STATE CORONER'S COURT

OF NEW SOUTH WALES

Inquest:	Inquest into the death of Kelvin MOULDS
Hearing date:	30 March 2021
Date of findings:	16 April 2021
Place of findings:	NSW State Coroner's Court - Lidcombe
Findings of:	Magistrate Carmel Forbes, Deputy State Coroner
Catchwords:	CORONIAL LAW – cause and manner of death – care and treatment – removal of CVC – delirium-hospital system changes
File number:	2016/75759

Representation:	Mr S A Beckett, Counsel Assisting, instructed by Mr V Musico, Department of Communities and Justice. Mr B Bradley instructed by Ms H Allison, Crown Solicitor's Office, representing St Vincent's Hospital.
Findings:	Kelvin Moulds died of hypoxic encephalopathy on 9 March 2016 at St Vincent's Hospital, Sydney, New South Wales, in circumstances arising from a cardiac arrest following his self-removal of the central venous catheter five days before.
Non-publication order:	Pursuant to section 74(1)(b) of the *Coroners Act 2009* I order that any evidence tending to identify the street addresses, email addresses and phone numbers of members of the Moulds family not be published.

Introduction

1. Mr Kelvin Moulds was a 61-year-old man who died at St Vincent's Hospital, Sydney on 9 March 2016. His death occurred only weeks after he received a bilateral lung transplant at the hospital by one of Australia's leading lung transplant teams.

2. Mr Moulds died of hypoxic encephalopathy. The crucial event that led to his death was his own removal of a central venous catheter (CVC) from his right jugular vein in the early hours of 4 March 2016. He went into cardiac arrest. He did not regain consciousness and sadly passed away five days later.

3. A coroner's primary role is to investigate and make findings as to the identity of the deceased person, the date and place of the death, and the manner and cause of death. A further role for a coroner is to assess whether there has been an appropriate response to an unexpected death and whether more needs to be done to protect others from a similar death.

Facts

4. In July 2015 Mr Moulds was diagnosed with bilateral idiopathic pulmonary fibrosis by Dr Saurabh Gupta at the Nepean Lung and Sleep Centre. He had a 2.5-year history of productive cough, without haemoptysis,[1] and shortness of breath. Dr Gupta recorded that Mr Moulds had a history of reflux or asthma and stated he was an ex-smoker and denied any asbestos exposure.[2] He also suffered from glaucoma, type 2 diabetes mellitus, and mild obstructive sleep apnoea.[3]

5. Mr Moulds was referred to St Vincent's Hospital in September 2015 for lung transplant assessment[4] and was placed on the organ donation waiting list in November 2015.[5]

[1] Coughing up of blood.
[2] Letter of Dr Saurabh Gupta to Astley Medical Centre dictated 1 July 2015, Astley Medical Centre Clinical Notes - Coronial Brief Tab 42. All subsequent footnote references to tabs are references to Coronial Brief tabs.
[3] Letter of Dr Saurabh Gupta to Astley Medical Centre dictated 28 October 2015, Astley Medical Centre Clinical Notes - Tab 42
[4] Referral letter of Dr Saurabh Gupta to Professor Alan Glanville dictated 2 September 2015, Astley Medical Centre Clinical Notes - Tab 42
[5] St Vincent's Hospital, Medical Records, Progress Notes - Tab 31

The bilateral lung transplant

6. In the early hours on 19 February 2016 Mr Moulds was informed that lungs had become available to him for transplant and that he needed to attend St Vincent's Hospital.[6] Mr Moulds was admitted to St Vincent's Hospital at 0315 hours via the emergency department at St Vincent's Hospital.[7] On admission Mr Moulds was 97 kilograms and 177cm.

7. Mr Moulds was transferred to the surgical ward where he was prepared for surgery, which was subsequently performed by Dr Mark Connellan.[8] The surgery commenced at approximately 1200 hours and was completed at approximately 1900 hours.[9] The operation performed was a bilateral sequential single lung transplant (**BSSL**).

8. As part of the operative process, a 4-lumen[10] central venous catheter (**CVC**) was inserted into Mr Moulds' right internal jugular vein.[11]

9. Post-operatively, Mr Moulds was admitted to the intensive care unit at approximately 1930 hours on 19 February 2016 (**Day 0**), where he was sedated and intubated.[12] Mr Moulds was also on venous extracorporeal membrane oxygenation (**ECMO**).[13]

10. During Mr Moulds' ICU admission he had impaired lung compliance, lactic acidosis, intermittent elevated white cell count, pericarditis with ST elevation on leads 4, 5, 6 I & II, intermittent paroxysmal atrial fibrillation, thrombocytopenia, bi-basal collapse and copious secretions, sputum plugs in the right and left lower bronchus, reperfusion oedema in the mid and lower zones of both lungs, and moderate left lower lobe atelectasis.

[6] NSW Police Force, Report of Death to the Coroner completed 9 March 2016 - Tab 1
[7] St Vincent's Hospital, Medical Records, Anaesthetic and Recovery Record - Tab 29o
[8] St Vincent's Hospital, Medical Records, Operative Report - Tab 29q
[9] St Vincent's Hospital, Medical Records, ICU Flow Charts - Tab 37
[10] A lumen is a line which allows for the delivery of medication or fluid to a patient through the catheter.
[11] St Vincent's Hospital, Medical Records, Anaesthetic and Recovery Record - Tab 29o
[12] St Vincent's Hospital, Medical Records, ICU Flow Charts - Tab 37
[13] St Vincent's Hospital, Medical Records, ECMO Observation Charts & Progress Notes - Tab 33. ECMO is an extracorporeal technique of providing prolonged cardiac and respiratory support to persons whose heart and lungs are unable to provide an adequate amount of gas exchange or perfusion to sustain life.

11. On 20 February (**Day 1** post-operatively) it was discovered that the donor lungs had a klebsiella infection. Mr Moulds was prescribed antibiotics.

12. On 22 February (**Day 3**) the decision was made to cease ECMO and Mr Moulds was de-cannulated at approximately 1300 hours.[14] A cytomegalovirus (**CMV**)[15] was discovered and Mr Moulds was prescribed anti-viral agents.[16]

13. On 23 February (**Day 4**) Mr Moulds was extubated.[17] Post-extubation, Mr Moulds was placed on high-flow nasal prongs (**HFNP**) for the provision of oxygen and was noted to be hypoxic.[18] Mr Moulds was prescribed Oxycodone PRN,[19] Paracetamol, and OxyContin for pain that day.

14. On 26 February (**Day 7**) Mr Moulds was transferred to a High Dependency Ward.[20]

15. Between 26 February and 2 March (**Days 7 and 12**) Mr Moulds had persistent periods of shortness of breath, required supplemental oxygen and experienced difficulty sleeping and lying flat.[21] He had anxiety on 1 and 2 March (**Days 11 and 12**).

16. Mr Mould's treatment post-operative treatment was overseen by two experienced specialists in lung transplantation, Dr Mark Benzimra and Dr Monique Malouf, who alternated treatment depending on who was on duty.

17. When Dr Malouf saw Mr Moulds on 1 March 2016 (**Day 11**) she noted that there were a lot of secretions as a result of a bronchoscopy and that he was "spaced out" and was dysarthric and had slurred speech. She reduced his Targin as a result. She noted also that he had reduced breath sounds at the right base of his lungs and that diaphragm palsy should be considered.

18. She further noted that the diaphragmatic palsy which he was experiencing was likely to be because of damage to the phrenic nerve during the surgery. He was also placed on an anti-viral medication. She says in her statement that the diaphragmatic

[14] St Vincent's Hospital, Medical Records, ECMO Observation Charts & Progress Notes - Tab 33
[15] CMV is a common viral infection which can be latent and arise in the context of a suppressed immune system.
[16] Ganciclovir was the medication administered.
[17] That is, the tube was removed. St Vincent's Hospital, Medical Records, Progress Notes - Tab 29d
[18] That is, have low oxygen. St Vincent's Hospital, Medical Records, Progress Notes - Tab 29d
[19] As needed.
[20] St Vincent's Hospital, Medical Records, Progress Notes - Tab 29d
[21] Dr Benzimra had advised him to sleep upright for better lung function - Tab 11 at [39].

palsy was not likely to resolve in the short term but may eventually resolve with time. She said that Dr Benzimra had recorded that Mr Moulds was to be positioned at night 'not flat', which was appropriate for his condition.[22]

19. Dr Benzimra last saw Mr Moulds on 2 March 2016 (**Day 12**). He noted in particular that there was palsy in his lung and there was right hemidiaphragm paralysis; that he had not tolerated CPAP that night and was not sleeping through the night. He also said that there were reduced breath sounds at base, that Mr Moulds' observations were otherwise stable, he was afebrile and well on room air. The plan was to refer him to the sleep team perhaps for BIPAP, he was not to have sleeping tablets and "position at night. Not flat".

20. Dr Benzimra was of the view that by 2 March 2016 Mr Moulds seemed to have been improving, his observations were stable and he was well on room air. The decision to commence him on CPAP on 1 March 2016 by the sleep team was done in the context of his diaphragm not working properly and to assist him with breathing. Dr Benzimra wanted the sleep team to reassess him and see if they could adjust the pressure to make him more comfortable with CPAP. He was also keen to have input from psychology to assist with sleeping and tolerating ventilation efforts. In particular he also directed that Mr Moulds was to be positioned upright at night to assist with ventilation and to reduce the risk of aspiration. [23]

3 March 2016 (Day 13)

21. On Day 13 at 0700 hours RN Johnson recorded that Mr Moulds was alert and oriented but frustrated overnight due to lack of sleep. Temazepam used overnight was noted to have had no effect.[24]

22. Between 0700 and 0900 hours Mr Moulds was seen by the Lung Transplant Team led by Dr Malouf and including Dr Koliarne Tong.

[22] Statement of Dr Monique Malouf - Tab 12 at [18]-[24]
[23] Statement of Dr Mark Benzimra - Tab 11 at [38]-[40]
[24] Statement of RN Elham Asgary - Tab 23 at [4]

23. Dr Malouf observed that the bronchial wash revealed no bacterial growth and she said she was able to then change from intravenous to oral antibiotics. This is significant because the decision to move him from intravenous medication to oral medication meant that if other IV use had ceased, his CVC could then be removed.

24. The clinical note, under "Issues" and "Plan", recorded "CVC out" twice.

25. Dr Malouf also said that Mr Moulds was very anxious following the transplant and was a little bit delirious, which she said is not uncommon in transplant patients. She thought that delirium would also have had some effect on his decision making at the time. She thought this might in part be due to his poor sleep and also referred him to the sleep team so that he could be given CPAP. She also wanted the psychologists involved to assist Mr Moulds with his anxiety and sleeping.

26. Dr Malouf noted Mr Moulds had diaphragmatic palsy and spoke to him about the importance of sitting up at night because of the physiological benefits. Dr Malouf observed that Mr Moulds' bronchial wash contained no bacterial growth and changed his antibiotics from intravenous Cefotaxime to oral Augmentin Duo Forte. [25]

27. At 0900 hours respiratory and sleep physician Dr David Abelson reviewed Mr Moulds, who complained that his insomnia was due to pain and discomfort. His arterial blood gas (**ABG**) from the previous evening showed a mild respiratory alkalosis with pH 7.47 (normal 7.35-7.45), low arterial partial pressure of carbon dioxide (**$PaCO_2$**) of 32 mm of mercury (**mmHg**) and low, but adequate, arterial partial pressure of oxygen (PaO_2) at 64 mmHg. His morning ABG on 3 March 2016 was similar, pH 7.43, $PaCO_2$ 36, PaO_2 66, indicating no substantial change in gas exchange overnight. Mr Moulds continued to state he did not want to use CPAP or BiPAP.[26]

28. Dr Abelson looked at the oximetry trace from the previous night and found no clear evidence of significant sleep disorder.

[25] Statement of Dr Monique Malouf - Tab 12 at [28]-[30]
[26] Statement of Dr David Abelson - Tab 15

29. At 0930 hours RN Elham Asgary reviewed Mr Moulds and recorded he was breathless and unwell.[27]

30. At about 0945 hours physiotherapist Mr Darryl Beddoe attended and noted Mr Moulds was "drowsy/confused/cannot talk in full sentences", his blood pressure was 150/71 and oxygen saturation on room air was 92%. He assessed Mr Moulds as deteriorating and asked for a review by the lung transplant team.[28]

31. At the time of the review by the physiotherapist, the CVC was attached. RN Asgary resecured the CVC and changed the dressing on the line. RN Asgary was unaware of the order to remove the CVC.[29]

32. At some time after their morning round, Dr Tong informed Dr Malouf that Mr Moulds' CVC was still in situ. Dr Malouf confirmed her order that it be taken out and sent Dr Tong back to the ward.[30]

33. Shortly after 1000 hours Dr Tong attended on Mr Moulds and found him drowsy but easily woken and oriented to time and place. His physical observations were stable but Dr Tong suspected he was delirious.[31]

34. Dr Tong asked RN Asgary why the CVC was still in place. RN Asgary said that she did not wish to remove it at that stage because the patient was unwell and needed access.[32] RN Asgary was of the impression that "the registrar" had approved of that approach.

35. Dr Tong then spoke with Dr Malouf and decided to investigate for any contributing factors to his altered mental state. She ordered a non-contrast CT brain, chest x-ray, an ABG to measure carbon dioxide level, and added thyroid function tests to the day's blood tests.[33]

[27] Statement of RN Elham Asgary - Tab 23 at [9]
[28] St Vincent's Hospital records, Progress Notes - Tab 29d
[29] Statement of RN Elham Asgary - Tab 23 at [10]-[12]. No criticism is made of RN Asgary in this respect.
[30] Statement of Dr Monique Malouf - Tab 12 at [32]
[31] Statement of Dr Koliarne Tong - Tab 16 at [25]-[26]; St Vincent's Hospital records, Progress Notes - Tab 29d
[32] Statement of RN Elham Asgary - Tab 23 at [10]-[12].
[33] Statement of Dr Koliarne Tong - Tab 16 at [25]-[26]

36. The results were later reviewed by Dr Tong who observed there were no abnormalities or changes to account for the suspected delirium.[34]

37. At 1250 hours RN Asgary noted that the patient "is alert and oriented, sleeping mane [morning], clinical review, ABG [arterial blood gas], RA sat [saturations on room air] 92% increased respiratory rate to 28. Settle down [with] reassurance & making him calm." Mr Moulds' wife came and visited him.[35]

38. At about 1430 hours RN Shin Chung took over from RN Asgary and received an individual patient handover from her. RN Asgary advised that Mr Moulds had been moderately unwell during the morning shift and that his respiratory rate was high. RN Chung understood that the doctor had asked that the CVC be removed but, given his condition, RN Asgary was concerned it was "a bit risky".[36]

39. RN Chung understood that RN Asgary had obtained the approval of a member of the Lung Transplant Team to leave the CVC in place until the next day.[37]

40. At 1445 hours Mr Moulds was reviewed by Dr Tong and Dr Senthen Rajalingam from the Lung Transplant Team. Dr Tong reviewed the earlier entry by psychologist, Dr Martijn, and noted that delirium was suspected. Mr Moulds appeared alert and brighter. They reviewed and discussed the brain CT and chest x-ray. Dr Tong noted the CVC was still in place and requested it be removed by nursing staff that evening.[38] The clinical note reads:

> "Pt feeling ok, falling asleep during the day – BO, nil reflux. CT brain – nil acute pathology, prominent ventricles. CXR – nil significant change. O/E: HR – 70, BP – 120/70, Sp O_2 – 97% 2LNP. Alert, appeals well – A/E both bases. Plan: await further input from sleep team. CVC out."

41. At 1445 hours Mr Moulds' oxygen saturation was recorded by Lung Transplant team as 97% at 1445 with 2 litres of oxygen by NP up from 94% at 1400.

[34] Ibid. The CT report said "no detectable ischaemia".
[35] Statement of RN Elham Asgary -Tab 23 at [14]; St Vincent's Hospital records, Progress Notes - Tab 29d
[36] Statement of RN Shin Chung - Tab 21 at [7]
[37] Statement of RN Shin Chung - Tab 21 at [6]-[9]
[38] Statement of Dr Senthen Rajalingam - Tab 14 at [22]; statement of Dr Koliarne Tong - Tab 16 at [27]-[30]; and St Vincent's Hospital records, Progress Notes - Tab 29d

42. It is not clear whether a registrar had in fact consented to a delay in removal of the CVC. RN Asgary believed that was the case but the medical practitioners do not recall such consent being given and the clinical note at 1445 supports that interpretation. It is, however, not possible to determine whether this was as a result of a misunderstanding or poor communication about the removal of the CVC or whether there was a simple mistake by either medical or nursing staff.

43. Towards the end of the workday, Mr Moulds was seen by Psychiatrist, Professor Kay Wilhelm, from the Consultant Liaison Psychiatry Service. Professor Wilhelm attended and found Mr Moulds distressed, delirious, and breathless. His Montreal Cognitive Assessment (**MoCA**) score had declined to 20/30, a significant decrease on his pre-transplant score and in this context was considered a further indicator of delirium. Prof Wilhelm recommended 5mg of Haloperidol (an anti-psychotic) be given that evening. Prof Wilhelm asked CNC Cooper to review the following morning.[39]

44. As Prof Wilhelm was not part of the treating team, the Haloperidol was only recommended for consideration by that team.[40]

45. Dr Rajalingam raised Professor Wilhelm's recommendation for Haloperidol with Dr Tong while they were completing the evening ward round. Dr Rajalingam said that Dr Tong wanted to speak with a consultant about the recommendation before charting.[41]

46. It is not known whether Dr Tong did speak with the consultant that evening and if she did, the nature of the consultant's response. In any event, the Haloperidol was not charted and was not administered to Mr Moulds.

47. At 2130 hours RN Raven took over the nursing management of Mr Moulds. At handover, she was advised that Mr Moulds was two weeks post-transplant, had experienced anxiety and delirium, and had been transferred to bed 13 in the Sleep Studies Unit to undergo investigations.[42]

[39] Statement of Professor Kay Wilhelm - Tab 9 at [12]-[17]; St Vincent's Hospital records, Progress Notes – Tab 29d
[40] Ibid. at [17]
[41] Statement of Dr Senthen Rajalingam - Tab 15 at p.5(2)(a)
[42] Statement of RN Sharyn Raven - Tab 25 at [4]-[6]

48. At 2200 hours Dr Richard Hanlon commenced his shift. The usual practice was for a handover to be conducted between the day rapid response team, including the medical registrar. Dr Hanlon was not advised of any jobs relating to Mr Moulds and was not asked to review him.[43]

49. That evening Mr Moulds was transferred to the Sleep Studies Unit but was noted to have "appeared anxious" and refused the sleep study. He was transferred back to the ward.[44]

4 March 2016 (Day 14)

50. At 0200 hours on 4 March 2016 Mr Moulds became anxious. RN Raven reassured him and records the following observations:

> "Blood pressure 130/81, Heart rate 89 bpm and regular, Respirations 20 bpm, Oxygen saturations 91% on room air."

51. RN Raven applied oxygen 2L via nasal prongs and his oxygen saturations increased to 97%. With further reassurance, Mr Moulds settled. He was alert and oriented to time and place and moving from his bed to the chair without assistance.[45]

52. At about 0330 hours RN Raven was attending to other patients near Mr Moulds' bed when she heard a noise. A nearby patient was found on the floor near the bathroom having fallen over. The patient was escorted back to bed and the night RMO was notified. All patients nearby, including Mr Moulds, were woken by the noise and the lights. They were checked and reassured by nursing staff.[46]

53. At about 0400 hours Mr Moulds removed the CVC from his right internal jugular vein for reasons which are unknown.[47]

[43] Statement of Dr Richard Hanlon -Tab 17 at [6]-[7]
[44] St Vincent's Hospital, Medical Records, Progress Notes - Tab 29d
[45] Statement of RN Sharyn Raven - Tab 25 at [9]-[10]
[46] Ibid. at [11]-[12]
[47] Ibid. at [13] and statement of RN Fiona Cattell - Tab 28 at [6]-[10]

54. The removal of a CVC is a procedure only undertaken in NSW hospitals by qualified medical or nursing staff because of the danger of creating an air embolism, which may in turn lead to a cardiac arrest.

55. RN Sharyn Raven and RN Fiona Cattell were nearby at the time.

56. Mr Moulds sat upright while holding out the CVC in the direction of the nurses and said, "What do I do with this?" or "What's this?".

57. RN Cattell noted that the CVC was still attached to his neck by the anchoring sutures but there was no bleeding.[48] She went to the treatment room to obtain a stitch cutter and dressing. Together with RN Raven, she removed the suture to seal the wound before applying the dressing. An occlusive dressing was placed on the CVC site on Mr Moulds' neck. No bleeding was noted. Mr Moulds was alert at this time.[49]

58. Mr Moulds was asked to lie flat on his back and placed on bed rest. Observations were recorded as follows:

> "Blood pressure 134/84. Heart rate 100 bpm and regular. Respirations 20 bpm. Oxygen saturations 100% on oxygen 2L via nasal prongs"

59. RN Raven noted later that Mr Moulds at this point was "Patient on bed, Tilted", which she clarified as lying partially on his left side.[50]

60. RN Raven remained in the room. She saw Mr Moulds looking in her direction and he asked her when he could get up and move around.

61. While RN Raven was attending to another patient, she noticed Mr Moulds had gone quiet. She turned to check he was not trying to get up and saw that he appeared to be looking at her, but was still. She went to Mr Mould's bedside and spoke to him but he did not respond. She called out to Dr Hanlon, who was still attending to the patient who had fallen.[51]

[48] Statement of RN Fiona Cattell - Tab 28 at [8]
[49] Statement of RN Fiona Cattell - Tab 28 at [6]-[10]
[50] Supplementary statement of RN Sharyn Raven - Tab 25 at [7]-[8] and St Vincent's Hospital, Medical Records, Progress Notes - Tab 29d
[51] Statement of RN Sharyn Raven - Tab 25 at [12]-[23]

62. CPR was commenced as it was apparent Mr Moulds' heart had stopped.

63. Dr Hanlon said he was reviewing a patient on the bed adjacent to Mr Moulds. He finished a conversation with the patient when he heard words to the effect of "Can I get some help over here?". When he turned around, he saw a female nurse commencing chest compressions on Mr Moulds. He went straight to Mr Moulds and began assisting the nurse. The Code Blue button was pressed. Within a few short moments of his arrival other nurses arrived. [52]

64. RN Raven later noted:

> "Patient on bed tilted – noted to become unresponsive - Dr in room started CPR and called CODE BLUE."[53]

65. At 0425 hours the ICU Code Blue team arrived at Mr Moulds' bed. They took over CPR from Dr Hanlon and the nurses present. Spontaneous circulation returned after approximately 15 minutes, six rounds of CPR and 800mcg of adrenaline.[54] In a clinical note written later that morning, the ICU Fellow noted "Imp[ression]: air embolism".

66. Mr Moulds was readmitted to the ICU at 0449 hours and was sedated and intubated.[55] A new right internal jugular CVC was inserted.[56]

67. At 0705 hours Dr Stephen Morgan reviewed Mr Moulds. He noted a "presumptive diagnosis of air embolism post-impromptu CVC removal on ward, Arrest as documented". Amongst other things he noted a Glasgow Coma Score of only 4. His impression was "Post-asystolic arrest with best neurological response of non-specific movements of all limbs. Pupils non-responsive. Cardiorespiratory support requirements not significant nor deteriorating." He also remarked that "Needs TOE [transoesophageal echocardiogram] to assess for any residual gas in chambers, to exclude PFO [patent foramen ovale or a 'hole in the heart'].[57]

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[52] Statement of Dr Richard Hanlon -Tab 17 at [8]-[10]

[53] Supplementary statement of RN Sharyn Raven - Tab 25 at [4] and St Vincent's Hospital, Medical Records, Progress Notes - Tab 29d

[54] St Vincent's Hospital, Medical Records, Progress Notes - Tab 29d

[55] Ibid.

[56] Ibid.

[57] Statement of Dr Stephen Morgan - Tab 13 at [10] and St Vincent's Hospital Medical Records, Progress Notes - Tab 29d

68. At 0730 hours Dr Tong attended the hospital early to review Mr Moulds in the ICU. She changed his oral transplant medications across to intravenous forms. She noted low urine output suggesting he needed more IV fluids. She changed his antibiotics and commenced Ganciclovir as he was a CMV positive patient. She noted he needed a **TOE** [Trans Oesophageal Echocardiogram] to look for an air embolism.[58]

69. At 1725 hours that day Dr Malouf noted the question as to whether there had been an air embolism. She noted that "RV [right ventricle] dilation [left ventricle] no air, no PFO".[59]

70. The results from the TOE did not reveal that Mr Moulds had suffered from an air embolism.

71. A later review of the TOE taken at the time by an expert radiologist also did not reveal that Mr Moulds had suffered from an air embolism.

Subsequent events

72. Mr Moulds' neurological condition did not improve over the subsequent days.

73. By the morning of 8 March 2016 (**Day 18**) Mr Moulds had shown no improvement in his neurological status with a Glasgow Coma Score persistently of 3. An MRI of his brain revealed that he had suffered severe hypoxic brain injury. Mr Moulds' family decided to transition Mr Moulds to palliative care and he was extubated that evening.[60]

74. Mr Moulds sadly passed away at 1415 hours on 9 March 2016.

Cause of death

[58] Statement of Dr Koliarne Tong - Tab 16 at [32] and St Vincent's Hospital Medical Records, Progress Notes - Tab 29d
[59] St Vincent's Hospital, Medical Records, Progress Notes - Tab 29d
[60] Ibid.

75. A limited autopsy was performed on 15 March 2016.[61] The forensic pathologist determined the cause of Mr Moulds' death as hypoxic encephalopathy; however, the pathologist was unable to determine the underlying event which caused Mr Moulds' death.

76. Statements were taken from nine of the treating medical practitioners at St Vincent's Hospital, including the specialists on the lung transplant team who were directly involved with Mr Moulds care, and 11 registered nurses responsible for his care.[62]

77. In addition, independent expert evidence was obtained from consultant anaesthetist and intensivist, Dr William O'Regan,[63] and consultant radiologist, Dr James Christie[64].

78. Dr O'Regan stated, and his opinion on this point is not in dispute, that Mr Moulds' cardiac arrest on 4 March 2016 led him to developing hypoxic encephalopathy.

79. Both experts looked to see if there was any evidence of an air embolism that may have caused the cardiac arrest. Both experts actively considered this possibility because of the well-known association between the poor removal of a CVC and the danger of developing an air embolism.

80. Dr O'Regan considered the detailed clinical notes and comprehensive medical records provided with respect to Mr Moulds, and could not detect any positive evidence of an air embolism. Dr Christie closely examined all of the x-rays, CT scans and MRIs that were taken on or about the time of Mr Moulds cardiac arrest on 4 March 2016. He could not see any evidence of an air embolism.

81. Dr O'Regan said, ultimately, he could not exclude that an air embolism had occurred and that it was not unreasonable to assume that that was the likely cause of the cardiac arrest. However, he could not be conclusive in this regard and posited that the cardiac arrest may have also been caused by an anterior event, being respiratory arrest caused by his poor respiratory condition. This condition was due, of course, to the fact that he had undergone a bilateral lung transplant just two weeks prior.

[61] Tab 4
[62] Tabs 9-28
[63] Tab 7
[64] Tab 8

82. Dr Christie concluded that although it was presumed, based on clinical course, that Mr Moulds had an air embolus, there were no positive findings in the imaging to confirm that this had occurred.

83. In all of the circumstances, I accept the expert opinion that a conclusive determination cannot be made as to what caused Mr Mould's cardiac arrest.

84. In those circumstances, the cause of death is best described as hypoxic encephalopathy arising from a cardiac arrest following self-removal of a CVC.

Manner of Death

85. The CVC that was inserted at the time of the lung transplant operation was still in situ some 14 days after. This was despite two instructions from the lung transplant consultant at St Vincent's Hospital to remove it. Dr Malouf clearly recorded in her notes on 3 March 2016 that the CVC was to be removed, and when later that day she found out from Dr Tong that the CVC was still in situ, she asked for Dr Tong to return to ensure that the CVC was removed. Dr Tong later confirmed in a clinical note that the CVC was to be removed. However, it had not been removed by 4 March 2016.

86. According to RN Asgary, she sought approval to leave the CVC in situ on the morning of 3 March 2016 because she was worried about Mr Moulds deteriorating and could foresee the need to use a CVC.

87. It is not possible for this Court, given the passage of time and the absence of any other clinical notes by either a nurse or medical practitioner, to ascertain at this time whether RN Asgary was able to obtain approval for this course of conduct. Dr Malouf states that it is unlikely that she would have permitted the retention of the CVC in situ.

88. What can be concluded is that there was a breakdown in communication on this important issue between the medical practitioners and the nurses on duty.

89. Mr Moulds woke up at about 0330 hours on 4 March 2016 when a neighbouring patient fell and was attended to by nurses. At about 0400 hours Mr Moulds removed

the CVC from his right jugular vein himself. The removal was not seen and the circumstances immediately prior to removal were not known.

90. Delirium had been specifically noted by a number of practitioners during 3 March 2016 and those responsible for Mr Moulds' care had noted that he was delirious and that it was likely to have been caused by a lack of oxygen. In particular, his saturation levels were low when he was on room air.

91. It is possible that Mr Moulds was in a state of delirium when he removed his CVC.

92. However, shortly before his neighbouring patient fell, Mr Moulds had been given oxygen and he was noted as being settled. It may have been that the sudden noise of the patient falling startled him, and this resulted in him being confused and pulling his CVC line. It is not possible to make a conclusive finding as to why he removed his CVC line.

93. St Vincent's Hospital has provided evidence of the changes that have been put in place to address the possibility that Mr Moulds was suffering from delirium and that this had not been adequately treated. (See paragraphs 97 and following.)

94. When Mr Moulds removed his CVC line, there were two nurses on duty nearby who were able to attend to him promptly. According to Dr O'Regan, they took appropriate action by dressing the wound that was caused as a result of the removal of the CVC and placing Mr Moulds in a supine position on his left-hand side. This accords with the New South Wales Health Policy of 2011 for the removal of CVC, which requires patients to be in the supine position when a CVC is being removed, and for a period of 30 to 60 minutes after the removal.

95. Dr O'Regan was not critical of the nurses taking this approach or for the treatment they adopted following the removal of the CVC. Dr O'Regan did say that while placing Mr Moulds, whose respiratory capacity was compromised by the lung transplant, in the supine position was unavoidable; such a position was dangerous because of further compromise to his ability to breathe.

96. Dr O'Regan concluded that the nurses concerned took the appropriate step of tilting Mr Moulds following the removal of the CVC and the dressing of the wound. Dr O'Regan made no adverse comments of the nurses in this regard and no criticism can be made of the care and treatment of Mr Moulds once he removed the CVC.

St Vincent's Hospital Systems Changes

97. St Vincent's Hospital took Mr Moulds' death very seriously and have provided statements setting out the significant changes that have taken place since 4 March 2016.

98. RN Mark Young, clinical nurse coordinator, summarised the main changes in CVC use during the period from 2016 to 2019 as follows:[65]

a) There has been an active effort to minimise the use of CVCs in favour of Peripherally Inserted Central Catheter (PICC) lines within St Vincent's Hospital. This is because PICC lines have fewer and smaller diameter lumens and are associated with lower air embolism risk.

b) There is an active focus on the early removal of CVCs, especially in patients with delirium. RN Young says there is an increased awareness that delirium is an indicator for early removal of CVCs. Those operating under the policy are directed to the following warning:

> *"consideration should be given to the presence of a femoral or internal jugular CVC and air embolism risk, particularly in the delirious patient in the ward setting. If delirium is suspected senior medical review should occur with respect to removal of CVC and replacement of lower risk device such as a PICC or peripheral cannula."* [66]

[65] Tab 64
[66] St Vincent's Hospital Vascular Access CVAD Removal (Non-Tunnelled) Protocol 2019 - Tab 64, Attachment MY-12, Section 4 *Process*

c) RN Young says that as a general rule, the use of CVCs are now discouraged in the ward setting unless clinically demanded. ICU medical officers are asked to consider switching CVCs to a peripheral cannula or a PICC where possible before transfer to a ward setting. One of the advantages of managing a CVC in ICU, as opposed to a ward setting, is the improved nurse to patient ratios. While ICU can provide 1:1 nursing, the ratios increase on the ward to 1:4-6 patients. Delirium has now been identified, according to RN Young, as an indicator for removal of CVC and is treated as a red flag for removal.

d) There have been increased educational opportunities provided through in-service papers to nursing graduates. Training and accreditation have improved through the requirement to complete the MyHealth learning program run by the Health Education and Training Institute. Any current nursing staff who have had a pause or gap in clinical practice are required to repeat their clinical competency.

99. In 2020 further changes were made including the introduction of an updated CVAD removal policy procedure, which includes an update Central Venous Access Device (CVAD) Care Management Plan. The new protocol specifies that all CVADs must be removed safely and without delay, noting specifically that delay in removal may increase the risk of CVAD related morbidity and mortality, and if there is not an accredited staff member to remove the CVAD, there is now an escalation chain that must be followed.

100. RN Young also pointed to a number of audits that have been conducted since 2016 into post-insertion care of CVADs. He noted that in November 2017, there was an improved 96% compliance across St Vincent's Hospital with insertion and post-insertion care. That compliance was about the same level in May 2018 where compliance was noted to be 95%. In November 2018, compliance was at 98% but in April 2019, results fell slightly to 93%. RN Young then went on to say that he noted some deficiencies in documentation at that stage and steps were taken to address and improve this.

101. On 16 August 2019 New South Wales Health issued a new policy directive titled Intravascular Access Devices Infection Prevention and Control. It was acknowledged in that document that CVADs pose a risk of air embolism in patients during insertion and removal and that public hospitals must have a process for the appropriate use and management of invasive medical devices to minimise the risk of device related infection to patients. Shortly after the release of this new policy, St Vincent's Hospital convened an air embolism/CVAD care meeting coordinated by RN Young and including a number of cardiothoracic surgeons, including thoracic physician, Dr Malouf, who was involved in Mr Mould's treatment.

102. At the meeting some of the issues discussed were: the preferred site for CVC insertion to reduce the risk of air embolism, a preference for early removal of CVCs in the intensive care unit (ICU) and before discharge to the ward, discussion as to the absence of PICC removal related area embolism in literature to date, and the use of the Delirium Risk Assessment Tool to monitor delirium in ward patients and agreement that delirium was an adequate reason for removal of CVCs.

103. As part of the review, RN Young referred to six patients who between 2014 and 2019 experienced adverse CVAD events creating an air embolism, with three of those patients subsequently passing away. RN Young noted that five of the events involved lung transplant patients, five of the events occurred on the ward as opposed to ICU, and three of the events involved delirium or behavioural issues. Mr Moulds' case was one of the events that was considered.

104. RN Young noted that substantial changes had happened as a result of this particular review, including consideration given to removing CVCs before discharge from the ICU to award setting, reduction in the use of CVCs in preference to PICCs, and delirium being now considered a red flag for removal of the CVC.

105. St Vincent's Hospital is accredited by the Australian Commission on Safety and Quality in Health Care and, as part of that accreditation, must meet two national safety and quality health service standards which relate to delirium.

106. RN Joanne Taylor provided a statement[67] setting out the changes to the monitoring of delirium in patients at St Vincent's Hospital. In particular, she referred to a new plan known as the SVHN – Delirium Screening, Assessment, Prevention and Management Plan of 9 September 2019.

107. In 2017 it was identified that St Vincent's Hospital had rates of delirium which were higher than other Peer A1 hospitals. This led to substantial work being undertaken to address this issue and to implement the above-mentioned 2019 plan. This included the formation of the Delirium and Cognitive Impairment Community of Practice to ensure a multidisciplinary approach to delirium screening assessment and prevention.

108. Following implementation of the new policy, the gap in the rate of hospital-acquired delirium at St Vincent's Hospital significantly narrowed and clinical care improved. As a result of audits completed, it has been demonstrated that screening for patients at risk of delirium increased from 21% at baseline to 93% in December 2020. The percentage of patients who had a comprehensive assessment to determine the cause of their delirium increased from 62% at baseline to 92% in December 2020. The success of the plan was also reflected in the data from the New South Wales Clinical Excellence Commission's quality improvement data system.

109. RN Peter Jones[68] outlined the improvements at St Vincent's Hospital with respect to the training and accreditation of nurses in relation to CVADs. He explained that all registered nurses working in areas where CVAD use was common were identified and required to have CVAD accreditation. In wards where CVAD use is less common, the training and competencies are recommended for clinical nurse specialists, clinical nurse educators, and team leaders.

110. Mr Moulds' case has provided an opportunity for lessons to be learned for the treating practitioners and St Vincent's Hospital. The significant changes that have taken place at the Hospital are supported by rigorous audit compliance and

[67] Tab 65
[68] Tab 66

continuing education. In those circumstances, I do not propose to make any recommendations.

Findings pursuant to section 81(1) of the *Coroners Act 2009*

111. Kelvin Moulds died of hypoxic encephalopathy on 9 March 2016 at St Vincent's Hospital, Sydney, New South Wales, in circumstances arising from a cardiac arrest following his self-removal of the central venous catheter five days before.

Non-publication order

112. Pursuant to section 74(1)(b) of the *Coroners Act 2009*, I order that any evidence tending to identify the street addresses, email addresses and phone numbers of members of the Moulds family not be published.

Carmel Forbes

Deputy State Coroner

NSW State Coroner's Court, Lidcombe

Date: 16 April 2021