



IN THE CORONERS COURT  
OF VICTORIA  
AT MELBOURNE

**COR 2017 000092**

**FINDING INTO DEATH WITHOUT INQUEST**

*Form 38 Rule 63(2)*

*Section 67 of the Coroners Act 2008*

Findings of:	Coroner Paul Lawrie
Deceased:	Vanessa Li
Date of birth:	2 January 2017
Date of death:	6 January 2017
Cause of death:	1(a) SUBGALEAL HAEMATOMA COMPLICATING AN OBSTRUCTED LABOUR.
Place of death:	Mercy Hospital for Women, 163 Studley Road, Heidelberg, Victoria, 3084
Keywords:	Subgaleal haematoma; obstructed labour.

## INTRODUCTION

1. On 6 January 2017, Vanessa Li was four days old when she passed away at the Mercy Hospital for Women in Heidelberg, Victoria.

## THE CORONIAL INVESTIGATION

2. Vanessa's death was reported to the Coroner as it fell within the definition of a reportable death in the *Coroners Act 2008* (the Act). Reportable deaths include deaths that are unexpected, unnatural or violent or result from accident or injury.
3. The role of a coroner is to independently investigate reportable deaths to establish, if possible, identity, medical cause of death, and surrounding circumstances. Surrounding circumstances are limited to events which are sufficiently proximate and causally related to the death. The purpose of a coronial investigation is to establish the facts, not to cast blame or determine criminal or civil liability.
4. Under the Act, coroners also have the important functions of helping to prevent deaths and promoting public health and safety and the administration of justice through the making of comments or recommendations in appropriate cases about any matter connected to the death under investigation.
5. Coroner John Olle initially held carriage of this investigation. Victoria Police assigned an officer to be the Coroner's Investigator for the investigation of Vanessa's death. The Coroner's Investigator conducted inquiries on Coroner Olle's behalf, including obtaining medical records and a report from the forensic pathologist. Further statements were also obtained by the court from treating clinicians at the Epworth Freemasons Hospital, the Royal Children's Hospital, and external experts.
6. I took carriage of this matter in October 2022 for the purposes of finalising the investigation and this finding.
7. In May 2023, draft findings (without inquest) were circulated to the interested parties and responses were received from Dr John Drew<sup>1</sup>, Dr Kent Kuswanto<sup>2</sup>, and Epworth Freemasons<sup>3</sup>.

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<sup>1</sup> Letter from Dr Drew dated 11 July 2023

<sup>2</sup> Letter from Avant Law dated 5 July 2023 and letter from Dr Kuswanto dated 5 July 2023

<sup>3</sup> Letter from Epworth Freemasons dated 22 June 2023

8. This finding draws on the totality of the coronial investigation into the death of Vanessa Li including evidence contained in the coronial brief and the responses from the interested parties. Whilst I have reviewed all the material, I will only refer to that which is directly relevant to my findings or necessary for narrative clarity. In the coronial jurisdiction, facts must be established on the balance of probabilities.<sup>4</sup>

## **BACKGROUND**

9. Vanessa was born at the Epworth Freemasons Hospital (Epworth) on 2 January 2017 at 1.43am with a birth weight of 3,010 grams.
10. Vanessa was the first child born to Yuanhang Gu and Yi Li, following Ms Gu's second pregnancy. Ms Gu's pregnancy was managed by private obstetrician Dr Kent Kuswanto. Ms Gu was in good health and had no significant medical issues. Her pregnancy was uncomplicated, and her routine antenatal tests and ultrasounds were normal. The expected date of delivery was 10 January 2017.
11. Ms Gu was admitted to the Epworth Hospital at 5.46pm on 1 January 2017 in spontaneous labour, at 38 weeks and 5 days gestation. Upon admission, she had a mildly elevated temperature of 37.5°C. Her other observations and cardiotocography (CTG) were normal.
12. At 6.40pm, Dr Kuswanto was informed of Ms Gu's temperature. He ordered blood tests to be undertaken, which revealed a possible infection.<sup>5</sup> Ms Gu had epidural pain relief commenced at 7.45pm.
13. At 8.00pm, Dr Kuswanto first saw Ms Gu and performed a vaginal examination. At this time, her temperature had decreased slightly and her cervix was observed to be 5cm dilated. Vanessa was noted to be in cephalic<sup>6</sup> presentation. Dr Kuswanto performed an artificial rupture of membranes and the liquor was noted to be blood stained. Dr Kuswanto later stated that it is 'common for there to be some blood in the liquor following a vaginal examination' and, as such, this did not cause any concern. A syntocinon infusion was started at 8.30pm to augment labour and a urinary catheter was inserted which drained clear urine.

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<sup>4</sup> Subject to the principles enunciated in *Briginshaw v Briginshaw* (1938) 60 CLR 336. The effect of this and similar authorities is that coroners should not make adverse findings against, or comments about, individuals unless the evidence provides a comfortable level of satisfaction as to those matters taking into account the consequences of such findings or comments.

<sup>5</sup> Ms Gu had a raised white cell count ( $20.4 \times 10^9/L$ ), raised neutrophil count ( $17.8 \times 10^9/L$ ) and CRP of 7. CRP is a non-specific marker for infection or inflammation. These results were suggestive of an early infection.

<sup>6</sup> Head first.

14. At 11.10pm, a midwife completed a vaginal examination which showed cervical dilation of 9cm. There were abnormal findings of caput<sup>7</sup>, blood-stained liquor, and a 1–2cm blood clot, which passed after the examination. Ms Gu’s temperature was again elevated at 37.6°C.
15. Dr Kuswanto was informed and he ordered that Ms Gu receive intravenous antibiotics as a precaution. The CTG was now also showing the baseline fetal heart rate (FHR) had increased to 160 beats per minute (bpm) and there was reduced baseline variability.<sup>8</sup> Nursing notes document that Dr Kuswanto was aware of these CTG findings.
16. At 12.05am (2 January 2017), Ms Gu was assessed to have a fully dilated cervix, and being ready to push and deliver. Nursing notes continued to document that Dr Kuswanto was aware of a rising baseline (fetal tachycardia) and reduced variability of trace.
17. Dr Kuswanto arrived at the Epworth at 12.20am. An accurate interpretation of the CTG baseline and decelerations was not possible at this time due to poor recording of maternal contractions. The liquor remained blood stained, indicating an obstructed labour. There was also persistent maternal fever and fetal tachycardia. Dr Kuswanto stated that at 12.20am:

*The baseline had risen to 180, with variable decelerations this was consistent with cord compression during contractions, the variability was normal at this stage. There were no signs of hypoxia.*
18. At 12.30am, Dr Kuswanto examined Ms Gu and found her cervix to be fully dilated with the fetal head at the ischial spines and in the left occipito-transverse position<sup>9</sup> and with ‘caput +++’. Ms Gu’s urine was now blood stained and the CTG showed fetal tachycardia, with increased FHR of 180 bpm and deep variable decelerations. Dr Kuswanto later stated, ‘this was considered a sign of obstructed labour’.
19. Dr Kuswanto re-assessed the labour to be obstructed at full dilation in the occiput transverse position above the ischial spines with caput succedaneum<sup>10</sup>. Dr Kuswanto attempted to rotate the head manually to the anterior position but was unsuccessful. He stated that ‘these

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<sup>7</sup> The presence of swelling over the head. Caput and moulding of the head into the pelvis is suggestive of obstructed labour.

<sup>8</sup> Baseline variability is the single most important feature of the CTG in determining fetal wellbeing. Normal baseline variability is the hallmark of adequate fetal oxygenation.

<sup>9</sup> The back of the head was towards the mother’s left.

<sup>10</sup> An oedematous swelling of the scalp above the periosteum, which is generally a benign condition, usually resolving within a few days and requires no treatment.

manoeuvres do not involve any significant pressure to the fetal head, and are well tolerated by a healthy baby’.

20. At 12.40am, Dr Kuswanto decided an emergency caesarean section needed to be undertaken and paediatrician, Dr John Drew, was called to attend.

21. Dr Kuswanto stated that the reason for caesarean section was obstructed labour at full dilation, not fetal distress. He reported that there was fetal tachycardia but no evidence of fetal hypoxia during the labour, saying:

*The CTG showed a variation from normal at 00:30 when there was increasing baseline with variable decelerations. This was considered a sign of obstructed labour.*

22. In a response to the draft findings, by letter dated 5 July 2023, Dr Kuswanto stated:

*While the CTG did show a rising baseline, it was still within normal limits (that is, below 160 bpm) at 11.10pm. Although there was some reduced variability through some periods of time, there was normal variability up to 1.16am, just prior to the end of the continuous CTG ...*

*... Complicated variable decelerations started at 12.40am, and this was when the decision was made for delivery, after attempts to manually rotate the fetal head was unsuccessful.*

23. At 12.58am, the syntocinon infusion was ceased and Ms Gu was transferred to the operating theatre. The epidural was topped up to convert her labour epidural to surgical anaesthesia. CTG monitoring was ceased at 1.18am, at which time there was ongoing fetal tachycardia and ongoing reduced variability. This was approximately 20 minutes prior to delivery.

24. Dr Drew stated that, at approximately 1.30am, he personally discussed the case with Dr Kuswanto, who informed him he was not expecting any problems with the baby. Dr Drew did not foresee any significant concern at that stage.

25. In theatre, Dr Kuswanto repeated the vaginal examination which remained unchanged. He manually pushed the fetal head up during the vaginal examination.

26. After making an incision into the uterus, Dr Kuswanto attempted to use forceps but was unable to apply the forceps to the fetal head. Upon removing the forceps, the fetal position changed

to an oblique/transverse lie, with the head in the left iliac fossa. External version (pushing on the maternal abdomen) was then performed to bring the head into the midline. The skin incision was also extended by one centimetre on either side. Dr Kuswanto reported that ‘the fetal head was then manually delivered with little effort’.

27. Dr Kuswanto recalled in a further statement<sup>11</sup>:

*To this day, I have a vivid recollection of the events of that night and morning, and I emphasise again that my clear evidence is that the forceps did not fit well, and so were removed without applying any traction. Further ... it took just eight minutes from commencing the caesarean section to delivering Vanessa, which is reasonable, and I would argue leaves no time for struggling with misaligned forceps.*

28. Vanessa was delivered on 2 January 2017 at 1.43am by caesarean section at 38 weeks and 6 days gestation. This was approximately one hour after the decision was made for a caesarean section. She was born in poor condition, with APGAR scores of ‘2’ at 1 minute, ‘6’ at 5 minutes, and ‘8’ at 10 minutes.

29. At delivery Vanessa’s heart rate was 40 bpm and there was no respiratory effort. Cardiopulmonary resuscitation (CPR) was commenced in the form of intermittent positive pressure ventilation (IPPV) and external cardiac massage. The heart rate quickly improved and external cardiac massage was ceased.

30. A Vitamin K injection was administered at 1.45am.

31. By 10 minutes of life, IPPV was ceased, and Dr Drew did not proceed to intubation. Vanessa was now breathing spontaneously, and her heart rate and tone were improved. At this point, Vanessa’s head was soft, which Dr Drew stated suggested craniolucanae<sup>12</sup>.

32. Dr Kuswanto stated that Vanessa’s poor condition at birth was a ‘surprise’, stating that there ‘were no other indicators throughout the labour to indicate that the baby was unwell’.

33. At 2.15am, Vanessa was admitted to the Special Care Nursery (SCN). Upon admission, her heart rate was elevated to 175 bpm, her respiratory rate was elevated to 80 breaths per minute,

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<sup>11</sup> Letter dated 5 July 2023

<sup>12</sup> The abnormal formation of the skull vault with areas of thinning of the skull.

and her temperature was normal. Dr Drew described Vanessa as mottled, but she was spontaneously breathing.

34. An intravenous line was inserted, blood tests were taken, and a chest X-ray was requested. These investigations showed evidence of infection and severe metabolic acidosis<sup>13</sup>. Vanessa's initial blood count was normal, at 184 g/L, which suggests there was no significant blood loss at that point in time. At 2.50am Vanessa was administered intravenous antibiotics (benzylpenicillin and gentamicin).
35. Dr Drew's statement did not provide further details of the examination findings of the scalp but his initial assessment noted 'head mushy ++ ?blood'.<sup>14</sup> This suggested a degree of bleeding in the scalp, but it is unclear if there was evidence of a subgaleal haemorrhage (SGH) or a more benign bleed, such as cephalohaematoma<sup>15</sup>.
36. Dr Drew documented a differential diagnosis of asphyxia, possible sepsis, and queried the possibility of an SGH<sup>16</sup>. The progress notes record, '? Sepsis + sub galeal bleed'.<sup>17</sup>
37. Blood pressure was first obtained at 3.00am and demonstrated significant hypotension. Dr Drew treated the initial hypotension and acidosis with the administration of a fluid bolus, however the hypotension and acidosis did not improve.
38. The Paediatric Infant Perinatal Emergency Retrieval (PIPER) service was contacted at 3.17am for advice, and to arrange transfer to a Neonatal Intensive Care Unit (NICU).
39. Dr Drew provided details of Ms Gu's antenatal history and the delivery to the PIPER team. The details of the initial resuscitation were provided, and Vanessa's head was described as 'mushy' on initial assessment. There was no specific mention of concerns about a SGH in the summary of this phone call. Details of initial management and investigations results were provided. The poor tone, lack of spontaneous movements and lack of eye opening were

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<sup>13</sup> This is suggestive of a recent significant hypoxic-ischaemic stress, consistent with an intrapartum and/or early neonatal episode of hypoxic ischaemia.

<sup>14</sup> CB 384

<sup>15</sup> Bleeding in the area between the skull and periosteum (membrane covering the skull) secondary to ruptured blood vessels, occurring especially over one or both of the parietal bones in newborn infants as a result of trauma sustained during delivery. A cephalhaematoma is generally benign and does not cause cardiovascular compromise.

<sup>16</sup> A SGH occurs when the veins between the scalp and dural sinuses are sheared or severed as a result of traction on the scalp during delivery. SGH can occur following normal birth, forceps delivery or caesarean section, it most frequently occurs following vacuum assisted birth. SGH is a potentially life threatening complication due to significant ongoing bleeding and blood loss.

<sup>17</sup> CB 384

determined to be consistent with moderate to severe hypoxic-ischaemic encephalopathy (HIE)<sup>18</sup>.

40. The PIPER team recommended that a blood gas be taken and to start passive cooling. Dr Drew was advised that it would be approximately one hour before the PIPER team arrived due to the need to call in a second emergency team as the night duty team was already deployed on another retrieval. This response time was deemed appropriate by the PIPER team as there was ongoing care being provided by a consultant paediatrician and SCN nurses at the referring hospital.
41. Whilst awaiting PIPER arrival, Vanessa was spontaneously breathing and had no additional oxygen requirements. Dr Drew did not document in the medical record or report in his statement any further examinations of Vanessa's head during this time.
42. The PIPER team, consisting of a neonatal senior registrar and neonatal transport nurse, arrived on site at the Epworth at 4.38am.
43. Dr Drew handed over care of Vanessa to the PIPER team. The handover included a detailed antenatal history, history of the labour and delivery, details of the initial resuscitation and current status and management. Dr Drew's statement did not specify whether he advised the PIPER team regarding the possibility of SGH or the specifics of the delivery during this handover. A subsequent statement from Associate Professor Michael Stewart, Director of PIPER, noted that 'the possibility of the baby being at risk for developing a symptomatic subgaleal haemorrhage was not noted during the handover'.
44. Dr Drew explained that his working diagnosis was asphyxia and possible sepsis. In respect of the potential for SGH, he stated:

*... I did not have a suspicion of a potential SGH. After resuscitation restored her spontaneous breathing, I examined Vanessa closely. She looked reasonable but, as I noted in my original statement, her head was soft, suggesting craniolucanae. I did not find any indication of SGH from that examination. ...*

*I noted the query SGH in order to return to that and check again if her condition did not improve. Had I suspected SGH I would have made hourly*

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<sup>18</sup> A condition in which the brain does not receive enough oxygen. This particular condition refers to an oxygen deficiency to the brain as a whole, rather than a part of the brain.



*measurements of her skull, although the presence of haematomas would have made it difficult to accurately assess her head measurements.*

*... I found no indication of SGH on examination and the fact that I knew the delivery was not especially difficult and that the ventouse had not been used made SGH even less likely. My note was therefore made to ensure that SGH could continue to be excluded if she did not respond to treatment. While Vanessa remained unwell, she was stable even without oxygen so I did not change my view about her likely diagnosis throughout the time I was caring for her.<sup>19</sup>*

45. Associate Professor Stewart's statement described Dr Drew's handover of the delivery as 'a difficult extraction requiring multiple forceps attempts.' However, specific details regarding the need for dis-impaction of the fetal head from below and manual manipulation were not handed over to the PIPER team.

46. Dr Drew explained some aspects of the handover in his further statement:

*I do not recall my verbal handover in detail but I would be very surprised if I made such a statement. While I did not witness the delivery, being behind the obstetrician, my impression of the procedure was that it was quick and without considerable difficulty. I was aware that at some point forceps were attempted but I did not believe that multiple attempts with forceps had been required. Having attended many thousands of deliveries, I am aware of how a difficult extraction presents.*

47. After completing the handover, Dr Drew left the hospital at 5.10am, by agreement with the PIPER team. Associate Professor Stewart noted that this is not unusual if the PIPER team reasonably anticipate they can carry out the required tasks without assistance from the referring doctor, and although Vanessa was high risk on a number of parameters, it was reasonable to assume she would stabilise once she had been intubated and provided standard treatment for hypotension and metabolic acidosis.

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<sup>19</sup> Letter from Dr Drew dated 11 July 2023

48. Associate Professor Stewart noted that the Epworth nursing staff remaining to assist the PIPER team ‘were struggling to provide the required assistance, having to consult with the nurse in charge to identify various items of equipment’.
49. After the PIPER team’s initial assessment, which showed ongoing hypotension, poor perfusion, and a metabolic acidosis, their working diagnosis was of moderate to severe HIE with significant cardiac impairment. Sepsis was also considered, and antibiotics had already been administered. Associate Professor Stewart observed:
- ...the initial physical examination of the baby specifically found no evidence of a significant subgaleal haemorrhage. The PIPER senior registrar noted the presence of two large haematomas on the baby’s head. The sagittal suture was palpable between the haematomas and there was no tracking of the haematoma behind the ears or down onto the occipital surface of the head.*
50. These examination findings were not consistent with an SGH, as an SGH tends to cross suture lines and tends to track to other areas. The two haematomas were thought to be cephalhaematomas, which are generally benign.
51. Vanessa had fluctuating blood pressures and ongoing hypotension and, at 5.20am, a teleconference was arranged with the PIPER consultant. A plan was developed for the PIPER team to give a second fluid bolus and commence dobutamine to provide blood pressure support. These treatments were commenced within 10 minutes of the teleconference call. The additional plan was to place umbilical lines, intubate and continue therapeutic cooling.
52. Between 6.00am and 6.45am, an umbilical vein cannula was inserted. An umbilical artery cannula insertion was attempted but proved difficult and was ultimately unsuccessful.
53. At 7.00am, pre-medications for intubation were given and intubation was successful on the first attempt.
54. At 7.30am, Vanessa was re-examined. She was noted to have a ‘boggy swelling at the back of the head extending laterally’, a further drop in blood pressure, and oozing and bleeding from the heel prick sites. Vanessa was diagnosed with having an SGH and possible

disseminated intravascular coagulation (DIC)<sup>20</sup>. The dobutamine infusion was increased and an urgent blood transfusion was ordered.

55. At 7.38am, a further call was made to the PIPER consultant for advice. A plan was developed to start a second blood-pressure support medication and give further blood product transfusions to treat the DIC. A second dose of Vitamin K was administered to treat the bleeding and Vanessa was re-warmed to 36°C to prevent the coagulopathy worsening. There was a significant drop in haemoglobin, from 184g/L at 2.50am, to 102g/L on repeat blood tests, indicating a significant bleed had occurred.
56. At 8.03am, the blood transfusion was commenced.
57. At 8.08am, there was a sudden deterioration and Vanessa's heart rate dropped to 40 bpm. Cardiac compressions were commenced and a Code Blue<sup>21</sup> was called. CPR was continued for nine minutes and two doses of adrenaline were required. By 8.17am, Vanessa's heart rate had normalised to 137 bpm.
58. During the Code Blue, the PIPER consultant was contacted, and they advised they were on their way to the Epworth, arriving at 8.40am. Due to ongoing hypotension, an adrenaline infusion was commenced in addition to the dobutamine infusion to improve Vanessa's blood pressure.
59. Dr Drew was called at approximately 8:35am in response to Vanessa's arrest in the SCN. He initially presumed the deterioration had occurred in the Mercy Hospital for Women NICU and was confused to hear that Vanessa was still at the Epworth. When Dr Drew arrived at 9.00am, Vanessa appeared very unwell with 'blood +++ around the head'. Further blood product transfusions and a morphine infusion were commenced.
60. By 9.00am, Vanessa had stabilised, and her mean blood pressure improved to 47mmHg, the first acceptable reading since birth.

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<sup>20</sup> DIC leads to the formation of small blood clots inside the blood vessels throughout the body. As the small clots consume coagulation proteins and platelets, normal coagulation is disrupted and abnormal bleeding occurs from the skin (e.g. from sites where blood samples were taken), the gastrointestinal tract, the respiratory tract and surgical wounds. The small clots also disrupt normal blood flow to organs (such as the kidneys), which may malfunction as a result.

<sup>21</sup> A medical emergency and triggers the immediate attendance of a rapid response team, including an anaesthetist.

## **MATTERS IN RELATION TO WHICH A FINDING MUST, IF POSSIBLE, BE MADE**

### **Circumstances in which the death occurred**

61. At 10.30am, Vanessa was transferred to the NICU at the Mercy Hospital for Women by the PIPER team. They arrived at the Mercy Hospital at 10.55am.
62. Vanessa was stable during the transfer with a normal blood pressure. However, she was very unwell with a working diagnosis of hypovolemic haemorrhagic shock secondary to a large SGH. She continued to require intensive cardiorespiratory support and was continued on broad spectrum antibiotics. Vanessa had severe anaemia and DIC requiring multiple blood product transfusions for correction.
63. Seizures were noted at approximately 24 hours of age, which were treated with anticonvulsant medications. A magnetic resonance imaging (MRI) scan of Vanessa's brain was performed at 2.35pm on 3 January 2017 (just over 36 hours of age), which was reported both at the Mercy Hospital with a second opinion from Royal Children's Hospital (RCH) neonatologist Dr Rod Hunt and neuroradiologist Dr Lee Coleman. This confirmed an SGH, as well as extensive subarachnoid haemorrhage and diffuse intraparenchymal bleeding<sup>22</sup>. There was evidence of hypoxic ischemic encephalopathy, uncal herniation<sup>23</sup> and severe damage to part of the spinal cord. Overall, it was commented by Dr Hunt and Dr Coleman that the appearance was noted to be 'amongst the worst hypoxic-ischaemic change [they had] seen in [a] day 3 child'.
64. On 4 January 2017, advice was sought from Dr Chris Barnes, Paediatric Haematologist, regarding Vanessa's ongoing coagulopathy. He was of the opinion that it was highly unusual for a baby with congenital coagulopathy to present in this manner. He suggested that the clinical picture was more suggestive of DIC with the primary event being a perinatal asphyxia. It was not possible to investigate for a specific congenital coagulopathy given Vanessa had already received a large amount of blood products.
65. Taking into account the MRI brain findings and clinical review by two consultant neonatologists, it was concluded that Vanessa had a severe brain injury due to a hypoxic

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<sup>22</sup> Bleeding into the brain tissue (parenchyma).

<sup>23</sup> When the innermost part of the temporal lobe (the uncus) is squeezed downward and causes displacement of and pressure on the brainstem. Herniation occurs due to increased intracranial pressure. Pressure on the brainstem can impair its vital functions such as maintaining breathing, heart rate and blood pressure.

ischemic insult. If she were to survive, she would be at ‘very high risk of severe neurological injury and disability with both motor and intellectual disabilities’.

66. Vanessa’s parents were counselled by the Mercy Hospital team in multiple family meetings, with a Mandarin interpreter, and the decision was made to withdraw care. Respiratory support was ceased, and Vanessa passed away at 12.46pm on 6 January 2017.

### **Identity of the deceased**

67. On 6 January 2017, Vanessa Li, born 2 January 2017, was visually identified by her father, Yi Li.
68. Identity is not in dispute and requires no further investigation.

### **Medical cause of death**

69. Forensic Pathologist, Dr Sarah Parsons from the Victorian Institute of Forensic Medicine (VIFM), conducted an autopsy on 7 January 2017 and provided a written report of her findings dated 30 May 2017. Dr Parsons’ report also referred to the findings of a neuropathological examination conducted by Dr Linda Iles on 13 January 2017.
70. The post-mortem examination revealed:
  - a) an organising extradural blood clot
  - b) an organising subarachnoid haemorrhage about the cerebral convexities and the base of the brain
  - c) patchy meningitis most marked about the posterior fossa structures
  - d) extensive early necrosis and apoptosis within the supratentorial cortex, ganglionic nuclei and pons
  - e) haemorrhagic necrosis/infarction within the cervicomedullary junction and proximal cervical cord
  - f) patchy subdural haemorrhage about the spinal cord
  - g) large SGH
  - h) cephalohaematoma
  - i) suture diathesis with radiating fractures
  - j) intracerebral haemorrhage
  - k) pulmonary haemorrhage
  - l) renal haemorrhage, and

m) meconium aspiration and acute myocardial infarction.

71. Dr Iles commented that the presence of focal collections of neutrophils in the subarachnoid space were more likely the result of meningitis rather than a secondary response to brain ischemia and infarction.
72. Dr Parsons noted that meningitis can lead to sepsis and DIC and that neonates have a high morbidity and mortality secondary to sepsis. However, the lack of specific clinical findings makes diagnosis of meningitis difficult in neonates. Ascending infection from the mother is a common cause of meningitis.
73. The placenta was examined by Melbourne Pathology. Although Ms Li was febrile in labour there was no evidence of choroamnionitis<sup>24</sup> upon examination of the placenta. Swabs of the placenta cultured *Ureaplasma urealyticum* and *Mycoplasma hominis*, both of which can be potentially pathogenic.
74. The causative agent of the meningitis was unable to be identified. Dr Parsons noted that antibiotics were administered to Vanessa which may have contributed to the inability to culture the causative organism.
75. Dr Parsons noted that meningitis and sepsis can lead to DIC which increases the risk of haemorrhage.
76. Dr Parsons also noted that obstructed labour can lead to SGHs and large SGHs can lead to significant blood loss in an infant, which would have been worsened if the child was suffering from DIC.
77. Dr Parsons noted that skull fractures identified at autopsy were likely to be secondary to significant swelling on the brain rather than as a complication of labour.
78. Dr Iles stated that the aetiology of the necrosis/infarction within the caudal brainstem and upper cervical cord was unclear. It was not clear if it was directly the result of birth trauma, as suggested by prominent axonal injury within the middle cerebellar peduncle, or due to ischaemic injury. Given that the change was not documented in the antemortem MRI report, Dr Iles indicated that the latter explanation would appear most likely.

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<sup>24</sup> Inflammation of the membranes and chorion of the placenta.

79. Microbiological testing showed staphylococcus species in blood culture and both lung swabs. The significance of this was uncertain as staphylococcus is a common post-mortem contaminant. It can, however, also cause neonatal sepsis.
80. Dr Parsons recommended a further review by an obstetrician given there were questions following obstructed labour, possible birth trauma and infection. She initially provided an opinion that the medical cause of death was ‘1(a) complications of an obstructed labour in an infant with neonatal meningitis’.
81. Expert opinions were subsequently received from Dr Andrew McPhee and Associate Professor Christopher Wilkinson which concluded that Vanessa’s death was caused by an SGH following birth trauma. I requested that Dr Parsons review her initial autopsy report in light of these expert opinions and provide a supplementary report.
82. On 9 March 2023, Dr Parsons provided a supplementary report, which she had completed in consultation with Dr Iles. The supplementary report noted that Dr Iles had reviewed the slides and found isolated meningitis not associated with the HIE changes which were identified elsewhere. There was no other evidence of sepsis at post-mortem and the meningitis was considered a primary pathology.
83. The report noted that isolated neonatal meningitis is reported in the literature and is usually due to gram-negative enteric bacteria. Fatality rates can be up to 60%. In this case, Vanessa was given antibiotics in hospital which meant that Dr Parsons and Dr Iles were unable to culture the causative organism.
84. Dr Iles conceded that there was no suggestion that the finding of meningitis was the primary cause of Vanessa’s presentation. Given that a proportion of infants with neonatal meningitis survive and this finding was localised, it is possible in a well infant that this would have been treatable if diagnosed early. In the setting of HIE and SGH however, it does represent an extra insult on the infant’s brain.
85. Dr Parsons agreed with Dr McPhee that an SGH is a medical emergency in an infant and can lead to DIC and death, and noted that the clinical history, as reviewed by Dr McPhee, appeared to follow the course of a worsening clinical condition due to SGH.
86. Whilst the autopsy findings remained the same, given the clinical picture Dr Parsons stated that the cause of death should be changed to reflect the clinical demise of the infant. As such,

she provided an updated opinion that the medical cause of death was ‘1(a) subgaleal haematoma complicating an obstructed labour’.

87. I accept Dr Parson’s opinion.

## **FAMILY CONCERNS**

88. Mr Li sent an email to the court on 31 July 2017, outlining his concerns with respect to the medical care provided to Ms Gu and Vanessa. He specifically outlined concerns regarding the absence of Dr Kuswanto during the period from 8.00pm on 1 January 2017 to 12.20am on 2 January 2017, and his failure to physically examine Ms Gu during that time. Mr Li also queried whether Vanessa’s delivery should have been expedited in light of Ms Gu’s intrapartum fever.

## **FURTHER INVESTIGATIONS**

89. After receiving Mr Li’s concerns, Coroner Olle requested a number of additional statements and expert opinions addressing the obstetric care provided to Ms Gu, and the medical care provided to Vanessa during and following her birth. Those statements are summarised as follows.

### **Statement of Doctor Kent Kuswanto, obstetrician**

90. A statement was obtained from Dr Kuswanto, specialist Obstetrician and Gynaecologist at Epworth, in relation to his management of the labour and birth.

91. Dr Kuswanto stated that although he was not physically present for the entirety of Ms Gu’s labour, he was regularly called throughout the evening and provided with updates concerning the progress of her labour. He provided advice to Ms Gu’s treating clinicians as required.

92. Dr Kuswanto stated that the labour progressed well up until it became clear that the labour was obstructed. Ms Gu was transferred to theatre promptly and the caesarean section was straightforward, despite Vanessa changing position which required correction.

93. Dr Kuswanto referred to the first autopsy report of Dr Parsons, which indicated in the comments section that ‘the infant was distressed’. He stated that this was inaccurate as there were no signs that Vanessa was in distress throughout the labour.



94. Dr Kuswanto stated that the reason for the caesarean section was obstructed labour at full dilation, not fetal distress. He also stated that the delivery of the head was not difficult. Although Vanessa ‘changed position unexpectedly and required rotation back to longitudinal lie, once this was done her head was delivered easily with little effort required’.
95. Dr Kuswanto stated that when Vanessa was born in poor condition this was a surprise as up until that point there had been no evidence of fetal distress. Rather, the clinical picture was that of an obstructed labour. He noted that ‘with the benefit of hindsight there were no other indicators throughout the labour to indicate that the baby was unwell’.
96. With respect to Vanessa’s head injuries, Dr Kuswanto stated:

*From my clinical perspective there was no trauma that occurred during labour or at delivery that could explain a subgaleal haematoma or skull fractures in a normal healthy baby... During the caesarean procedure Baby Li’s head was easily lifted from the pelvis. As is my usual practise I applied forceps to assist in the delivery of the head however they did not fit well and no pull of the forceps was made. Once the foetus was at longitudinal lie her head was delivered manually with little effort. No undue force was applied or required. There was no evidence of oxygen deprivation or hypoxia during the labour.*

97. Dr Kuswanto was adamant that he applied no traction with the forceps. In his supplementary statement he recalled:

*... I have a vivid recollection of the events of that night and morning, and I emphasise again that my clear evidence is that the forceps did not fit well, and so were removed without applying any traction. Further ... it took just eight minutes from commencing the caesarean section to delivering Vanessa, which is reasonable, and I would argue leaves no time for struggling with misaligned forceps.<sup>25</sup>*

98. Dr Kuswanto agreed that the SGH was most likely caused during the delivery but contended that there was insufficient evidence to identify a singular cause of the SGH.

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<sup>25</sup> Letter from Dr Kuswanto dated 5 July 2023

## **Statement of Associate Professor Michael Stewart, Director of PIPER**

99. A statement was obtained from Associate Professor Michael Stewart, Director of PIPER, regarding the management of Vanessa by the PIPER team.
100. Associate Professor Stewart outlined the qualifications and seniority of the medical and nursing staff on PIPER retrieval teams, noting that there is a consultant neonatologist available exclusively for retrieval-related matters. He confirmed that a PIPER retrieval team usually consists of a neonatal nurse and a senior registrar, and that a consultant would also attend the retrieval in approximately 5% of cases.
101. Associate Professor Stewart confirmed that a PIPER senior registrar is required to have completed their specialist paediatric exams and have a minimum of six months experience in a tertiary NICU. He also confirmed that the registrar is not deployed on retrievals where the matter is likely to result in a situation that is beyond their scope of practise.
102. The first PIPER team sent to retrieve Vanessa consisted of a senior registrar and neonatal transport nurse. The senior registrar was in her final year of specialist general paediatric training. She had six months experience in a NICU, and experience working in non-tertiary environments and low resource settings. She had undertaken 33 retrievals during her PIPER term. Associate Professor Stewart noted that the senior registrar successfully intubated Vanessa on their first attempt, which ‘was a reflection of a high level of neonatal procedural experience’.
103. The neonatal transport nurse in the first PIPER team was very experienced and had attended over 500 neonatal retrievals over the preceding eight years.
104. A second PIPER team, also consisting of a senior registrar and neonatal transport nurse, was deployed to relieve the night duty team at 7.00am on 2 January 2017. A consultant neonatologist with 15 years’ experience in neonatal retrieval also attended after Vanessa’s condition deteriorated at 8.05am.
105. Associate Professor Stewart stated that it is standard procedure for a PIPER team to consult with the supervising PIPER consultant shortly after the clinical handover has occurred and the team has made a clinical assessment of the baby. He noted that this ‘process ensures that a high level of consultant input is maintained for all retrievals’.

106. He also noted that ‘stabilisation of a baby at the referring hospital is the joint responsibility of the retrieval team and referring staff members’.
107. Associate Professor Stewart provided a detailed timeline of Vanessa’s management by the PIPER team. He indicated that there were no complications that impeded the timely completion of procedures, however there were a number of factors which affected the time taken to complete these procedures. These factors included that:
- a) the PIPER clinicians needed to provide assistance to a very ill baby in a non-NICU environment who required multiple interventions and procedures;
  - b) the PIPER clinicians needed to undertake multiple concurrent tasks, including drawing up and administering fluid boluses and medications, and locating and preparing equipment;
  - c) ongoing assessment and monitoring of Vanessa needed to be undertaken; and
  - d) there were technical challenges with siting the umbilical arterial catheter resulting in brief prolongation of the umbilical cannulation procedure.
108. Associate Professor Stewart summarised the work of the PIPER team between 4.40am and 7.40am on 2 January 2017 as consisting of a period of active management of the hypotension and metabolic acidosis characterised by encouraging levels of response in blood pressure. He noted that Vanessa’s condition was closely monitored during this time and stated that there was initially no evidence of subgaleal bleeding. An SGH first became evident at approximately 7.30am.
109. Associate Professor Stewart also stated that the PIPER team was working on a provisional diagnosis of moderate to severe perinatal asphyxia as the underlying cause of the circulatory compromise based on a number of factors, including the handover from Dr Drew, their initial examination of Vanessa’s head being not suggestive of SGH, initial blood gas results, including haemoglobin level, and the absence of the most common obstetric association with SGH, specifically multiple attempts at ventouse delivery.
110. Associate Professor Stewart confirmed that the RCH quality department had completed a critical incident review of the case, which was undertaken in part with the Epworth Freemasons Clinical Governance Unit. The Clinical Review Panel noted that:

- a) *The treatment of Vanessa by the PIPER team was consistent with the standard treatment for birth asphyxia and hypoxic ischaemic encephalopathy.*
- b) *Continuous rectal temperature monitoring should have been commenced soon after arrival of the PIPER team when ongoing cooling of the baby was being undertaken.*
- c) *Fatigue was identified as a potential factor by the PIPER neonatal consultant. The fatigue was influenced by the time of the call together with the high number of referrals managed by PIPER that night.*
- d) *Detailed information regarding the birth of the baby was not handed over to the PIPER team by the referring team. The difficulties associated with the birth of the baby (disimpaction of the fetal head from below, inability to apply forceps and manual manipulation of the fetal head during the delivery by caesarean section) may have alerted the team to the increased risk of a subgaleal haemorrhage developing after delivery. It is noteworthy that the most common risk factor for subgaleal haemorrhage – multiple attempts at ventouse delivery – was not present in this case.*
- e) *The referring team perceived there was a delay in the arrival of the PIPER team... There are currently no KPIs identified for the 'time of arrival' of the second on-call team.*
- f) *The referring team expressed concern that the referring paediatrician had not been kept updated when the baby's expected course changed significantly.*
- g) *Feedback from the referring hospital identified a lack of understanding of the roles of staff from each service when PIPER arrives to assist with managing and retrieving a patient.*
- h) *PIPER clinical observation documentation was not left with the referring service.*

111. In relation to the identified issues, the panel made several recommendations, which included:

- a) Updating the existing guideline to highlight the insertion of a rectal thermometer when elective cooling of a baby is initiated. This was subsequently actioned in an updated

guideline completed in February 2018 and reinforced to PIPER staff members through email.

- b) Considering the implementation of fatigue management strategies for periods of high workload in the PIPER service. This was actioned by the development of a clear position on fatigue-related issues for consultant staff members which was included in the PIPER Neonatal Consultant Roster Principles. This included limitations to after-hours rostering (such as avoiding consecutive nights on call), encouraging the splitting of weekend days into two shifts (to eradicate 24-hour shifts) and a pathway for escalation for assistance to cover excess demand or fatigue.
- c) Developing standard operating procedure (SOP) documents, together with the referring unit staff, that inform referring staff of expectations about:
  - i. the response time in various circumstances
  - ii. agreed expectations about roles and responsibilities of both PIPER team members and referring unit staff for when PIPER is assisting with the clinical care of a patient, and
  - iii. including an escalation pathway for notifying the referring paediatrician about the clinical condition of a patient.

112. It was noted that, given the variation in geographic locations, it was difficult to set a KPI for mobilising an on-call team. However, for all emergency retrievals, PIPER provides an estimate of response time and discusses it with the referring clinician.

#### **Statement of Associate Professor Genie Pedagogos, Epworth Freemasons**

113. Associate Professor Genie Pedagogos, Medical Director at the Epworth, provided a statement to the court outlining the investigations and reviews undertaken by the hospital following Vanessa's death. She provided details of an in-depth case review and root cause analysis (RCA) which was undertaken, and also noted that the case was presented at a number of quality and risk committees. She also confirmed that the Epworth had engaged an independent expert paediatric specialist, Dr Andrew McPhee, to review the case for quality assurance and improvement purposes.

114. Associate Professor Pedagogos advised that the RCA concluded that Vanessa's case involved: an obstructed labour, that management of the obstructed labour at the time was appropriate,

and that Vanessa's deterioration was unexpected at the point of delivery, but she had a good response to the initial resuscitation. The decision to contact PIPER was made when Vanessa deteriorated whilst in the SCN.

115. Associate Professor Pedagogos also noted that the Epworth's view was that Vanessa's death was primarily caused by her SGH and it was not possible to definitively identify whether the onset of her meningitis was prior to or following her delivery.
116. Following the RCA, Epworth and PIPER staff held a meeting to review Vanessa's case and identify any opportunities for improvement in the coordination of patient stabilisation and transport processes. This meeting identified an opportunity to improve the clinical handover approach between Epworth and PIPER with more explicit designation of responsibilities between these staff.
117. As a result, Epworth updated the 'Protocol for Emergency Transfer of a Neonate to an Intensive Care Unit with PIPER' to provide clearer designation of responsibilities. An escalation process was also added which requires the paediatrician, obstetrician, obstetric anaesthetist and On Call Executive to be contacted when a PIPER transfer is activated.
118. Epworth advised they were also considering implementing a maximum time threshold for patient transfers to occur. Under such a threshold, when a transfer has not been affected within two hours this would trigger a mandatory notification to the paediatrician and On Call Executive.
119. Epworth and PIPER have also collaborated on the development of a new form for completion when PIPER arrive on site. This form specifies the key roles and responsibilities that need to be allocated between PIPER and Epworth staff and requires that those roles be identified and documented in accordance with the above protocol.
120. A memorandum was also distributed to Maternity Services staff on 29 April 2017 to reinforce the roles and responsibilities of Epworth staff and paediatricians when PIPER is on site.
121. The Maternity Safety and Outcome Committee also discussed the importance of Epworth staff continuing to document care delivered to the patient in the Epworth medical record whilst the patient is still on site at Epworth, notwithstanding that clinical handover of responsibility has occurred with PIPER.

122. A number of incidental clinical improvements were also identified during the RCA, although they were unrelated to the outcome in Vanessa's case. These included improvements to the staffing allocation and skill mix in the delivery suite to ensure that graduate midwives are exposed to a more supportive environment until they develop more experience. Also, improved communication between the delivery suite and the SCN to ensure that the SCN is provided advance notice of new admissions, noting that the SCN were not notified of Ms Gu's emergency caesarean section and Vanessa's likely admission (although this did not compromise Vanessa's management on her arrival in the SCN).
123. The RCA also identified that the quality and completeness of documentation of maternal and neonatal observations and assessments in this case warranted improvement. A memorandum was sent to Epworth staff on 10 February 2017 directing that the exact time observations are taken must be documented on the CTG recording and an abdominal assessment is to be conducted on admission of the labouring mother in addition to subsequently undertaking vaginal examinations as warranted.
124. Associate Professor Pedagogos noted that PIPER documentation was not provided to the Epworth prior to Vanessa's departure from the hospital. As such, Vanessa's management by PIPER was not assessed during the Epworth's case review.

### **Independent Review by Dr Andrew McPhee**

#### *Initial review*

125. Epworth also engaged an independent expert, neonatologist Dr Andrew McPhee, to review Vanessa's case.
126. Dr McPhee stated that, in his opinion, the core pathology underlying Vanessa's death was a large SGH that was complicated by the development of DIC, which is a well-recognised feature of SGH. There had also been a significant episode of intrapartum fetal hypoxic-ischemic stress preceding the delivery, though this was minor in comparison to that attributable to the SGH. He stated there was scant evidence to support a contribution of early onset bacterial infection or meningitis, and that such a diagnosis was not needed to explain the events that transpired over the first 6 to 8 hours of life, which were adequately explained by the SGH. Dr McPhee stated that he was:

*Highly sceptical of a significant contribution of infection in this case and believe that a subgaleal haemorrhage per se, likely preceded by an episode of significant*

*intrapartum hypoxic-ischemia, adequately explains [Vanessa's] clinical course and sad demise.*

127. Dr McPhee considered that Dr Drew's initial actions following Vanessa's birth were appropriate and in accordance with peer professional practice. Although he noted that when volume loading with normal saline only had a small effect on improving her blood pressure, the persisting hypotension should have been managed with a dopamine infusion, prior to the PIPER team's arrival at 4.38am.
128. Dr McPhee commented that, as Dr Drew had considered the possibility of a SGH, it was 'surprising that he did not pursue and manage this diagnosis aggressively given the clinical picture of persisting hypotension and acidosis'. He noted that in these circumstances, blood loss due to an evolving SGH should have been a serious consideration and indicated urgent treatment. Dr McPhee commented that serial measurements of head circumference and monitoring of haemoglobin and acid-base levels were clearly indicated. Although acid base levels were closely monitored, haemoglobin was not. After a normal initial blood count was noted at one hour of life, the next level was not taken until five hours later.
129. Dr McPhee observed that it was unclear whether Dr Drew advised the PIPER team of the possibility of an SGH. He noted that the PIPER team appeared to spend the first few hours after their arrival focussing on intubating Vanessa and inserting an umbilical venous catheter, rather than treating the hypotension and acidosis with aggressive volume loading with blood products and medications for blood pressure support.
130. Dr McPhee commented that if a suspected SGH had been raised with PIPER, this should have prompted careful clinical review and aggressive support, rather than the procedures that they pursued. Additionally, given the recalcitrant hypotension and severe acidosis, such review may have prompted earlier attendance by a PIPER consultant. He suggested there was an 'inappropriate, and ultimately prolonged focus, on the pursuit of procedures rather than addressing [Vanessa's] poor clinical state, as a matter of urgency'.
131. The observations of Dr McPhee concerning Dr Drew's consideration of the possibility of an SGH are predicated on a reading of the note made by Dr Drew – '? Sepsis + sub galeal bleed'<sup>26</sup> – without the benefit of the further explanation of Dr Drew's reasoning as detailed at paragraph 43 above.

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<sup>26</sup> CB 384



132. Dr McPhee commented that 2 to 3 hours to intubate and insert an umbilical venous catheter appeared to be an inordinately long time in a baby with severe hypotension and acidosis, especially given it was likely that evidence of worsening hypotension and increasing pallor would have been evident during this time.
133. Dr McPhee stated that Dr Drew and the PIPER team did not appear to appreciate the gravity of the clinical situation. He recommended:
- a) That both Epworth and PIPER each develop care pathways for the diagnosis, monitoring and management of SGH.
  - b) That both Epworth and PIPER each develop care pathways for the early diagnosis and (aggressive) management of refractory shock (severe hypotension and acidosis unresponsive to volume loading).
  - c) If not already in place, that PIPER ensure detailed consultation between the retrieval team and PIPER base, following the initial assessment of the baby by the PIPER team. This would be particularly relevant if there were concerns regarding the experience of the retrieval medical officer and/or if the clinical status of the baby was worse than had been anticipated. Such a scenario may prompt consideration of additional on-site support for the team.
134. In response to these recommendations, Epworth developed the protocol, ‘Diagnosis and Management of Subgaleal Haemorrhage in at Risk Infants Protocol’, which incorporates the RANZCOG<sup>27</sup> statement on the prevention, detection and management of SGH in the newborn.
135. Epworth advised that Dr McPhee’s second recommendation was under consideration as they reviewed how their current responses could be enhanced. They indicated that the focus should be on early recognition of the clinical state and early referral to PIPER. In the setting of a neonatal patient at an Epworth hospital experiencing unresponsive refractory shock, emergency PIPER transport to a NICU should be arranged whilst concurrently continuing resuscitation efforts and ongoing communication with the PIPER team. They also reviewed their protocol ‘Resuscitation of the Neonate’ to incorporate the Australian Resuscitation Council’s Neonatal Resuscitation Guidelines.

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<sup>27</sup> The Royal Australian and New Zealand College of Obstetricians and Gynaecologists.

136. It is noted that, at the time of conducting this review, Dr McPhee did not have access to a copy of the PIPER medical notes or the details and timeline provided in Associate Professor Stewart's statement. As a result, Dr McPhee's report lacked vital details regarding Vanessa's management by PIPER.
137. Dr McPhee was subsequently provided with a copy of the statement made by Associate Professor Stewart and asked to provide an expert opinion to the court, updating his initial review in light of this information.

#### *Subsequent review*

138. In his subsequent report, dated 21 November 2018, Dr McPhee maintained his opinion that Vanessa's demise was 'the result of a combination of a large SGH (with complicating DIC) and intrapartum asphyxia' however he revised his view of the timing and progression of the SGH.
139. Dr McPhee noted that 'neonatal death from SGH can be prevented if appropriate attention is paid to identification of risk factors, early diagnosis, close observation and aggressive treatment'.
140. Dr McPhee also noted that the initial examination by PIPER identified two large haematomas on Vanessa's head, which were felt to reflect cephalhaematomas, and appeared to exclude a diagnosis of SGH at the time of this assessment. Dr McPhee stated that he had no reason to question this assessment but suggested that it was at variance with the autopsy report, which suggested only a single cephalhaematoma of moderate size.
141. Dr McPhee suggested that if there was no evidence of the SGH at the time of the initial assessment by PIPER, then 'logically the SGH happened at some time thereafter and ...the significant hypotension and acidosis since birth reflected intrapartum hypoxic-ischaemia (asphyxia) and ongoing myocardial dysfunction'. However, he also noted that given the incongruity of the description of the cephalhaematomas by PIPER and the description of the single cephalhaematoma at autopsy, he suspected that there was an 'evolving SGH present at the time of the initial assessment, though with this being perhaps only small-moderate at that time'.
142. Dr McPhee observed that whilst the sagittal suture being able to be palpated between the cephalhaematomas would be consistent with bilateral large cephalhaematomas, it did not necessarily exclude the co-existence of a small-moderate SGH. He suggested the presence of

a small-moderate SGH at this time would also be congruent with the subsequent poor response to the interventions initiated by the PIPER team, noting that the poor response likely reflected ‘ongoing blood loss and gradual progression of the SGH, with this likely escalating as DIC developed’.

143. Dr McPhee concluded that the medical assistance provided by the PIPER team was appropriate and of a good standard, although he was of the opinion that closer monitoring of blood pressure and the addition of dopamine should have been considered during the attempted insertion of the umbilical catheters, and certainly at 6.45am when persisting hypotension was documented. He also noted that careful review at this time would have raised concerns regarding an evolving SGH.
144. Dr McPhee observed that, although the most common scenario for an SGH did not apply, the history of a difficult extraction requiring multiple forceps attempts with the clinical presentation of severe acidosis and persistent hypotension three hours after delivery should have raised the possibility of a SGH. He reiterated that ‘a very high index of suspicion regarding SGH is important because early diagnosis and aggressive management are key to securing good outcomes’.
145. He stated that the management of the SGH once it was identified was appropriate, although significant injury was likely well established by this time, with a poor prognosis.
146. Dr McPhee considered that, had a provisional diagnosis of SGH been provided at the time the PIPER team were initially requested, a more aggressive approach perhaps involving the PIPER consultant directly, may have been pursued. He added that it was important his comments regarding the care by the PIPER team:

*...not be construed as direct criticism. An SGH is an uncommon and quite frightening complication, and I would strongly suspect that few registrars with even 6 months of NICU training... would have seen or been involved in the management of a significant SGH.*

147. In light of the updated information concerning the PIPER response, Dr McPhee was satisfied that there was a good level of consultation between the PIPER team and the PIPER consultant. As such, implementation of the third recommendation in his initial report was unnecessary.
148. Dr McPhee also noted that no umbilical cord gases were taken after delivery. Paired umbilical artery and vein gas samples provide confirmatory evidence of the duration of hypoxia, as cord

blood gas or lactate can suggest whether a baby has had an acute hypoxic event, over minutes, or a more prolonged event, over hours.

149. Accordingly, Dr McPhee provided an additional recommendation that:

*When babies are born in poor condition and require significant resuscitation, a cord blood gas (ideally arterial) should be drawn and analysed to determine the degree of recent hypoxic-ischaemic stress. If a cord specimen is not drawn, then a blood gas should be performed within the first hour. In my opinion this is common practice in many centres and serves to identify babies who may benefit from early volume and pressor support and from close observation, including serial clinical assessment and blood gas measurements to monitor progress.*

### **Expert Opinion of Associate Professor Christopher Wilkinson**

150. The court engaged an obstetrician, Associate Professor Christopher Wilkinson, to provide an expert opinion regarding the obstetric management of Ms Gu during the labour.

151. Associate Professor Wilkinson noted that Dr Kuswanto's initial management of the labour was appropriate, and that his prompt attendance upon Ms Gu at 8.00pm was an indication of appropriate conscientiousness and level of care.

152. However, he raised some concerns with Dr Kuswanto's decision to start syntocinon. Associate Professor Wilkinson noted that this decision appeared to have been made because Ms Gu's contractions had reduced from three contractions every 10 minutes to two contractions every 10 minutes. However, he noted that Ms Gu had made very rapid progress from being 1 to 2cm dilated at 6.50pm to 5cm dilated at 8.00pm and questioned 'the clinical necessity for syntocinon when such rapid progress had been recorded, particularly in what is usually considered the latent phase of labour'.

153. Associate Professor Wilkinson stated that a photocopy of the CTG provided with Ms Gu's medical records was virtually unreadable and as such it was difficult to ascertain the frequency of uterine contractions from these records. However, he noted they appeared to be 5 to 6 in 10 minutes without an adequate resting baseline. In combination with Ms Gu rapidly progressing

from 1cm dilated to fully dilated within six hours, this raised the question of whether Ms Gu had experienced uterine hyperstimulation as a result of the syntocinon infusion.

154. Associate Professor Wilkinson noted that the decision for caesarean section was appropriate and timely and that the matter would have been classified as a 'category 2' caesarean section for delivery within one hour. The delivery of Vanessa within one hour and three minutes was consistent with the recommended standards for a category two emergency caesarean section.
155. Associate Professor Wilkinson stated that the birth injuries described by Dr Parsons were consistent with misaligned application of Neville Barnes forceps blades and noted that although Dr Kuswanto stated that he did not apply traction, the bruising over Vanessa's head may suggest otherwise. In particular, he stated that the 'underlying haematomas would raise suspicion that firm application and/or traction had been applied on the forceps by Dr Kuswanto, as otherwise [Dr Parson's] findings of the distribution of the significant scalp bruising and the deeper layers of haematoma are inexplicable, from all of the other evidence accessible'.
156. Associate Professor Wilkinson referred to Dr Parson's finding that the skull fractures were likely to be secondary to significant swelling of the brain rather than as a complication of labour and noted that Dr Kuswanto's delivery of Vanessa within eight minutes of commencement of the caesarean section made it unlikely he was struggling for a prolonged time to deliver the fetal head with forceps.
157. Associate Professor Wilkinson also noted that there was no evidence that the dis-impaction of the fetal head from the maternal pelvis may have caused fetal trauma, and a manual rotation was unlikely to have caused the significant fetal head and scalp trauma described by Dr Parsons.
158. Associate Professor Wilkinson was unable to address some of the questions that were put to him, due to issues with respect to the readability of the CTG records provided to the court.

## **CORONERS PREVENTION UNIT REVIEW**

159. Given the concerns raised by Mr Li, and the issues identified in the various statements provided to the court, this case was also referred to the Coroners Prevention Unit (CPU)<sup>28</sup>

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<sup>28</sup> The Coroners Prevention Unit (CPU) was established in 2008 to strengthen the prevention role of the coroner. The unit assists the Coroner with research in matters related to public health and safety and in relation to the formulation of

Health and Medical Investigations Team. The CPU considered the medical records and statements provided to the court and reviewed the care provided to Ms Gu and Vanessa.

#### *Cause of death*

160. The CPU provided an opinion that the primary cause of death was SGH following birth trauma.

#### *Obstetric management*

161. The CPU disagreed with the findings of the Epworth case review that there were no contributing factors identified in the obstetric management of Ms Gu. They noted that, although the Epworth case review found that the labour management was appropriate, it also identified that the documentation of maternal and neonatal observations and assessments warranted improvement. In particular, exact time observations were not documented on the CTG.

162. Further, the CPU opined that there was evidence of an abnormal CTG from as early as 11.10pm, when there was fetal tachycardia and reduced baseline variability and, as such, it was considered that there was an under recognition of fetal distress and hypoxia. The CPU noted that normal baseline variability is the hallmark of adequate fetal oxygenation. The decision to proceed to caesarean section was made at 12.40am and Vanessa was delivered at 1.43am, two and a half hours later.

163. They further noted that an accurate interpretation of the CTG was not possible at 12.20am when Dr Kuswanto arrived at the Epworth, due to poor recording of maternal contractions.

164. The CPU reported that a proper examination of the obstetric management was unable to be completed due to clear and adequate CTG records being unavailable to the court. In particular, the record was unable to be read due to small resolution and no simultaneous recording of maternal heart rate. Further enquiries to obtain a clear copy of the CTG records revealed that the original CTG recording was not retained by Epworth.

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prevention recommendations. The CPU also reviews medical care and treatment in cases referred by the coroner. The CPU is comprised of health professionals with training in a range of areas including medicine, nursing, public health and mental health.

165. Dr Kuswanto disagreed that the CTG showed early evidence of fetal distress, explaining in his further statement:

*The intrapartum hypoxia was unexpected – particularly in the context of a normally grown fetus with normal reserve, who was at term. ... While the CTG did show a rising baseline, it was still within normal limits (that is, below 160bpm) at 11.10pm. Although there was reduced variability through some periods of time, there was normal variability up to 1.16am, just prior to the end of the continuous CTG, when the patient was transferred to the operating theatre for the caesarean section.*

*...Complicated variable decelerations started at 12.40am, and this was when the decision was made for delivery. ...Features of significant fetal compromise requiring immediate or urgent delivery, such as bradycardia, absent variability, sinusoidal patten, and late decelerations were not present in the CTG.*

#### *Management of the SGH*

166. The CPU noted that, at the time of Vanessa’s birth, paired umbilical cord blood gas or lactate analysis was not performed in accordance with the RANZCOG intrapartum fetal surveillance guideline, which states that paired umbilical blood cord gas or lactate analysis should be taken at delivery either routinely or when there is an APGAR score less than ‘4’ at 1 minute or less than ‘7’ at 5 minutes. Vanessa’s APGAR scores were ‘2’ at 1 minute and ‘6’ at 5 minutes.
167. The CPU opined that the initial management of Vanessa by the PIPER team was reasonable. Based on the handover by Dr Drew to the PIPER team, there were no clear risk factors for SGH. In addition, a thorough physical examination by the PIPER registrar at approximately 5.00am did not show evidence of an SGH. The treatment of hypotension and metabolic acidosis was reasonable, and fluid and inotropes were commenced immediately following the initial assessment.
168. They noted that the time taken for procedures was appropriate and expected given the patient’s clinical severity, which required multiple concurrent tasks to be undertaken, the setting in a non-NICU environment, and technical challenges with respect to inserting the umbilical arterial catheter. Once the diagnosis of SGH was made, appropriate treatment was initiated immediately.

169. The CPU also noted that there was regular PIPER consultant contact throughout Vanessa's care. The PIPER registrar contacted the consultant at 5.15am, 7.38am and 8.15am and additional assistance was provided by a PIPER consultant following Vanessa's cardiac arrest.
170. The CPU were otherwise in general agreeance with the clinical practice improvements and recommendations of the Epworth review and Dr McPhee's report.

### **SUBSEQUENT IMPROVEMENTS TO EPWORTH SYSTEMS AND PROCESSES**

171. In light of the concerns raised during this investigation, I requested a further statement from Epworth regarding their current practices with respect to CTG monitoring during labour, storage of CTG records, fetal blood sample collection and RANZCOG fetal surveillance education.
172. In response, Dr Vivek Nigam, Director of Medical Services at Epworth provided a statement to the court dated 15 September 2022.
173. Dr Nigam confirmed that currently all obstetricians are able to remotely access CTG monitoring of their patients both via computer and mobile phone. This capability commenced in 2018 and all obstetricians were signed up to this facility at the time of the last audit in February 2022.
174. Dr Nigam confirmed that all birth suite CTG monitoring systems are electronic with remote monitoring and direct upload to medical records. All electronic traces are uploaded to the records at the end of each tracing session. Paper tracings are also collected during admission in patient medical records and uploaded on discharge along with the patient's history.
175. Dr Nigam confirmed that cord blood for cord lactate levels are collected and tested on site for every delivery, every time, irrespective of APGAR scores. This capability and protocol was developed in July 2017 and has been Epworth's policy since that time. Other foetal blood samples are able to be collected on site in the birthing unit, and the SCN (which is adjacent to the birthing suite) has a point-of-care testing unit for blood gases that can provide an immediate result.
176. With respect to staff credentialling in the RANZCOG fetal surveillance education program, Dr Nigam confirmed that all birthing unit staff are required attend face to face education every second year with online education and testing on alternate years, with a standardised expectation of competency depending on level of experience that is recorded in policy.



177. In response to the draft findings, Epworth again detailed the developments described by Dr Nigam and provided further responses to specific concerns.<sup>29</sup> In respect of the observation that nursing staff remaining to assist the PIPER Team were struggling to provide the required assistance<sup>30</sup>, Epworth advised that it has put in place:

- (a) a unit specific orientation manual with detailed information about each clinical area;
- (b) a standard orientation process for new staff;
- (c) ‘Practical Obstetric Multi-Professional Training’ for all permanent staff in Obstetric emergencies, including neonatal resuscitation;
- (d) a requirement that all SCN staff are ‘NeoResus Advance’ trained;
- (e) development and training in non-invasive ventilation;
- (f) creation of a CPAP<sup>31</sup> protocol and learning package, together with a neonatal ‘Code Blue’ protocol; and
- (g) an upgrade of the SCN ventilator which now aligns with PIPER for ease of use.

178. In response to the concern that Dr Drew was not notified until 8.35am that Vanessa had not been transferred to the Mercy NCIU, it advised that it had developed an ‘Emergency Neonatal Transfer with PIPER’ protocol designed to make clear the roles and responsibilities of medical and nursing staff. In short, Epworth staff and the treating paediatrician are expected to assist the PIPER team with stabilisation prior to transfer. If applied to Vanessa’s treatment, this protocol would have presumably required much earlier notification of Dr Drew.

179. In response to the concern that detailed information regarding Vanessa’s birth was not handed over to the PIPER team by the referring team<sup>32</sup> it detailed some of the roles and responsibilities of medical and nursing staff in the ‘Emergency Neonatal Transfer with PIPER’ protocol, which is designed to reduce the risk that important information is missed in a handover to the PIPER team.

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<sup>29</sup> Letter from Epworth Freemasons dated 22 June 2023

<sup>30</sup> See paragraph 47

<sup>31</sup> Continuous Positive Airway Pressure

<sup>32</sup> See paragraph 109(d)

180. I note each of the developments described in the statement of Dr Nigam and the further response by Epworth, and I accept they are significant initiatives in response to the respective issues.

## **DRAFT RECOMMENDATION**

181. The draft findings included a recommendation as follows:

*That Epworth Health amend their policies and procedures to ensure that when babies are born in poor condition and require significant resuscitation, an umbilical cord blood gas (ideally arterial) should be drawn and analysed to determine the degree of hypoxic ischaemic stress. If an umbilical cord blood specimen for gas analysis is not drawn, then a blood gas should be performed within the first hour of life. (the ‘draft recommendation’)*<sup>33</sup>

182. In response to the draft findings Epworth advised that the standard of care for all births at Epworth now required routine cord blood lactates on all births in conformity with an associated protocol. Further, compliance with the protocol was subject to regular auditing.

183. Epworth provided its ‘Cord Lactate Sampling Protocol’<sup>34</sup> which forms part of its ‘Maternity Clinical Procedures Manual’. Under the heading, ‘Indications’, the protocol states:

*Paired cord blood lactates should be taken at delivery either routinely or where foetal compromise is suspected or expected. This includes but is not limited to:  
(RANZCOG)*

- *Instrumental Deliveries*
- *Emergency Caesarian Section*
- *Any baby needing active resuscitation*
- *Abnormal CTG during labour*
- *At request of the treating doctor*

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<sup>33</sup> See recommendation of Dr McPhee at paragraph 148

<sup>34</sup> Approved 2 September 2020

184. The Cord Lactate Sampling Protocol and the evidence of Dr Nigam<sup>35</sup> answers the concerns that underpinned the draft recommendation and renders it unnecessary. The implementation of the protocol is to be commended.

#### **OTHER RELEVANT CORONIAL FINDINGS**

185. I note that this court has considered issues regarding the treatment of SGH in infants in a number of cases and has made recommendations to ensure that information about assertive identification and treatment of SGH is conveyed to medical practitioners across Victoria.

186. Most recently, issues regarding the delayed identification of a SGH were considered by Deputy State Coroner Jacqui Hawkins in the coronial investigation into the death of Cai Wheeler-Tow,<sup>36</sup> who developed a SGH in the context<sup>36</sup> of a birth involving multiple failed forceps attempts.

187. In the findings into this matter, Deputy State Coroner Hawkins noted ‘the importance of understanding the risks associated with instrumental births and the potential for the development of subgaleal haemorrhages’ noting that the case ‘emphasised the significance of assessing and measuring the baby’s head circumference and conducting regular scalp observations to assist to identify the development of subgaleal haemorrhage after an instrument birth’.

188. Deputy State Coroner Hawkins identified that the RANZCOG guideline on *Prevention, detection and management of subgaleal haemorrhage in the newborn* applicable at the time did not refer to the ‘significance of assessing and measuring the baby’s head circumference and conducting regular scalp observations to assist to identify the development of a subgaleal haemorrhage after an instrumental birth’.

189. Deputy State Coroner Hawkins also ‘reiterated the importance of providing an accurate clinical picture when referring a case to PIPER’ and urged the RCH to consider using video conferencing methods to enable the PIPER team to visualise the condition of the baby to assist with their assessment and management plans.

190. Deputy State Coroner Hawkins made three recommendations as follows:

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<sup>35</sup> See paragraph 174

<sup>36</sup> COR 2017 5946.

### *Recommendation One*

*I recommend the Royal Australian and New Zealand College of Obstetricians and Gynaecologists amend the guideline: Prevention, detection, and management of subgaleal haemorrhage in the newborn, which is currently under review, to include a section on the importance of assessing head circumference and scalp observations to assist to identify the development of a subgaleal haemorrhage after an instrumental birth.*

### *Recommendation Two*

*I recommend the Royal Australasian College of Physicians incorporate the current state of knowledge obtained from paediatric clinical practice, peer review studies such as Colditz et al, any other relevant studies and coronial findings and develop a guideline to assist paediatricians with the identification, management and treatment of subgaleal haemorrhages in newborns.*

### *Recommendation Three*

*I recommend the Royal Children's Hospital PIPER service continue to develop and implement the ability to video conference with a referring hospital to facilitate visualisation of a baby's condition, and to assist with the assessment and management of a baby. Further, in the interim, I would urge the hospital to consider the use of the video capacity of clinician's mobile phones, laptops and/or ipads until other compatible information technology can be developed and implemented.*

191. In response to these recommendations RANZCOG amended their guideline on *Prevention, detection and management of subgaleal haemorrhage in the newborn* to include further information about the time of observations, other risk factors to be considered, and specific mention of scalp observations and head circumference as part of level two surveillance.
192. The Royal Australian College of Physicians noted they had considered Recommendation Two and determined that:

*the most robust way to raise the level of awareness across multiple disciplines including not only paediatrics but also general practice, midwifery and neonatal nursing, was to publish a peer-reviewed review article in the medical literature that would then be retrievable for all time. This article*

*specifically focuses on early diagnosis and aggressive management, both of which are necessary to prevent [deaths related to SGH].*

193. It also noted that clinical guidelines for management of SGH in the specific context of each hospital are maintained and updated as necessary.
194. The RCH confirmed that PIPER had expanded its use of teleconferencing to enhance patient care through use of personal devices and a range of tele-video conferencing projects which had been implemented.

## **FINDINGS AND CONCLUSION**

195. The standard of proof for coronial findings of fact is the civil standard of proof on the balance of probabilities, with the overlay of caution described in *Briginshaw v Briginshaw*.<sup>37</sup> Adverse findings or comments against individuals in their professional capacity, or against institutions, are not to be made with the benefit of hindsight but only on the basis of what was known or should reasonably have been known or done at the time, and only where the evidence supports a finding that they departed materially from the standards of their profession and, in so doing, caused or contributed to the death under investigation.
196. Pursuant to section 67(1) of the *Coroners Act 2008* I make the following findings:
- a) the identity of the deceased was Vanessa Li, born 2 January 2017;
  - b) the death occurred on 6 January 2017 at Mercy Hospital for Women, 163 Studley Road, Heidelberg, Victoria, 3084, from subgaleal haematoma complicating an obstructed labour; and
  - c) the death occurred in the circumstances described above.

### *Obstetric management*

197. I am satisfied that Vanessa experienced intrapartum asphyxia. I have considered the further statement of Dr Kuswanto and the submissions made on his behalf, and I accept that the state of the CTG record renders precise analysis difficult. I also note the observation that *ex post facto* analysis of the clinical care is vulnerable to hindsight bias. With these cautions in mind,

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<sup>37</sup> *Briginshaw v Briginshaw* (1938) 60 CLR 336 at 362-363: ‘The seriousness of an allegation made, the inherent unlikelihood of an occurrence of a given description, or the gravity of the consequences flowing from a particular finding, are considerations which must affect the answer to the question whether the issues had been proved to the reasonable satisfaction of the tribunal. In such matters ‘reasonable satisfaction’ should not be produced by inexact proofs, indefinite testimony, or indirect inferences...’.

I cannot conclude that fetal distress requiring immediate delivery was apparent from the CTG until 12.40am, at which time there was the onset of the ‘complicated variable decelerations’ identified by Dr Kuswanto.

198. Dr Kuswanto has stated (and reiterated in his further statement) that no traction was applied with the forceps and he did not make multiple attempts to use the forceps. His recollection is supported, albeit indirectly, by the evidence of Dr Drew in his further statement. His impression of the procedure was that it was ‘quick and without considerable difficulty’. I accept that both these recollections are likely accurate.
199. I am satisfied that the SGH most likely originated during delivery but the state of the evidence does not permit a finding as to the precise cause.
200. I note the opinion of Associate Professor Wilkinson that the clinical necessity for the administration of syntocinon to Ms Gu during labour was questionable, but I make no finding in this regard.
201. Due to the lack of a properly legible CTG record and the lack of umbilical cord blood gas readings, I am unable to conclude whether uterine hyperstimulation occurred. For the same reasons, it has not been possible to determine the cause and timing of the intrapartum asphyxia.
202. Whilst the lack of legible CTG records in this matter is of concern, I am satisfied that Epworth has subsequently put in place sufficient measures to ensure that CTG readings will be recorded appropriately in future.

#### *Neonatal care*

203. I am satisfied that Dr Drew made the note ‘? Sepsis + sub galeal bleed’ in order to return to the possibility of an SGH if Vanessa’s condition did not improve. Although Dr Drew did not consider that his thoughts concerning the possibility an SGH reached the level of a ‘suspicion’, it was nonetheless, subjectively, at a level high enough to warrant the note he made.
204. Dr Drew did not communicate his thinking concerning the possibility of an SGH to the PIPER team during the handover. However, his plan when making the note, was to check again for signs of an SGH if Vanessa’s condition did not improve. It follows therefore that Dr Drew’s own reasoning for making the note supports a conclusion that the subject should have been included in the handover.

205. I accept Dr McPhee's opinion that closer monitoring of blood pressure and the addition of dopamine should have been considered during the attempted insertion of the umbilical catheters or at 6.45am when persisting hypotension was documented, and this may have led to earlier detection of the SGH.
206. I also accept the opinion of Associate Professor Wilkinson that a small to moderate SGH may have been present at the time that the PIPER team initially assessed Vanessa, and that SGH was not necessarily excluded because the sagittal suture was able to be palpated between the two cephalohaematomas. However, in all the circumstances, including the clinical history that had been provided, the assessment of the PIPER team that these were likely cephalohaematomas was reasonable.
207. Symptomatic SGH is a serious medical emergency which carries a high risk of significant injury or death. As such, it requires a low threshold for suspicion and assertive identification and management.
208. Whilst there were potential opportunities for the SGH to have been detected earlier, I cannot conclude whether earlier detection was likely to have resulted in a different outcome, particularly given the range of co-morbidities present, as outlined in Dr Parsons' report.
209. I also note that since Vanessa's passing, the RANZCOG guideline 'Prevention, detection, and management of subgaleal haemorrhage in the newborn' has been updated to improve guidance regarding identification of the development of a SGH after an instrument assisted birth.

I convey my sincere condolences to Vanessa's family for their loss.

Pursuant to section 73(1B) of the Act, I order that this finding be published on the Coroners Court of Victoria website in accordance with the rules.

Pursuant to section 49(2) of the Act, I direct the Registrar of Births, Deaths and Marriages to amend the cause of death to the following '1(a) subgaleal haematoma complicating an obstructed labour'.

I direct that a copy of this finding be provided to the following:

Yi (Peter) Li, Senior Next of Kin

Dr Kent Kuswanto

Rebecca Kovaks, Avant

Laura Hardman and Samantha Downes, Lander and Rogers

Jamilla Simonsen, Epworth Freemason's Hospital

Associate Professor Michael Stewart and Annabelle Mann, Royal Children's Hospital

Dr Andrew McPhee, Department of Neonatal Medicine, Women's and Children's Hospital

Dr Christopher Wilkinson, Women's and Children's Hospital

Consultative Council on Obstetric and Paediatric Mortality and Morbidity (CCOPMM)

Safer Care Victoria, Department of Health

Professor Tim Draycott and Dr Katie Cornthwaite, the University of Bristol

Senior Constable Joseph McKeown, Coroner's Investigator

Signature:



Coroner Paul Lawrie

Date : 20 October 2023

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NOTE: Under section 83 of the *Coroners Act 2008* ('the Act'), a person with sufficient interest in an investigation may appeal to the Trial Division of the Supreme Court against the findings of a coroner in respect of a death after an investigation. An appeal must be made within 6 months after the day on which the determination is made, unless the Supreme Court grants leave to appeal out of time under section 86 of the Act.

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## Appendix A – List of Abbreviations

BPM	Beats per minute
CPAP	Continuous Positive Airway Pressure
CPR	Cardiopulmonary resuscitation
CPU	Coroners Prevention Unit
CTG	Cardiotocography
DIC	Disseminated intravascular coagulation
FHR	Fetal heart rate
HIE	Hypoxic-ischaemic encephalopathy
IPPV	Intermittent positive pressure ventilation
MRI	Magnetic resonance imaging
NICU	Neonatal Intensive Care Unit
PIPER	Paediatric Infant Perinatal Emergency Retrieval
RANZCOG	Royal Australian and New Zealand College of Obstetricians and Gynaecologists
RCA	Root Cause Analysis
RCH	Royal Children's Hospital
SCN	Special care nursery
SGH	Subgaleal haemorrhage
SOP	Standard operating procedure