



**CORONERS COURT
OF NEW SOUTH WALES**

Inquest:	Inquest into the death of Phillip IBRAHIM
Hearing dates:	7, 8, 9, 10 August 2018
Date of findings:	24 August 2018
Place of findings:	State Coroner's Court, Glebe
Findings of:	State Coroner Les Mabbutt
File number:	2014/321164
Catchwords	CORONIAL – Manner of death and Central Venous Access Devices
Representation:	<p>Ms M Gerace Counsel Assisting instructed by Mr S Hogan Crown Solicitor's Office</p> <p>Mr H Chiu instructed by B Madden of Carrol & O'Dea Solicitors for the family of Mr Phillip Ibrahim</p> <p>Ms P DYWER instructed by Mr Bridges-Webb of Curwood Lawyers Sydney Local Area Health District/Concord Hospital, Dr Jadav, Dr Kol, RN Puvanendiranathan, RN Chungath, RN Gilfillan, RN Cook;</p> <p>Mr Bowen instructed by Avant Law for Dr Oyman.</p>

Introduction

1. Mr Phillip Ibrahim died on the 30 October 2014 at Prince of Wales Hospital. Phillip was 39 years old. Phillip had been admitted to the Intensive Care Unit (ICU) at Concord Hospital on 17 October 2014 suffering from community acquired bronchopneumonia. Whilst receiving treatment in the ICU a Central Venous Access Device (CVAD) was inserted. On the morning of 28 October Phillip's condition had improved. A decision was made to remove the CVAD at midday.

2. Just after 6pm the CVAD was still in place. Phillip developed a cerebral air embolism that resulted in severe brain damage. Tragically as a consequence of that event despite transfer to the Prince of Wales Hospital for hyperbaric treatment Phillip died on 30 October 2014.

Why was an inquest held?

3. The role of the Coroner pursuant to s 81 of the *Coroners Act* 2009 is to make findings regarding:
The identity of the deceased
The date and place of that person's death
The cause and manner of that person's death
4. An inquest was conducted to determine the manner of Phillip's death including the circumstances surrounding the air embolism that occurred, medical treatment received at Concord Hospital and clinical use of the CVAD.
5. A Coroner may also make recommendations in accordance with s 82 of the Act concerning any public health or safety issues arising out of the death.

Background

6. Phillip was born at Penrith on 7 January 1975. His parents were Moshen and Samia Ibrahim. Phillip married Leanne Whichelo and was the father of two young children Soliman and Sahara at the time of his death. Phillip operated a catering business and supported his family. Phillip had a younger brother Peter. Prior to becoming ill Phillip exercised regularly, did not smoke or drink alcohol and was in good health.

Events leading up to Phillip's death

7. Phillip became ill around 7 October 2014 with flu like symptoms. On 13 and 14 October 2014 he attended Ryde Medical Centre consulted a doctor and was prescribed antibiotics. Phillip's condition did not improve. On 17 October Phillip's wife Leanne took him back to the doctor. Phillip was sent for a chest x-ray and was informed he had contracted pneumonia. Leanne drove him immediately to the emergency department at Concord Hospital. Phillip was admitted to the emergency department shortly after 4:20 PM on 17 October 2014.
8. Phillip respiratory condition was seriously compromised and he was admitted to the ICU later that evening. Given his severe respiratory condition he was sedated and

placed on a ventilator. To facilitate the administration of medication and monitoring of central venous pressure a CVAD was inserted into Phillip's right side internal jugular vein.

9. Phillip remained very ill and under treatment and sedation in the ICU unit for the over a week and a half. By 27 October Phillip's condition had improved and following a review by Dr Mark Kol the ICU Staff Specialist, Phillip was taken off the ventilator at 2.25pm.
10. About midday on 28 October another review by Dr Kol took place. Given Phillip's improvement overnight it was decided a plan would be put in place with the aim that Phillip would be discharged from the ICU to a ward at some point in the near future.
11. Dr Kol made the following medical notes:

"Deline

SOOB (sit out of bed)

Physio

Mobilise

IDC (indwelling catheter out)

Cease IVT (intravenous therapy)"

12. Prior to 1.30pm RN Puvanendirathan who was the morning shift RN and had been allocated to Phillip's bed on a one on one nurse/patient ratio, removed the indwelling catheter. Either prior to the review by Dr Kol or shortly afterwards Phillip had been moved out of bed into a reclining chair next to his bed. That was the first time in 11 days Phillip had been out of bed.
13. Despite RN Puvanendirathan having spent over two months in the ICU he was not accredited to remove the CVAD. It remained in place. At 1.30pm RN Chungath came on duty. RN Puvanendirathan advised him that the CVAD was ordered for removal. RN Chungath saw the words "deline" in the notes but had not seen that term before and considered he needed to confirm the order with the medical team before removing the CVAD. At the time Leanne and the children were visiting Phillip.

14. At 1.45pm RN Puvanendirathan went on a meal break. RN Chungath checked the CVAD and connectors. At this stage the brown lumen was connected to a transducer and the blue lumen to a Multi Flow Extension Set (MFES) with three connectors. The first connector had a proper cannula cap and was closed off. The second had the original cap and RN Chungath replaced that with a proper cannula cap. The third connector was attached to an IV fluid line. IV fluid was not running in accordance with Dr Kol's directions.
15. At 2.30pm RN Puvanendirathan returned from his break. RN Chungath then left and attended a staff meeting leaving Phillip in RN Puvanendirathan's care.
16. RN Chungath returned at 3.30pm and took over Phillip's care. RN Chungath did not remove the CVAD. He had not confirmed the order in the notes with Dr Oynan the ICU registrar, Phillip would have to be placed back in bed and Phillip had visitors.
17. At 5pm RN Chungath went on a break. During that time RN Cook, who had care of the patient in bed 8 took over Phillip's care, but remained with the bed 8 patient as that patient was intubated. He only observed Phillip's monitor and occasionally checked on Phillip by looking around the divider/privacy wall between the beds. Phillip's brother Peter and Peter's wife Melissa were with Phillip.
18. Dr Oyman was the junior medical registrar in the ICU ward on the afternoon shift 4-11pm. Dr Oyman has been assigned responsibility for Phillip. Dr Oyman conducted a medical review of Phillip at 5.38pm. She understood the "deline" order meant removal of the CVAD.
19. RN Chungath returned at 5.40pm. He went to speak to Dr Oynan who was called away to an emergency in another ward prior to RN Chungath being able to confirm the order in the notes. At 5.50pm RN Chungath checked Phillip's temperature and the CVAD noticing the attachments to the blue lumens were behind the chair out of the way.
20. At 17.50 RN Cook left for his meal break and RN Chungath took over care of both patients. RN Chungath remained in the bed 8 space but returned to check Phillip's blood pressure. At 6pm the respiratory registry reviewed Phillip and left.

21. About 6.10pm Phillip suffered an immediate catastrophic deterioration and collapsed. Melissa and Peter Ibrahim sought urgent assistance. Nursing staff and doctors attended and provided an immediate medical response. An emergency was called. Whilst doctors and nurses were attending Phillip and attempting to stabilise his sudden deterioration and establish the cause of his sudden collapse Clinical Nurse Specialist Michael Gilfillan the senior nurse in the ICU attempted to arrange the existing connections and lines on the CVAD to ensure they would not get caught when Phillip was being moved.
22. CNS Michael Gilfillan observed the IV line had become disconnected from the connection on the Multi Flow Extension leaving the connector open to air. CNS Gilfillan's recollection is that occurred approximately 5 to 15 minutes after Phillip had collapsed. CNS Michael Gilfillan immediately notified the senior ICU registrar that there was air in the line and the line remained open. Following further emergency treatment to stabilise Phillip the conducting of clinical tests to exclude other diagnosis, it was determined Phillip had suffered a serious cerebral air embolism due to the disconnection of the IV line to the MFES and entry of air into the CVAD.
23. Phillip was transferred to the Prince of Wales Hospital for hyperbaric oxygen therapy by helicopter later that evening. Hyperbaric treatment did not result in any improvement in Phillip's condition. Following an assessment by doctors of the degree of brain damage that had occurred to Phillip and in consultation with his family a decision was made to withdraw life-support. Phillip was declared deceased at 11.45pm on 30 October 2014.

Cause of death

24. A post mortem was conducted at the Department of Forensic Medicine Glebe by Dr Johann Duflou on 31 October 2014. The cause of death was determined as Hypoxic/Ischaemic Encephalopathy due to Cerebral Arterial Gas Embolism.
25. Dr Duflou also noted severe and advanced lung disease consistent with community acquired pneumonia.

How and in what manner did the cerebral air embolism occur?

26. Associate Professor Craig French the Director of Western Health Melbourne Victoria is an expert in specialist intensive care treatment. Associate Professor French gave evidence the volume and rate of air into the line required for such a serious event

may be variable, but only a short time frame is required for a serious air embolism to develop. Another variable involves differentials in pressure due to respiratory action of the patient. Air will generally enter the line and travel into the blood stream when a patient is breathing in. Upon the entry of air into the closed CVAD system and into an artery rapid clinical decline will occur in seconds or minutes. Associate Professor French's opinion is it is more likely that the IV fluid line became disconnected from the extension due to increased tension on the connection between the IV line and the multi-lumen extension.

27. The evidence received at inquest establishes there was an unintended disconnection of the IV line to the Multi Flow Extension Set at approximately 6.10pm. That occurred minutes after Phillip was reviewed sitting in his chair by the respiratory registrar. RN Chungath was with the patient in bed 8 when this occurred. Phillip was with his brother Peter and sister in law Melissa when he collapsed. Phillip was sitting up and the normal respiratory process led to entry of air into the line that travelled through the MFES and into the CVAD where it entered Phillip's right internal jugular vein. That resulted in the development of a cerebral air embolism causing Phillip's immediate collapse.

The CVAD

28. A CVAD is a catheter introduced via a large vein to facilitate the administration of fluids, medications and to provide an accurate measurement of central venous pressure. Throughout the course of the inquest a CVAD of the same specification was labelled and illustrated on a display board for reference. That exhibit was of substantial assistance. CVAD devices are widely used throughout the hospital system. In 2015 the New South Wales Clinical Excellence Commission published a Clinical Focus report on "*Central Venous Access Devices and Air Embolism.*"
29. That report identified approximately 15,000 CVADs are used every year in the NSW Health system.
30. The Report identified six factors that impact of the severity of outcomes to patient when an air embolism occurs, in summary:
 - The volume of air entry
 - Rate of air entry

- Patient position at the time of the incident
- Insertion site of the device
- Route by which the air enters, venous or arterial
- The location to where the embolism migrates

What caused the disconnection of the IV line to the MFES?

31. There were no witnesses to how the IV line became disconnected from the MFES allowing entry of air into the system. Air embolisms develop very rapidly with immediate onset of symptoms as occurred in Phillip's case. Some minutes after noticing the disconnected line CNS Gilfillan located the IV line caught in the armrest of the reclining chair where Phillip had been sitting. Given the immediacy of the need for treatment to Phillip, CNS Gilfillan was unable to determine an exact timeframe when he noticed the IV line on the chair.
32. In the days following Phillip's death, Dr Kol and others at the hospital examined a MFES where it was considered there may have been a distortion of the luer connector on the MFES due to possible overtightening. The connector was examined by Mr Lohrey the director of biomedical engineering at Concord Hospital. The results were inconclusive. The actual MFES on the device used for Phillip's treatment was never tested.
33. Given that evidence, the time of the air embolism developing and the locating of the IV line on the chair I am unable to make a positive finding as to the exact circumstances of the disconnection of the line. The evidence does allow for a finding that tension on the line must have occurred at some stage to break the connection. In what exact circumstances that tension occurred is not available on the evidence.

What contributing factors resulted in the air embolism occurring?

Delay in the removal of the CVAD

34. CNS Giffillan stated the clinical procedure to remove a CVAD takes approximately 20-25 minutes. The patient must be lying down in bed with their head lowered. The dressing on the insertion site must be removed and the site sterilised. The internal catheter is removed from the vein/artery and pressure placed on the insertion site for some time to ensure it has closed. Following that procedure, the patient must remain

lying down for a further period between 30 to 60 minutes to ensure the wound has healed and to reduce any risk.

35. The order to remove the CVAD was made at midday when Phillip was reviewed by Dr Kol. The medical notes do suggest Phillip may have already been mobilised out of bed. Dr Kol's order of SOOB (Sit out of bed) resulted in Phillip either remaining out of bed in the chair or he was allowed out of bed into the chair a short time after midday. The indwelling catheter was removed by RN Puvanendiranathan after the medical review. Phillip received a number of visitors over the following hours. Despite the order to "deline" the CVAD was still in place at 6:10 PM when the fatal air embolism occurred.
36. In 2014 there was no policy at Concord ICU stipulating a timeframe for the removal of a CVAD.
37. RN Puvanendiranathan gave evidence that he was not credentialed to undertake any actions on the CVAD. He had removed the arterial line and the catheter but stated he was unable to undertake any removal of the CVAD. That had to be done by a credentialed nurse. RN Puvanendiranathan was aware of the policy that CVAD removal had to take place with the patient in bed with the patient's head lowered.
38. The evidence is he spoke to the Clinical Nurse Educator in the ward RN Brannelly at some stage in his shift, obviously after midday. The exact time is unknown. In any event, the issue of obtaining assistance to remove the CVAD was not resolved by RN Puvanendiranathan during his shift. He was on duty at Phillip's bed until 1:30 pm. RN Puvanendiranathan again cared for Phillip between 2.30 and 3.30pm whilst RN Chugath who had relieved him at 1.30pm attended a staff meeting. No action was implemented during that entire period by either RN for the removal of the CVAD.
39. On starting his shift at 1.30pm RN Chungath stated he did not action the removal of the CVAD as he was unfamiliar with the term "deline". He agreed that RN Puvanendiranathan informed him the CVAD was to be removed in the handover. Despite that verbal handover he stated he required confirmation of an order to remove the CVAD prior to performing the task. The only line in place at the commencement of RN Chungath's shift was the CVAD.

40. Over the preceding four and half hours RN Chungath did not obtain confirmation of that order. He agreed that obtaining confirmation only required a short verbal confirmation from any one of the medical officers in the ICU. The close location of Phillip's bed proximate to the "flightdeck", the central desk in the ICU provides little understanding of why such a basic verbal confirmation did not occur. Clarification of the order could also have been obtained from the senior nurse in the ward CNS Gilfillan who had no doubt about what the term "deline" meant in the circumstances. All witnesses except RN Chungath understood the term "deline" in the medical notes to mean the removal of the CVAD(the only line in left in place).
41. RN Chungath indicated another impediment in removing the CVAD was Phillip in the chair out of bed and the need to return him to bed before removal of the device. He acknowledged he understood the risk involved in a CVAD remaining in place longer than necessary. However he stated he spoke to Phillip who was happy to stay in the chair and he still had not confirmed the order for removal. RN Chungath considered there was no urgency to stop Phillip from enjoying time with his family and he did not wish to interrupt that.
42. Consequently the effect of the decisions by both registered nurses was that the CVAD with the attached IV line remained in place. Whilst ever the IV line remained in place and Phillip was mobilised, the risk of an air embolism occurring due to an unintended disconnection was elevated. The risk in a mobilised patient with lines still attached was apparent to RN Chugath's as he saw the need to move the lines behind Phillip's recliner chair to avoid tension on the line.
43. RN Chungath is an experienced nurse well regarded by doctors and other staff at Concord. However his evidence of needing to confirm the "deline" order before actioning removal and his explanation that Phillip's family were somehow a preventative factor is of concern and I do not find him a credible witness in this regard. I find RN Chungath simply did not prioritise, for whatever reason, the removal of the MFES or the CVAD.
44. I find there was a lack of priority and clinical rigour by both RN Puvanendiranathan and RN Chungath in actioning the removal of the CVAD.

Medical review by Dr Oyman

45. Doctor Oyman had responsibility to ensure Dr Kol's plan for Phillip's treatment was implemented. The medical review took place at 5.38pm. Dr Oyman was aware from the handover and notes the CVAD was to be removed. Her understanding of the delay in removing the CVAD was that Phillip was out of bed with visitors and nursing staff just hadn't had the opportunity to get him back to bed. Dr Oyman understood the risks associated with CVAD use and removal when not required. She considered the removal of the CVAD was a responsibility of nursing staff.
46. Dr Oyman considered it was a reasonable decision at the time to allow Phillip to remain out of bed given the benefits of mobilisation and spending time with his family. Whilst acknowledging the pressures that operate on junior medical staff in busy ICU units and in 2014 there was no designated time frame for CVAD removal in the ICU, I find Dr Oyman had the opportunity to intervene and direct the removal of the CVAD as a priority. That did not happen.
47. The CVAD was still in place at 6.10pm with the IV line attached.

Low credentialing rates of staff in the ICU.

48. RN Puvanendiranathan's inability to action the removal of the CVAD was due to his lack of credentialing on that device. He was able to remove the arterial line, the indwelling catheter and change IV fluids. His evidence was that lack of a credentialing on the CVAD also included inability to even close a clamp on any of the lines. For him to obtain the assistance of a senior nurse simply to clamp the line would have required much less time and effort. It did not happen.
49. The procedure for credentialing of new staff to the ward involves the use of clinical nurse educators or senior nurses supervising and educating new staff in specific procedures. On day shifts in particular there are clinical nurse educators rostered for that specific purpose. The senior ward nurse also is available to assist in those functions.
50. Dr Kol stated in 2014 the credentialing rate of nurses on the ICU ward was between 60 and 70%. That resulted in certain functions unable to be performed by a number of staff that should normally occur. I find the low rate of credentialing of staff in the ICU in 2014 was a contributing factor.

Failure to disconnect and remove the IV Line

51. RN Puvanendiranathan's recollection in evidence was the IV line was being kept open with a low volume of saline solution known as TKVO (to keep veins open). That issue was not mentioned in his statement. RN Puvanendiranathan later indicated in evidence he may have been mistaken on this point.
52. RN Chugath was somewhat uncertain in his evidence on this point however paragraph 18 of his statement clearly states "*the third arm of the multi-flow extension set was connected to an IV fluid line although these fluids were not running -they had ceased.*"
53. There was no clinical record of a TKVO order in the medical notes and Dr Kol's evidence was IV therapy was ceased and there was no need for the line to be kept open as the CVAD was to be removed.
54. In those circumstances I find there was no planned use for the IV line or a need for it to remain in place.

Failure to clamp the line at the MFES and/or the line at the blue lumen.

55. The CVAD and the MFES provide two clamping points that facilitate the removal of lines/attachments no longer in use. This allows effective sealing of the system to prevent air entry.
 - A white clamp between the MFES and the blue lumen.
 - A blue clamp behind the blue lumen to prevent any air entering the system following disconnection. For further airtight security the blue lumen connection is a one way valve to prevent air from entering the system following disconnection.
56. Dr Kol stated that staff knew or should have known in 2014 that all unnecessary connections to a CVAD should be removed when no longer needed. That was consistent with NSW Health Policy Directive PD 2011/060 "*Central Venous Access Device Insertion and Post Insertion Care*" was issued on 22 September 2011. It was a mandatory policy.
57. 22.3.of the Policy on Care and administration of sets states:

58. *“22.3.1 Clamping unused CVAD lumens and multi flow adaptors to prevent air emboli and back flow of blood, protein or lipid solutions.”*
59. On the basis IV therapy was ceased at midday in tandem with an order to remove the CVAD the MFES with the IV line in its entirety should have been removed from the blue lumen. The action to close the white clamp on the MFES and the closure of the blue clamp on the blue lumen should have occurred.
60. This mandated procedure would have reduced the risk to Phillip whilst he was sitting out of bed awaiting the removal of the CVAD. There would have been no need to ensure lines and attachments had to be placed behind the chair to avoid the risk of an unintended disconnection as RN Chungath found necessary. Dr Kol’s evidence was the removal of the IV line, MFES and clamping of the line was a short procedure that did not involve the post procedure waiting period of full CVAD removal.
61. RN Puvanendiranathan’s evidence that he was not credentialed to undertake any tasks on the CVAD does not allow for the fact at handover at 1.30pm at the very least the MFES should have been removed with both nurses in attendance. Any ambiguity of the “deline” order by RN Chungath did not affect the policy of removal for line attachments not in use.
62. Failure to clamp the lines and remove the MFES increased the risk to Phillip who was mobilised out of bed, of an air embolism occurring.

Over tightening of the luer connectors and attachments.

63. The luer connector and the MFES on the actual CVAD used on Phillip was not examined. The inconclusive testing by the hospital of a similar set following Phillip’s death does not allow for a finding that over tightening of the connectors directly caused the air embolism.
64. The checking of connectors was an important component of management of CVADs and MFES with attachments. CNS Gilfillan gave evidence of the awareness that over tightening of the connections needed to be considered by staff.

The decision to leave Phillip in the recliner chair

65. The mobilisation of patients at an early opportunity is well recognised and accepted practice. Likewise the benefits of Phillip's family visiting him whilst he was sitting in a chair out of bed are of course acknowledged. Decisions made by nursing staff not to move Phillip back to bed, particularly from 1.30pm onwards when RN Chungath came on duty prevented the removal of the MFES with the IV line or the CVAD.
66. RN Chungath considered the benefits of Phillip spending time with his family was important. He cited this as a reason for delaying the removal of the CVAD.
67. Dr Kol and Associate Professor French both indicated clinical procedures or tests, medical reviews or other requirements regularly interrupt family visits to patients they are visiting in hospital. The decision to ask family or visitors to leave is a matter for medical or nursing staff to determine and action.
68. Whilst I accept it may be disappointing, annoying or frustrating to visitors or a patient, it is a frequent occurrence in hospitals. It was not the case Phillip had only spent a few minutes with his family. By 6pm he had spent many hours with his family in the chair. The removal of the CVAD or clamping the lines had to take priority.
69. RN Chungath's evidence demonstrated he was clearly aware of the increased risk of a mobilised patient with CVAD attachments. He placed the attached lines from the CVAD extension behind Phillip's chair before he left on his meal break to avoid the possibility of any tension on the lines. His recognition of the risk of an unintended disconnection in those circumstances is difficult to reconcile with his evidence of a lack of priority in removing the MFES or the CVAD.
70. RN Chungath throughout his shift failed to prioritise the removal of the MFES and/or the CVAD. His continued belief over many hours that the benefit of visits from family members and Phillip's mobilisation outweighed any need to get Phillip back to bed cannot be accepted. It demonstrated a clear lack of appreciation of the increased risk of an unintended disconnection and resultant air embolism involved in a mobilised patient sitting up. It was a lack of professional judgement regarding what was necessary and in the best interests of Phillip.
71. In Associate Professor Craig French's opinion:

- A suitable timeframe for the removal of a CVAD is between two to four hours. However a multitude of factors may result in that period being longer or shorter. A deterioration of the patient's condition or other clinical issues will affect this timeframe.
- Best practice requires the removal of all unnecessary lines and attachments irrespective of whether the CVAD is to be removed. The removal of the MFES is a relatively quick procedure.
- The removal of the IV line would have resulted in a reduction in the risk of a break in the system due to tension on the line. If the white clamp available on the multi-lumen connection was closed that would have prevented or substantially reduced air entering the system.
- Closing the blue clamp would have reduced or prevented the entry of air, in addition to the protection of the one way valve on the lumen.

Conclusion

72. For the reasons set out above I find that the following factors contributed to the development of the air embolism:

- Delay in actioning the removal of the CVAD
- The low accreditation rate of staff in the ICU
- Failure to disconnect and remove the IV Line, clamp the line and remove the MFES connection
- Failure to disconnect the line at the blue lumen and clamp the line
- The decision to leave Phillip in the chair sitting up beyond what was appropriate in balancing the risks of a disconnection and the time frames involved.

73. That an air embolism was a rare event and had not occurred at Concord Hospital prior to Phillip's death in 2014 in no way reduced the need for staff to properly recognise and act to mitigate the risk of such an event.

74. If action had been taken to undertake the basic and quick procedure of removing the MFES and clamping the line, I find Phillip would not have suffered the air embolism.

Whilst taking into account the demands of staff and the busy and stressful environment of an ICU ward there was sufficient opportunity to put Phillip back into bed and either remove the MFES or the CVAD over the 6 hours that elapsed. I find that Phillip's death was preventable.

Lessons learnt and action taken by Concord Hospital

75. It was accepted by Dr Kol the Director of Concord Hospital ICU in accordance with the Clinical Excellence Commission Report that air embolism is a preventable patient safety event.
76. Dr Kol gave evidence of the subsequent actions taken at Concord Hospital by himself and Dr Steevie Chan the previous Medical Administrator following Phillip's death:

Removal of the MFES device from use and notification

77. A decision was taken to promptly remove from clinical use all existing MFES within the hospital. They were replaced by upgraded equipment that contained a more secure locking mechanism to prevent accidental dislodgement.
78. A report was made to the Therapeutic Goods Administration on this issue.
79. A Safety Notice was issued on 13 May 2015 by NSW Health "*Risk of Air Embolus with Multi Lumen Access Devices*" This safety notice highlighting proper practice regarding connectors and that overtightening of connections may result in slipping and/or unplanned disconnections. This information was notified to staff.
80. In 2015 the New South Wales Clinical Excellence Commission published a Clinical Focus report on "*Central Venous Access Devices and Air Embolism.*"

A change in culture and practice by staff in the ICU regarding use of CVADs

81. There has been a renewed emphasis on the removal of CVADs in the ICU at an early opportunity once it has been identified they are no longer required for a patient.
82. There has been an increased focus by staff of the risks involved in the use and management of CVADs.
83. Education and notification to staff of the four hour benchmark period for removal of CVADs.

84. A 30 minute prohibition on transferring a patient to another ward after removal of a CVAD is in place to ensure compliance with the new policies.
85. Daily assessment of patients and ongoing evaluation of the need for insertion of CVADs, continued use and need for removal.
86. A commencement of shift checklist in the ICU to ensure staff are reminded of the need for removal of invasive lines as soon as possible.
87. Positive actions were taken to increase credentialing of staff within the Unit. It is now above 90% a marked increase to the ratio in 2014.
88. If a delay in removal is experienced due to lack of accredited staff, the ICU Clinical Nurse Educator or Clinical Nurse Consultant will assist to remove the device. A working group has been formed to ensure recommendations of CVAD management were implemented.

Introduction of specific labelled sticker for orders to remove a CVAD

89. To ensure clear documentation on a patient's medical record for CVAD removal, a specific labelled sticker was designed and implemented. This provides clear directions for removal and the four hour benchmark. Notation of the time of the order and the time of removal is required to facilitate auditing of CVAD removal timeframes.
90. Dr Kol has supervised auditing of time frames for removal of CVADs in the ICU. Dr Kol presented data to the inquest detailing median time removal and the percentage of CVADs that were removed within the 4 hour benchmark time set by the ICU.
91. In April 2015 the median time for removal of a CVAD was 300 minutes (5 Hours). In the period January to June 2018 the median time for removal had been reduced to 104 minutes.
92. In the period April to December 2015 75% of CVADs were removed within the 4 hours timeframe. In the period January to July 2018 compliance with the 4 hour benchmark increased to 91%. An ongoing audit will be conducted of those cases where removal was not undertaken within the four hour time frame to determine whether patient deterioration or other factors were involved.

Should any recommendations be made under s 82 of the Coroners Act 2009?

93. I find the extensive changes in practice, training and culture implemented in the ICU establishes appropriate and effective change has occurred to address the contributing factors that resulted in the air embolism occurring.
94. The publication subsequent to Phillip's death of the Clinical Excellence Report on CVAD use and air embolism and the NSW Health Safety alert has also resulted in better recognition of the risks of air embolism and notification of the need for proper and ongoing clinical risk assessment in CVAD use state wide. It is acknowledged that ICUs at various hospitals throughout the state operate under different demands and requirements and CVAD use is not restricted to ICU areas alone.
95. In those circumstances I do not consider the making of any recommendations is necessary or desirable.
96. However, the implementation of a four hour bench mark at Concord Hospital is an innovation that may be considered desirable or useful dependent on specific clinical circumstances. To ensure the lessons learn from this tragedy are not lost and appropriate agencies/professional organisations may properly consider the changes and procedures that have been implemented at Concord Hospital regarding CVAD use, I direct the Registrar forward a copy of these finding to:
- The NSW Clinical Excellence Commission
 - The NSW Ministry of Health
 - The College of Intensive Care Medicine of Australia and New Zealand
97. Dr Kol's evidence satisfies me the decision to set a time frame for removal of a CVAD in the ICU at Concord and ongoing auditing of that time frame will be disseminated and discussed with other ICU ward Directors. I encourage Dr Kol to publish that material as it develops.

Conclusion

98. Phillip had battled a severe episode of bronchopneumonia. His recovery no doubt assisted by his general good health. Phillip and his family were looking forward to his full recovery and planned discharge from hospital. Instead the family were

confronted with the harrowing experience of his sudden deterioration and death. Phillip's death has profoundly affected his family in the loss of a loved and respected son, brother, husband and father.

99. To Phillip's family who have attended each day of the inquest into his death I offer my sincere condolences.

100. I thank Counsel Assisting Ms Gerace and instructing solicitor Mr Hogan for their assistance.

Findings pursuant to s 81 of the *Coroners Act 2009*

Identity

The person who died was Phillip Ibrahim

Place of death

Princes of Wales Hospital Randwick

Date of death

30 October 2014

Cause of death

Hypoxic/Ischaemic Encephalopathy due to Cerebral Arterial Gas Embolism

Manner of Death

Unintended disconnection of an IV line from a Multi Flow Extension Set connected to a Central Venous Access Device due to delay by staff in removing the device and a failure to disconnect and/or clamp unused extension lines.

Les Mabbutt
State Coroner
24 August 2018