Obstetric Consultants and Obstetric NCHD's[222]
    - CTG
    - K2[223]
    - PROMPT (Practical Obstetric Multi-Professional Training)
- K2training implemented at end of 2014
- Polices Procedures and Guidelines (PPPG's) reviewed on an ongoing basis at local meeting attended by midwives and doctors
- Multidisciplinary twice daily safety huddle/pause
- Triggers for escalation clearly identified
- Each Clinical Midwife Manager2 has been allocated their own cohort of staff midwives to mentor and support. This involves meeting with each staff midwife individually, reviewing training and identifying educational requirements

Recommendation

- It is recommended that routine audits of compliance with the Policies, Procedures & Guidelines in particular "Guidelines on Fetal Heart Rate Monitoring" within the maternity Unit are developed and carried out and the results of such audits are subject to review by the relevant governance committee.

[222] Non Consultant Hospital Doctors

[223] Encompassing all the established and award winning content of the K2 Fetal Monitoring Training System, the Perinatal Training Programme is an interactive computer based training system covering a comprehensive spectrum of learning that can be accessed over the internet, anywhere, anytime, from within your own hospital or from home. It is a cost effective option compared to the high cost and inconvenience associated with traditional 'lecture based' training courses

Team Factors

Supervision & seeking help - Willingness of junior staff to seek help

From **19:00hours – 20:00hours,** there was a failure to appreciate the significance of the patient's complaint of pain and the CTG tracing during this time. Advice and assistance was not sought from the Consultant on Call.

It is outlined in the "Guidelines on Fetal Heart Rate Monitoring" (2007)" non-reassuring and abnormal traces should be reported to the Registrar/Consultant.

At interview, **at 20:30approx**, Clinical Midwife Manager1 A indicated s(he) contacted the Consultant on Call.

Recommendation

- It is recommended it is the responsibility of the obstetricians and unit manger to ensure that staff are aware of the current guideline in Hospital1 in relation to "Guidelines on Fetal Heart Rate Monitoring" and that it is implemented in practice.
- It is recommended it is the responsibility of all staff to ensure they are aware of and comply with the current Guideline in Hospital1 in relation to "Fetal Heart Rate Monitoring" and the principles contained within.

Work Environment Factors

Work load & one to one care

At the time of the patient's admission on 9th February 2010, Staff Midwife1 and Student Midwife1 were allocated to the care of the patient from **10:15hours – 13:00hours.**

Clinical Midwifery Manager1 A and Student Midwife2 provided care from **13:00hours – 16:40hours.**

At interview, Staff Midwife1 informed the investigators s(he) was not entirely sure why Clinical Midwifery Manager1 A took over the care of the patient at 13:00hours. Usually one midwife is assigned to the patient. There could be a number of possibilities as to why Clinical Midwifery Manager1 A took over the patient's care.

At interview, Clinical Midwifery Manager1 A outlined s(he) was overseeing Student Midwife2 and was in charge of the labour ward that day.

There were no entries in the patient's healthcare records from **16:40hours** - **20:00hours** by Student Midwife2. The entries are solely from Clinical Midwifery Manager1 A during this time.

It has been noted by the investigators there were no entries in the patient's healthcare records from **16:40hours –17:30hours** except an entry at 17:00hours counter signing entry from Student Midwife2. Also, there was no entry documented on the CTG tracing from **17:10hours -19:00hours.**

It is outlined in "NICE No. 55, (2007)" when the woman is in established labor, the support should be as follows:

- Provide a woman in established labour with supportive one-one care
- A woman in established labour should not be left on her own except for short periods or at the woman's' request

The patient was in established labour since 14:30hours and should have had one to one midwifery care. This was paramount due to the patient's previous obstetric history.

It is outlined in Hospital 1 "Guideline on Trial of Labour "2005,

- Half hourly pulse pulse and blood pressure should be recorded in the active phase of labour.

It is noted by the investigators; hourly clinical observations were recorded on the partogram, this commenced at 15:00hours. CTG is recorded for Fetal Heart Rate.
From **16:30hours,** there were few entries documented if any in the "Notes in Labour" proforma outlining the four main features of a CTG. (Baseline rate, Baseline variability, accelerations and declarations).

It has not been documented on any occasion from the time the CTG tracing re-commenced at 14:30hours, the features were systematically examined to indicate if the tracing was:

- Normal/Reassuring
- Suspicious/Non-reassuring
- Pathological/Abnormal

(Appendix 4)

Actions taken since February 2010:

- Clinical Midwife Manager is now rostered 24/7 in the labour ward

Recommendation

- Adhere to practice of one midwife being assigned to a patient as in place in the labour ward in accordance with "NICE No. 55, (2007)"

- **Key Causal Factor 2:** Failure to follow the guideline that was in place in relation to the management of Vaginal Birth After Caesarean (VBAC)

It is outlined in "Guideline on Trial of Labour (2005)", this guideline applies to women who are aiming for vaginal birth after caesarean section (VBAC)

Individual (Staff) Factors - *Knowledge and skills/competence*

At **15:40hours**, the following was recorded at that time by Student Miwife2 on VE:

- Cervix Dilation: 5 cms dilated
- Bulging membranes were felt.
- An artificial rupture of membranes (ARM)[224] was carried out and the cervix was central and effaced[225].
- Liquor[226]: Meconium[227]

This entry was co-signed by Clinical Midwife Manager1 A

The meconium was not graded.

At interview, Consultant Obstetrician1 outlined an ARM is carried out for 2 reasons:

1. To augment the labour
2. To see the colour of the meconium

At interview, Consultant Obstetrician1 outlined there are 4 grades to consider when grading meconium.

i. Green tinge
ii. Thicker
iii. Pea soup
iv. Can't flow it is so think, no liquor

Clinical expert (Midwifery) nominated from the membership of the Clinical Review Team indicated an ARM should not be performed by a midwife unless the head is engaged if the head is very high a controlled ARM may sometimes be performed by an obstetrician. The last recording station = -4, presentation of the baby was cephalic and 4/5 palpable. It has not been documented a further palpation and vaginal examination was carried out to determine if the baby's head was lower than -4 and engaged at 2/5 palpable[228]

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[224] An artificial rupture of the foetal membranes is usually performed to stimulate or accelerate the onset of labour (reference http://medical-dictionary.thefreedictionary.com/amniotomy)

[225] Effacement relates to the softening and shortening of the cervical canal from about 3cm long to less than 0.5cm long. (Reference: National Collaborating Centre for Women's and Children's Health 2008 Clinical Guideline; Induction of Labour RCOG Press London)

[226] Liquor is amniotic fluid within the amniotic cavity produced by the amnion during the early amniotic period and later by the lungs and the kidneys. Amniotic fluid protects the embryo and foetus from injury. (Reference: Dorland's Illustrated Dictionary 31ed)

[227] Meconium is the greenish-black sticky material passed from the baby's bowels after birth. In some instances, the foetus will pass meconium into the amniotic fluid while still in the womb, indicated by the presence of meconium staining of the liquor after the membranes have ruptured. Meconium staining is more common approaching and after term. It may indicate the presence of foetal distress in labour, but not universally so (reference: http://www.nice.org.uk/nicemedia/live/12012/41255/41255.pdf

[228] 2/5 of the head palpable means that most of the head is below the pelvic brim, and on doing the deeppelvic grip, your fingers only splay outwards from the fetal neck to the pelvic brim.1/5 of the head palpable means that only the tip of the fetal head can be felt above the pelvic brim. It is very important to be able to distinguish between 3/5 and 2/5 head palpable above the pelvic brim.
If only 2/5 of the head is palpable, then engagement has taken place and the possibility of disproportion at the pelvic inlet can be ruled out (reference: http://www.gfmer.ch/PEP/pdf-MCM-2006/MCM_SW-81-2006.pdf.

It is outlined in "Induction of labour, NICE Clinical Guideline 70" (2008), to avoid Amniotomy (artificial rupture of membranes) if the baby's head is high to avoid cord prolapse[229]

It is outlined in "Guideline on Trial of Labour" (2005) Hospital 1

- artificial rupture of membranes should be used with caution
    - The decision lies with the consultant/registrar

The expert also indicated; considering the cervix dilation = 5cms, head at -4 and presence of meconium in a high risk mother, the patient should have been reviewed by a senior member of the obstetric team.

At interview, Consultant Obstetrician1 outlined if induction is carried out it reduces the success rate. The patient should be examined to establish how suitable she is to break the waters. If labour didn't progress, any signs of fetal distress following breaking the waters, intervention would be required and a caesarean section carried out.

At **17:30hours**, the following was recorded at that time by Clinical Midwife Manager1 A on VE:

- Cervix Position: Not recorded
- Consistency of Cervix: not recorded
- Cervix Dilation: 5 cms dilated, loosely applied
- Station: -3
- Effacement: yes

Clinical expert (Obstetrician) outlined the entry "loosely applied" indicated the head was not tight against the cervix. This is consistent with the slow progress of labour. In a second or third labour, a patient would normally be expected to progress from 4cm to 6cm within 2hours. If progress does not occur to this effect, this would normally prompt action and investigation, even in a low risk pregnancy.

At interview, Clinical Midwifery Manager1 A indicated to the investigators that at 17:30hours the head was still quiet high at -3 station. S(he) outlined to the investigators, the patient had no scar tenderness, s(he) was watching out for this due to patient's previous history of caesarean section.

There was a failure to appreciate the significance of the position of the baby's head at this time further to the findings of the previous vaginal examinations at

14:30hours: station=-4, cervix: 4-5cms dilated
15:40hours: station not recorded, cervix: 5cms dilated

[229] Umbilical cord prolapse occurs when the umbilical cord comes out of the uterus with or before the presenting part of the fetus

At **17:30hours**, it has been documented by Clinical Midwife Manager1 A the patient was feeling pressure and blood stained liquor was draining.

The Clinical Expert (Obstetrician) outlined that whilst the presence of blood stained liquor may sometimes occur if the cervix is stretching quickly in a rapidly progressing labour, in this case, the patient was not in fact progressing and an alternative cause should have been considered.

At **18:15hours,** the patient was feeling a lot of pressure at this time. Clinical Midwife Manager1 A documented s(he) contacted Anaesthetics Registrar2 to administer further top up of the epidural infusion. Clinical Midwife Manager1 A had administered a top-up of the epidural at 17:45hours.

At interview, the patient indicated the pain she experienced was not just contraction pains; the pain was all over her tummy. She recalled looking at the clock at the time, it was 18:00hours and thought of asking for a section then as the pain was so severe. The patient indicated she couldn't explain how bad the pain was. She did not know there was anything wrong with her baby or that there was any risk to her baby. She didn't see what was going on.

At **18:30hours**, Clinical Midwife Manager1 A has documented in the patient's healthcare record the patient was very distressed with pressure. The patient was using entonox[230] for pain relief. There was no show.

At interview, Clinical Midwife Manager1 A informed the investigators the patient was very distressed from this point in time and onwards.

It has been documented by Clinical Midwife Manager1 A the Obstetric Registrar was asked to review the patient. At interview, Obstetric Registrar informed the investigators Anaesthetic Registrar2 called him/her to review the patient as s(he) wished to ensure nothing was amiss.

At **19:00hours**, it has been documented in the patient's healthcare record by Anaesthetic Registrar2 they were on-call. S(he) was called to review the patient because of abdominal pain. The epidural was in place since 14.00hours and was working fine. The patient was complaining of contraction pains during the previous hour.

At interview, Anaesthetic Registrar2 indicated the pain described by the patient was different. Usually when an epidural starts to wear off or is not working the patient feels contractions. In this case, the patient was feeling pain in her lower abdomen. Anaesthetic Registrar2 indicated s(he) waited to discuss the patient's care with the Obstetric Registrar as s(he) wanted to ensure the pain was not obstetric related.

[230] Entenox is used as an analgesia and can be self administered using a demand valve which is popular in obstetric practice (Reference: British National Formulary 2009

It is outlined in "Guideline on Trial of Labour, 2007, Hospital 1" the signs and symptoms of uterine scar rupture include lower abdominal pain with a contraction or a constant unrelating pain (Appendix 3)

It is also outlined in this Guideline-

- The woman should be observed closely for scar tenderness
- The midwife/obstetrician should be vigilant for signs of uterine rupture

At **19:00hours,** the Obstetric Registrar reviewed the patient and has documented in the patient's healthcare record s(he) performed a vaginal examination. The findings were recorded as follows:

- Cervix Dilation: 7cms dilated
- Station: 0[231]

An ultrasound scan was carried out.
There no change made to the patient's care plan at this time.

At interview, Obstetric Registrar indicated everything was ok at that time.

- Normal CTG
- Normal vaginal & abdominal examination

The assessment ended at **19:10hours.**

At **20:00hours,** Clinical Midwife Manager1 A has documented in the patient's healthcare record s(he) performed a vaginal examination. The findings were recorded as follows:

- Cervix Position: Not recorded
- Consistency of Cervix: not recorded
- Cervix Dilation: 8-9cms dilated
- Station: 0

At **20:30hours**, Clinical Midwife Manager1 A contacted Consultant Obstetrician2 as s(he) was not satisfied with the CTG tracings.
Consultant Obstetrician2 documented a retrospective note that s(he) made at this time (no time entered) that at this time (20:30hours-21:00hours) s(he) performed a vaginal examination. Consultant Obstetrician2 has documented in the patient's healthcare record the VE findings as follows

- Dilation: 9cms dilated
- Station: Vx[232] high (-1/-2)
- Cervix position: anterior

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[231] Where 0 station is in line with the plane of the maternal ischial spines.

[231] Ischial spines are two relatively sharp posterior bony projections into the pelvic outlet from the ischial bones that form the lower border of the pelvis (reference http://medical-dictionary.thefreedictionary.com/ischial+spines). The spines are the narrowest part of the pelvis and they are natural measuring point for the delivery progress. If the presenting part of the baby (the head, shoulder, buttocks or feet) lies above the Ischial spines, the foetal position is reported as a negative number from -1 to -5 (each number is a centimetre). If the presenting part lies below the Ischial spines, the station is reported as a positive number from +1 to +5. The baby is said to be 'engaged' in the pelvis when it is even with the Ischial spines at 0 station (reference: http://www.umm.edu/ency/article/002060.htm)

[232] Vertex (Vx) presentation**:** Head presentation of the foetus during birth in which the upper back part of the foetal head is the presenting part. (reference: The American Heritage® Medical Dictionary, 2004 Published by Houghton Mifflin Company; Medical Dictionary for the Health Professions and Nursing © Farlex 2012)

- Cervix consistency: thick

At interview, Consultant Obstetrician2 outlined on vaginal examination the cervix was thick; this indicated the patient was unsuitable for vaginal delivery.

At 20:50hours approx, the patient was transferred to theatre for trial of vacuum or possibility of proceeding to Emergency Lower Segment Caesarean Section (LSCS).

Recommendation

- It is recommended it is the responsibility of the obstetricians and unit manger to ensure that staff are aware of the current guideline in Hospital1 in relation to Trial of Labour /VBAC and that it is implemented in practice.
- It is recommended it is the responsibility of all staff to ensure they are aware of and comply with the current Guideline in Hospital1 in relation to Trial of Labour /VBAC and the principles contained within. In addition it is recommended that routine audits of compliance with this Guideline are developed and carried out and the results of such audits are subject to review by the relevant governance committee

Team Factors

Supervision & seeking help - Willingness of junior staff to seek help

From **19:00hours – 20:00hours,** there was a failure to appreciate the significance of the patient's complaint of pain, along with the findings on the CTG tracing at this time. There was no contact made with the Consultant on call to seek his/her advice and or assistance.

It is outlined in "Guideline on Trial of labour (2005)" the consultant / registrar should be called if complications arise.

At interview, **at 20:30approx**, Clinical Midwife Manager1 A indicated s(he) contacted the Consultant on Call.

Recommendation

- It is recommended it is the responsibility of all staff to ensure they are aware of and comply with the current Guideline in Hospital1 in relation to Trial of Labour /VBAC and the principles contained within. In addition it is recommended that routine audits of compliance with this Guideline are developed and carried out and the results of such audits are subject to review by the relevant governance committee

7.0 Incidental Findings and Linked Recommendations

Incidental findings are issues identified in the course of the investigation which did not impact on the outcome but are system development issues.

Incidental Finding 1 - Documentation

Legible, timely and complete patient records are a critical component of communication between members of the multidisciplinary team. All professionals rely upon thorough records to ensure that they are properly informed prior to making their own clinical intervention.

In conducting this systems analysis the review of the healthcare record revealed incidences of poor legibility throughout the clinical content of the healthcare record and on occasions the documentation was not in line with the HSE Code of Practice for Healthcare Records 2011.

- It was noted there were gaps in the partogram – the section "STATION" was not completed for three of the vaginal examinations.
- Some entries and signatures were difficult to decipher which made it difficult and sometimes impossible to identify the note and the healthcare professional.
- CTG documentation on the CTG tracing was poor. There were no signatures. The patient's clinical observations were recorded on occasions. It was not recorded when VE's were carried out.
- There was no record in the patient's healthcare records of a discussion with the patient at the initial clinic visit or subsequent visits in relation to a delivery plan apart from the following "Aim for VBAC" (Vaginal Birth After Caesarean). This is undated and unsigned.

The investigators note the National Maternity Healthcare Record has been introduced in Hospital 1.

Recommendation

Ensure that all staff are aware of adhere to the HSE Standards and Recommended Practices for Healthcare Records (May 2011). In addition it is recommended that routine audits of compliance with the Standard are developed and carried out and the results of such audits are subject to review by the relevant governance committee.

Incidental Finding 2 - Communication with the patient

At the meeting with the investigators on 16th May 2016, the patient indicated there were occasions when she was not informed of the decisions around her care plan. The patient

stated she was not aware there were issues with the CTG readings or that there was anything wrong with her baby.

Recommendation

It is recommended it is the responsibility of the obstetricians and unit manger to ensure that staff are aware of the current guideline in Hospital1 in relation to Care of Women in the first stage of labour and that it is implemented in practice. In addition it is recommended that routine audits of compliance with this Guideline are developed and carried out and the results of such audits are subject to review by the relevant governance committee

Incidental Finding 3 – Communication with the patient

At the meeting with the investigators on 16th May 2016, the patient informed the investigators she did not receive any written information on VBAC at the antenatal clinic visits.

Recommendation

Develop patient information leaflet with the current guideline in Hospital1 in relation to "Trial of Labour" / "VBAC"

8.0 Specific issues raised by the family

The patient and her husband during the meeting with the investigation team on 16th May 2016 raised the following queries:

1. Has there been staff engagement and training provided for staff in relation to "Open Disclosure" in the hospital?
2. Were the CTG monitors in the hospital during 2009-2011 "Philips Avalon"

1. Has there been staff engagement and training provided for staff in relation to Open Disclosure[233] in the hospital?

During the meeting with the investigators on 16th May 2016, the patient and her husband outlined further to the inquest in May 2011 into the death of their baby girl, the hospital carried out a review. They were not informed and invited to participate. Subsequently, they found out a report was completed in November 2011 by the hospital.

In 2013, the National document[234] on Open Disclosure was launched.

In January 2014, Hospital 1 engaged with the Project Lead in Open Disclosure.

In February 2014, the Open Disclosure project leads met with the management team in the hospital to discuss and agree project rollout and also provided staff awareness sessions.

The hospital identified an Open Disclosure lead, four staff participants in the hospital were also identified to participate in "The train the trainer programme"

Throughout, 2014, 2015 and to date in 2016, further provision of half day workshops (off site) were undertaken, with a total of 40 participants from all disciplines within the hospital. There was awareness session's provided during this time, total of 70 participants attended - all grades of staff.

The Open Disclosure policy and supporting documents are available on the hospitals document control system Q-Pulse and hard copies were circulated throughout the hospital.

A draft Open Disclosure policy & procedure has been compiled by the hospital and forwarded for consideration to the management team.

Ongoing staff awareness sessions are provided.

[233] An open, consistent approach to communicating with service users when things go wrong in healthcare.

[234] Health Service Executive (November 1013) Open Disclosure Policy: QPSD-D-062-1

2. Were the CTG monitors in the hospital during 2009 -2011 "Philips Avalon"

The CTG Monitors in the hospital during 2009-2011 were Agilent – Hewlett Packard. Anytime there was a fault with a monitor, this was reported by the medical physics and bioengineering department in the hospital to Cardiac Services. These monitors were serviced on a 6 monthly basis with a Preventative Maintenance Contract with Cardiac Services Ltd.

9.0 Urgent Follow up Required Post Investigation

Follow up for the implementation of the recommendations of this Incident/Complaint Investigation

In order to ensure that the recommendations contained in this report are implemented as expediently as is reasonably practicable it is of the utmost importance that the hospital develops an Action Plan to agree a schedule of prioritisation of the recommendations of this report and to further agree the named person who will take responsibility for advancing specific recommendations.

10.0 Summary of Recommendations

Recommendation 1

It is recommended that routine audits of compliance with the Policies, Procedures & Guidelines in particular "Guidelines on Fetal Heart Rate Monitoring" within the maternity Unit are developed and carried out and the results of such audits are subject to review by the relevant governance committee.

Recommendation 2

It is recommended it is the responsibility of the obstetricians and unit manger to ensure that staff are aware of the current guideline in Hospital1 in relation to "Guidelines on Fetal Heart Rate Monitoring" and that it is implemented in practice.

Recommendation 3

It is recommended it is the responsibility of all staff to ensure they are aware of and comply with the current Guideline in Hospital1 in relation to "Fetal Heart Rate Monitoring" and the principles contained within.

Recommendation 4

Adhere to practice of one midwife being assigned to a patient as in place in the labour ward in accordance with "NICE No. 55, (2007)"

Recommendation 5

It is recommended it is the responsibility of the obstetricians and unit manger to ensure that staff are aware of the current guideline in Hospital1 in relation to Trial of Labour /VBAC and that it is implemented in practice.

Recommendation 6

It is recommended it is the responsibility of all staff to ensure they are aware of and comply with the current Guideline in Hospital1 in relation to Trial of Labour /VBAC and the principles contained within. In addition it is recommended that routine audits of compliance with this Guideline are developed and carried out and the results of such audits are subject to review by the relevant governance committee

Recommendation 7

Ensure that all staff are aware of adhere to the HSE Standards and Recommended Practices for Healthcare Records (May 2011). In addition it is recommended that routine audits of compliance with the Standard are developed and carried out and the results of such audits are subject to review by the relevant governance committee.

Recommendation 8

It is recommended it is the responsibility of the obstetricians and unit manger to ensure that staff are aware of the current guideline in Hospital1 in relation to Care of Women in the first stage of labour and that it is implemented in practice. In addition it is recommended that routine audits of compliance with this Guideline are developed and

carried out and the results of such audits are subject to review by the relevant governance committee

Recommendation 9

Develop patient information leaflet with the current guideline in Hospital1 in relation to Trial of Labour /VBAC

11.0 References

Health Service Executive; Guideline for Systems Analysis Investigation of Incidents; Ref NIMLY 0010 (2015)

Health Service Executive, Standards and Recommended Practices for Healthcare Records Management V3.0 (May 2011)

Hospital 1, Guideline on Trial of Labour, (2005)

Hospital 1, Guideline on Fetal Heart Rate Monitoring, (2004)

Hospital 1, Care of women in the first stage of normal labour, (June 2009)

National Institute for Health and Care Excellence, Intrapartum care: care of healthy women and their babies during childbirth, Clinical Guideline 55, 2007

Appendices

Appendix I – Terms of Reference

Review of the Maternity Services at Portiuncula Hospital, Ballinasloe (PHB) and of a number of adverse perinatal events between 2008 and November 2014

Terms of Reference:

Introduction

A Preliminary Review into the care of 7 women who had adverse perinatal events between February and November 2014 at Portiuncula Hospital, Ballinasloe was undertaken in December 2014 by Dr. Geraldine Gaffney, Prof. Declan Devane and Ms Dawn Johnston. The results of this preliminary Review were reported on the 19th Jan 2015.

Scope of the Review

It has been decided on the basis of the preliminary Review completed in December 2014 to commission a full Review of the Maternity Service at Portiuncula Hospital, Ballinasloe. This Review will include as an integral part of it, the review of the care of the women who were the subject of the Preliminary Review.

A number of other similar cases have been identified since the Preliminary Review was concluded and it has been decided that they will be included in this new Review. The total number of cases to be covered by the Review is anticipated to be in the region of 12.

Review Team

A Review Team has been appointed to undertake the overall Review. They will be assisted in their work in relation to the Review of the individual cases, by a systems analysis investigation which will be conducted on their behalf by experienced systems analysis investigators. These reports will be available to the Review Team as key inputs to their work.

Review Commissioner

This Review is being commissioned by the Chief Clinical Director, Saolta University Health Care Group.

The final report will be provided to the Group CEO and Board of Saolta University Health Care Group and the HSE's National Director for Acute Hospitals.

Purpose of the Review

The purpose of the Review is to:

Part 1: Review of maternity services at Portiuncula Hospital

1. Review the perinatal care provided by PHB maternity unit including the findings of the analysis of the perinatal care in the cases covered by this Review.
   - **a.** Identify the extent, if any, of deficiencies in the process and outcome of care.
   - **b.** Identify any patterns that would have wider implications for the safety of services delivered during the time period in question.
2. Review, the wider delivery of services at PHB maternity unit during the time period in question.
3. Examine the extent to which the corrective measures that were put in place during the Preliminary Review and the audits of their implementation, address any deficiencies identified in items 1 and 6 of these Terms of Reference.
4. Examine the implementation of national HSE policies in relation to patient safety, risk management, incident management, reporting, investigation and open disclosure, to ascertain the extent that they were:
   - **a.** In place in the PHB maternity unit, and
   - **b.** Followed in the cases comprehended by this Review, and
   - **c.** Managed and escalated appropriately by the Saolta Group
5. Arising from the findings from 1 to 5 above, recommend any actions necessary to improve the safety and quality of services at;
   - **a.** PHB maternity unit
   - **b.** Other maternity units in the Saolta University Health Care Group and across the country

Part 2: Review of individual cases

6. Undertake a review of the perinatal care (from their presentation for care at PHB maternity unit to their immediate postnatal care) provided to the women who were the subject of the preliminary Review and those agreed additional cases. In addition this review will include the initial neonatal care provided to the babies born. In particular it will focus to
   - **a.** Establishing the factual circumstances leading up to the adverse perinatal event in each of the individual cases.
   - **b.** Identifying any key causal factors that may have occurred.
   - **c.** Identifying the contributory factors that led to the key causal factors.

(Should any immediate safety concerns arise during the course of the Review the Chair

of the Review Team will convey the details of these safety concerns to the Commissioner as soon as possible)

Membership of the Review Team

Professor James Walker (Chair): Professor of Obstetrics in the University of Leeds.

Professor Sean Daly: Elected Master of the Coombe Hospital in 1998: Mastership 1999-2005: Head of Perinatal Medicine in Coombe Hospital 2005-2010

Dr Paul Hughes: Obstetrician & Gynaecologist, Kerry

Dr Elaine Madden: Head of Midwifery and Gynaecology at the South Eastern Trust (Belfast)

Ms Rachel Conaty: Assistant Director of Midwifery and Nursng at the National Maternity Hospital in Holles Street, Dublin from 2008 to 2015..

Professor Eugene Dempsey: Consultant Neonatologist at Cork University Maternity Hospital and Professor of Paediatrics at University College Cork.

Dr Adrienne Foran**:** Consultant Neonatologist, Rotunda Hospital

Ms Breda Shiel Kerans: service user representative on the Maternity Services Steering Group

Should the Review Team require further external independent input, the Chair of the Review Team will discuss this with the Commissioner.

Support for the Review Team

The Review Team will;

- Be afforded the assistance of all relevant staff and other relevant personnel.
- Have access to all relevant files and records (subject to any necessary consent/data protection requirements including court applications, where necessary).

Review methodology

The Review will follow the HSE Investigation policy and will be cognisant of the rights of all involved to privacy and confidentiality; dignity and respect; due process; and natural and constitutional justice.

The Review will commence immediately and will be concluded in the shortest timeframe necessary to achieve the purpose of the Review. It is anticipated that a maximum of 5 month will be required.

Following completion of the Review, an anonymised draft report will be prepared by the Review Team outlining the findings and recommendations. All who participated in the investigation will have an opportunity to give input to the extracts from the report relevant to them to ensure that they are factually accurate and fair from their perspective.

As part of the overall Review individual Investigation Reports into the care of each of the women will also be produced and shared with the women/partners concerned.

The anonymised version of the full Review report will also be shared with the women involved and may be published. This report may also be the subject to Freedom of Information requests.

Communications

A named individual within the Saolta group, will be appointed for the purpose of communicating information pertaining to the Review to the family/staff member(s) affected by and/or involved in the adverse events which are the subject of the Review.

Dr. Pat Nash

Chief Clinical Director, Saolta University Health Care Group

Appendix 2

Risk Assessment (Guidelines on Fetal Heart Rate Monitoring (2007)

Low Risk indicators are:

- Normal pregnancy
- Normal fetal growth
- Normal labour

High risk indicators are:

Complicated pregnancy
Intrauterine growth retardation
Induction of labour
Abnormal labour, which is prolonged or augmented
Epidural analgesia
Clinical evidence of fetal distress
Cardiotocograph abnormalities
Previous perinatal loss
Multiple pregnancy

Appendix 3 – Signs and symptoms of uterine scar rupture (Guideline on Trial of Labour (2005))

Pain

- Sudden uterine or scar pain
- A feeing of 'giving way' (Silverton 1993)
- Lower abdominal pain with a contraction or a constant unrelating pain
- The woman may find it too painful to have her abdomen touched

Uterus/contractions

- Solid tonic uterus

Or

- Contractions may stop or dwindle

Fetal Heart rate (FHR)

- Abnormal FHR changes may occur such as prolonged or variable decelerations, usually progressing to a serious bradycardia

Appendix 4 – Categorisation of fetal heart rate (FHR) features

Feature	Baseline FHR	Variability	Decelerations	Accelerations
Re-assuring	110-160	greater than 5	None	Present
Non-reassuring	100-109 161-180	Less than 5 for 40 to greater than 90 minutes	• Early deceleration • Variable deceleration • Single prolonged up to 3 minutes	The absence of accelerations with an otherwise normal CTG is of uncertain significance
Abnormal	Above 180 or below 100 Sinusodial pattern greater than 10 minutes	Less than 5 for over 90 minutes	• Atypical variable deceleration • Late deceleration • Single prolonged deceleration greater than 3 minutes	The absence of accelerations with an otherwise normal CTG is of uncertain significance

Categorisation of fetal heart traces

Category	Definition
Normal	A CTG where all four features fall into the reassuring category
Suspicious	A CTG whose features fall into one of the non-reassuring categories and the remainder of the features are reassuring
Pathological	A CTG whose features fall into two or more non-reassuring categories or one or more abnormal categories

Guidelines on Fetal Heart Rate Monitoring, (2007) Hospital 1

Appendix 5- Framework of Contributory Factors

Factor Types Contributory Factor (i.e. potential causes related to each key causal factor and incidental finding

Individual affected/harmed

- Condition (complexity & seriousness)
- Language and communication
- Personality and social factors
- Psychological, existing mental health condition, stress

Task and Technology Factors

- Task design and clarity of structure
- Availability and use of protocols, policies, standards
- Policies etc. relevant, unambiguous, correct and realistic
- Availability and accuracy of test results
- Decision-making aids

Individual (Staff) Factors

- Knowledge and skills
- Competence – education, training, supervision
- Physical, psychological and mental health illness

Team Factors

- Verbal communication
- Written communication
- Supervision and seeking help
- Team structure (leadership, congruence, consistency etc.)

Work Environmental Factors

- Staffing levels and skills mix
- Workload and shift patterns
- Administrative and managerial support
- Environment - Physical and cognitive.
- Design, availability and maintenance of equipment

Organisational & Management Factors

- Organisational structure
- Financial resources and constraints
- Policy, standards and goals
- Quality & Safety culture and priorities

Institutional Context Factors

- Economic and regulatory context
- National health service executive
- Links with external organisations

Appendix 6-Hierarchy of Hazard Controls

Strength of control	Category of Control	Comments/ Examples
Strongest Control  Weakest Control	Elimination	The work process or task is redesigned so as to remove the hazard/ contributory factor. However, the alternative method should not lead to a less acceptable or less effective process. Examples of controls may be to stop providing service; discontinue a particular procedure; discontinue use of a particular product, service or piece of equipment. *If hazard elimination is not successful or practical, the next control measure is substitution.*
	Substitution	Replacing the material or process with a less harmful one. Re-engineer a process to reduce potential for "human error". *If no suitable practical replacement is available the next control measure is engineering controls*
	Engineering Controls	Installing or using additional equipment. Introduce "hard" engineering controls e.g. installation of handling devices for moving and handling people and objects, e.g. Re-engineer equipment so that it is impossible to make errors. *If no suitable engineering control is available, the next control measure is administrative procedures.*
	Administrative Procedures	Ensure that administrative policies, procedures and guidelines are in place Ensure staff are appropriately trained in these Monitor compliance with policies, procedures and guidelines through audit *If no administrative procedure is available the next control measure is work practice controls.*
	Work Practice Controls	This is the last control measure to be considered. Change the behaviour of staff, e.g. make staff wear personal protective equipment, etc. *Work Practice controls should be only considered after all the previous measures have been considered and found to be impractical or unsuccessful*