Canterbury District Health Board

Consultant Neurosurgeon, Dr E

Neurosurgical Trainee/Registrar, Dr F

Registered Nurse, Ms I

Registered Nurse, Ms J

Registered Nurse, Ms K

A Report by the

Health and Disability Commissioner

Case 09HDC01565

Health and Disability Commissioner
Te Toihau Hauora, Hauātanga

Table of Contents

Executive Summary

Background

1. In 2008, Mr A, aged 21 years, was diagnosed with a Chiari malformation[1] by consultant neurosurgeon Dr E. Mr A was admitted to hospital in early 2009 for an elective posterior fossa decompression.[2] Surgical registrar Dr F met with Mr A to discuss the proposed surgery and obtain his consent. Mr A was concerned that there were more risks with the surgery than he had realised, and he was consequently uncertain about whether to proceed. Later that day, Mr A met with Dr E, and after discussing his concerns further, said he felt comfortable to go ahead with the surgery.

2. The surgery was performed the following morning by surgical registrars Dr G and Dr F, under the supervision of Dr E. After 1½ hours in the recovery ward, at 1.30pm Mr A was transferred to a special care unit (SCU) for the postoperative care of neurosurgical patients. Mr A's recovery appeared to be progressing uneventfully.

3. Mr A was looked after that afternoon and evening by Registered Nurse (RN) Ms I, and overnight by RN Ms J. His neurological observations were checked hourly for the first 12 hours postoperatively, and then two-hourly. However, his respiratory rate was not recorded after 5pm on the day of surgery.

4. Mr A's care was handed over to RN Ms K between 6.45 and 7.05am the next morning. At 7.30am, Mr A was found unresponsive. He was not able to be resuscitated. The pathologist was not able to anatomically ascertain the cause of death. There was no evidence of surgical mishap, pulmonary embolism, excessive morphine administration, or pre-existing cardiac disease. The post-mortem report refers to the possibility of a "functional loss of breathing control while asleep".

5. Canterbury District Health Board (CDHB) carried out a Root Cause Analysis. This identified several concerns, some of which were associated with the neurosurgical unit's routine practices. A number of changes have been made by the DHB as a result of what happened.

Commissioner's findings

6. Mr A was not provided with services of an appropriate standard. There were deficiencies in the service provided by CDHB, as well as individual members of staff.

7. There were a number of organisational issues that impacted adversely on the quality of the postoperative care provided to Mr A in the SCU, and conspired to create an unsafe situation, in which appropriate monitoring did not take place. Concerns were identified in relation to: the observation chart with no specific place to document respiratory rate; the practice of ending "specialling" prior to the morning medical review; the circumstances in which Mr A was changed to two-hourly observations

[1] A structural defect in the bottom part of the brain (cerebellum). Normally the cerebellum and parts of the brain sit in an indented space at the lower rear of the skull, above the opening at the base of the skull (foramen magnum). Chiari malformation occurs when part of the cerebellum (cerebellar tonsils) is located below the foramen magnum.

[2] A procedure to relieve pressure by removing bone at the base of the skull.

overnight; a conflict between the postoperative instructions for Mr A and the SCU protocol; and the practice of conducting morning handover for SCU patients in another room. Accordingly, CDHB did not take reasonable actions in the circumstances to ensure that services were provided to Mr A with reasonable care and skill, and breached Right 4(1) of the Code of Health and Disability Consumers' Services Rights (the Code).[3]

8. Mr A was not informed as to who would be performing his surgery. This is information that a reasonable consumer, in these particular circumstances, would expect to be given. In addition, there were some deficiencies in the nursing care provided by RNs Ms I, Ms J and Ms K. However, in the circumstances it was found that individual breach findings were not warranted.

Investigation process

9. On 10 August 2009, the Commissioner received a complaint from Mrs C about the services provided to her son, Mr A. An investigation was commenced on 3 November 2009. The following issues were identified for investigation:

- *Whether CDHB provided Mr A with an appropriate standard of care on Days 1-3.*
- *Whether Dr E provided Mr A with an appropriate standard of care from the time of Mr A's diagnosis of Chiari malformation in 2008, to his death.*
- *Whether Dr E provided Mr A with an adequate explanation of his condition and with sufficient information to enable him to make an informed choice about the options available to treat his condition, including an assessment of the expected risks and benefits of surgery.*
- *Whether Dr F provided Mr A with an adequate explanation of his condition and with sufficient information to enable him to make an informed choice about the options available to treat his condition, including an assessment of the expected risks and benefits of surgery.*

10. On 1 April 2010, the scope of the investigation was extended to include the following issues:

- *Whether registered nurse Ms I provided Mr A with an appropriate standard of care on Day 2.*
- *Whether registered nurse Ms J provided Mr A with an appropriate standard of care on Days 2 and 3.*
- *Whether registered nurse Ms K provided Mr A with an appropriate standard of care on Day 3.*

11. The scope of the investigation was further extended on 12 April 2011 to include the following issue:

[3] Right 4(1) — Every consumer has the right to have services provided with reasonable care and skill.

- *Whether Dr F provided Mr A with an appropriate standard of care on Days 1-3.*

12. The parties directly involved in the investigation were:

Mr A (dec)	Consumer
Ms B	Consumer's fiancée
Mrs C	Complainant/Consumer's mother
Mr C	Consumer's father
Dr D	General practitioner
Dr E	Consultant neurosurgeon
Dr F	Neurosurgical trainee/registrar
Dr G	Neurosurgical trainee/registrar
Dr H	Anaesthetist
Ms I	Registered nurse
Ms J	Registered nurse
Ms K	Registered nurse

Also mentioned in this report:

Ms L	Registered nurse
Ms M	Registered nurse
Ms N	Registered nurse
Dr O	On-call registrar
Mr P	Ms I and Ms K's legal representative

13. Information was reviewed from: Mr and Mrs C, Dr D, CDHB, and CDHB staff including Dr E, Dr F, Dr G, RN Ms I, RN Ms J, and RN Ms K.[4]

14. Independent expert advice was obtained from neurosurgeon Dr Darryl Nye (**Appendix 1**) and RN Janet Hewson (**Appendix 2**).

Information gathered during investigation

Diagnosis and pre-admission

15. In 2008, Mr A (aged 21 years) consulted a general practitioner, Dr D. Mr A was fit and active, but had been having frequent headaches, brought on by activity that increased his heart rate. Dr D conducted a full medical the following day, and recommended he restrict physical activity. Dr D discussed Mr A with a neurologist at the public hospital, and prescribed medication to slow his heart rate (nadalol).

16. In 2008, Mr A had an MRI of the brain, which showed: "Significant cerebellar descent consistent with a Chiari one anomaly". Dr D referred Mr A privately to

[4] Mr A's fiancée was invited to contribute but declined to do so.

neurosurgeon Dr E.[5] Dr D noted in his referral letter that the medication had helped with the frequency of attacks and morning headaches, but that the improved symptoms may also have coincided with Mr A restricting his physical activity and being able to do things at his own pace.

17. Mr A had an MRI of the spine and was seen by Dr E a few days later. In his letter to Dr D, Dr E noted that Mr A had described the development of symptoms over the past year becoming worse over the previous two to three months, to the point that they worried him daily. He had reported daily headaches brought on by straining, coughing, exercise, and any form of activity requiring increased mobility. He also described unsteadiness of balance and abnormal vision. Dr E noted that the MRI findings revealed "a 2cm Chiari malformation with descent of the lower medulla and cerebellar tonsils up to the level of the C1 posterior arch".

18. Dr E concluded that Mr A clearly had an Arnold Chiari malformation[6] which was symptomatic, and that this would best be managed with a Chiari type decompression of his foramen magnum[7] to help relieve the symptoms. Dr E noted in his letter to Dr D: "I have gone through the details of the procedure with him including the risks and benefits. I suggest that this be done in the near future so he can get back to daily activities." Dr E noted the options of having this done privately under his care, or being placed on the waiting list at the hospital to have it done publicly.

19. Dr E subsequently told HDC that he did not take undertake the consent process with Mr A at this time, but did state that the goal of the surgery was to relieve the headaches that came on during physical exercise. He recalls stating that he "thought there would be a good chance that [Mr A] would be able to return to [work] [within] months following surgery".

20. The following month, Dr D wrote to Dr E asking that Mr A remain under Dr E's care but be returned to the public system. Dr D noted Dr E's previous advice that there was likely to be a three to six month wait for the surgery in the public sector, and asked that Mr A be placed on a cancellation list for earlier surgery if possible.

21. Three months later, Mr A completed a preoperative questionnaire. He ticked "yes" to a question asking if he had ever had asthma, emphysema or chronic bronchitis, and "yes" to having had wheeziness or croup within the past year. He noted that the only medication he had taken in the previous four weeks was codalgin.[8] Mr A also completed an "Application for admission, treatment and investigation as an inpatient", on which he noted he was taking no medicines at the time, and again that codalgin was the only medication he had taken within the previous four weeks.

22. Mr A's mother noted in her statement for the Coroner that as a child, her son had had ongoing chest and respiratory problems. He had asthma which often led to chest infections such as bronchitis or pneumonia. She recalls that he was hospitalised about

[5] Dr E works in the private sector, and in the public sector for Canterbury DHB.
[6] See footnote 1.
[7] See footnote 2.
[8] Paracetamol and codeine, used to relieve pain.

three times before they came to New Zealand, and once in New Zealand (September 1997) for infections relating to his respiratory problems. Mrs C said her son stopped using his inhalers when he was aged 14 or 15 because his asthma was under control, although she noted there was an inhaler amongst the property returned to her by his employer. There was no reference to inhalers in Dr D's referral letter to Dr E.

Treatment at the hospital, early 2009

Admission and first surgical consent discussion, Day 1

23. Mr A was admitted to hospital. He was booked for surgery the following day. Dr E recalls that Mr A was called in at short notice when theatre space became available.

24. Mr A was admitted by a house surgeon from Dr E's team. It was noted that Mr A had childhood asthma with one hospital admission, that he was "cleared on entrance into [employment]", and that he was on no regular medications. It was noted that Mr A could go on leave that evening, but that he was to return to the ward to sleep there.

25. Dr E was in theatre on the day of Mr A's admission, and registrar Dr F met with Mr A to go through the consent process.[9] Dr E states that it is commonplace for registrars in teaching units to take consent and to complete the administration of the process. He states that in most cranial cases and complex spinal cases, he would have a second liaison with the patient to give them the opportunity to ask questions and to make sure they appreciated the details and risks of the procedure.

26. Mrs C was also present when Dr F spoke with Mr A. Dr F recalls that they first discussed Mr A's symptoms, as documented in Dr E's previous correspondence. He stated:

> "I then showed them his MRI scans which had a Chiari Type 1 malformation manifest as cerebellar tonsillar ectopia.[10] It was also explained that his brainstem was lower as part of the malformation. I then went over the MRI cervical spine and I indicated that this did not reveal evidence of a cervical syringomyelia.[11] At this point, I explained to [Mr A] that this finding (Chiari Type 1 malformation) is not always associated with headaches and therefore foramen magnum decompression was not guaranteed to alleviate his headaches."

27. Dr F states that he proceeded to discuss the operative technique, noting that Mr A would have a general anaesthetic with intubation and that the risks of this would be discussed in detail with the anaesthetist. Dr F explained the technique using skull and cervical spine models in conjunction with the MRI scans.

28. Dr F went on to explain the risks:

[9] Dr F was a full-time employee of Canterbury DHB, on a one-year contract to provide services as a neurosurgical trainee/registrar at the public hospital. This was part of the Australasian Neurosurgical training scheme provisioned by the Royal Australasian College of Surgeons and the Neurological Society of Australasia.
[10] Incorrect positioning of the cerebellar tonsils (see footnote 1).
[11] The formation of a fluid-filled cavity in the spinal cord.

> "I explained that there were general risks such as infection and bleeding. I also explained that there was a risk in some cases of major intraoperative bleeding from anomalous arterial and venous structures but that this was not common. I also explained that in some cases, despite excellent haemostasis at the time of surgery, that a post-operative haematoma could develop and compress the brainstem causing a spectrum of neurologic deficits which could be mild or as severe as tetraplegia/paralysis, or at that level cause *breathing difficulties*. I also explained that these neurologic complications could also occur as a consequence of direct injury to the upper spinal cord and brainstem during the operation but that this was an uncommon complication. I then explained that if these complications did occur that there would be a *risk to life*. I then informed him that there was a risk of leakage of cerebrospinal fluid if the wound did not heal appropriately and that the risk of this was low and was usually managed with either additional sutures or reclosure of the wound with antibiotic cover. I explained that in this scenario meningitis could develop. I then explained the cardiovascular risks such as stroke, heart attack and the risk of clots in the legs (deep venous thrombosis) which could embolise to the lungs (pulmonary embolus) (these could be *life threatening*) could occur. I then explained that there was also a risk of chest infection and further anaesthetic risks such as a reaction to the anaesthetic which would be explained in more detail by the anaesthetist."[12]

29. Dr F noted that Mr A seemed uncomfortable with some of the potential complications and risks, with particular concern about the risk of paralysis. Dr F explained that although the risk was low he could not guarantee this would not occur, and that Mr A had to weigh up whether the risk-benefit ratio was favourable or not. Dr F states that he confirmed some of the risks were indeed major, and that he asked Mr A if his headaches were severe enough to warrant taking those risks, reiterating that the operation was not guaranteed to alleviate or cure his headaches and that his condition did not require urgent surgery. Dr F states: "As such, I did not allow [Mr A] to sign the consent form and asked that he discuss what had been said with his mother ([Mrs C]) to help him clarify things in his own mind." Dr F advised Mr A to consider the situation over a few hours and stated that they would meet again for a further discussion regarding the operation, its risks, and any ongoing concerns.

30. Mrs C recalls that Dr F explained that an incision would be made in the back of the head to allow access to the base of the skull. From there bone would be removed from around the skull to allow the brain to have more room. Bone might also need to be removed from the vertebrae. Mrs C recalls that her son was worried and agitated because he had not previously understood that it would be an operation on his spine. She states that Dr F confirmed her son was not committed to the procedure and that he could back out if he wished.

31. Mrs C says that after the meeting with Dr F, she sat with her son for about two hours, during which time he became increasingly agitated.

[12] Emphasis in this paragraph (italics) is Dr F's.

32. Mr A rang Dr D, who recalls that Mr A spoke to him about the surgical risks that had been explained to him, including things like paralysis. Dr D states they did not discuss the specific procedure or risks as he was not familiar with these in detail, but that he advised Mr A to speak directly with the consultant surgeon, to "go over the procedure and risks involved and any concerns he had about the surgery before consenting or proceeding with the surgery". He recalls that Mr A was happy with this course of action.

Second surgical consent discussion

33. Dr E was informed of Mr A's concerns, and went to speak with Mr A in between operations he was performing that afternoon. Dr F was present, as was registrar Dr G. Dr E recalls:

> "I explained that his condition was not life-threatening and in fact, now that he had a "desk job", he was relatively asymptomatic. I suggested that we have a period of expectant observation and that I would review him again in outpatients after several months.[13] After getting up to return to theatre, [Mr A] suddenly stopped me and said he changed his mind, was very keen to return to [work] and wanted to go ahead with the procedure. I reiterated that I could not make him any better than he was clinically at that time (asymptomatic) and that the only benefit would be his likely return to physical exercise and [work]. He still wanted to proceed. I was happy with the risks explained by [Dr F] including CSF [cerebrospinal fluid] leak (which I believe together with a surgical pseudo-meningocoel are the most common complications of posterior fossa surgery including Chiari decompressions). I did not in so many words tell him that he could die from the surgery, but used my 'plane flight analogy' which I use with all my cranial and most spinal cases (this can be verified by any person that regularly attends my consent taking process with patients). The basics were that if you fly from Christchurch to Sydney, you expect that you […] arrive safely the majority of times. However, there is a small chance that for whatever reason, the plane crashes into the Tasman and that obviously is very serious. Therefore if you do not want to crash, you should not fly in the first place. Otherwise trust the plane, the pilot and copilot and take the flight. [Mr A] accepted this and **he himself** signed a legal document stating the risks, including stroke, neurological deficit, deep vein thrombosis and pulmonary embolus, acute myocardial injury, etc **all of which on their own** could be a cause of death."[14]

34. Dr E notes that the fact that Mr A hesitated to give consent the first time supports his view that the consent process was done appropriately. He states: "I do not believe in 'scare tactics' when taking consent from a patient as undergoing neurosurgery is worrying enough to a patient. However I think that my consent 'technique' abovementioned suffices in the process of explained risk."

35. Dr F also recalls the discussion that he and Dr E had with Mr A in relation to the operation, its risks, and potential complications. He notes that Mr A had the

[13] Expectant observation is the management of a condition by surveillance, or "watchful waiting".
[14] Emphasis in this paragraph (bold) is Dr E's.

opportunity to ask questions, and he again mentioned his concerns about the risk of paralysis. Dr F states that Mr A initially agreed to postpone the operation, but at the conclusion of the meeting said that he wished to proceed. Mr A then signed the consent form that Dr F had prepared during their earlier meeting.

36. The risks are listed on the consent form (see **Appendix 3**) as: "Infection, CSF leak, neurological deficit, bleeding/haematoma, stroke, anaesthetic risk, AMI [acute myocardial injury], DVT [deep vein thrombosis]/PE [pulmonary embolism], chest infection. May not help headaches."

37. Dr F subsequently acknowledged that his documentation of the risks was not complete in terms of respiratory risk and death. He states that although the risk of death was mentioned several times with respect to other complications, he used the terms "risk to life" or "life-threatening" rather than "death". Dr F considers that Mr A's apprehension indicated that he understood the gravity of the implications of the operation, and in particular the risks and potential complications. He does not think Mr A was under the impression that he was to undergo "minor surgery".

38. The consent form also states: "I acknowledge that an assurance has not been given that the procedure will be performed by a particular doctor, but that doctor will, however, have appropriate experience."

39. Dr G observed the consent process but did not participate. Although he does not remember the specifics that were discussed, he cannot recall anything unusual or out of the ordinary about the conversation.

40. Mrs C was not present for Dr E's meeting with Mr A. She said that her son had phoned after the meeting with Dr E to say he was going ahead with the operation, and that when she and her husband visited later that evening, he was relaxed and comfortable.

41. Mrs C said that when her son first told her and her husband about the operation, he said it was a small operation to take away his headaches, with the normal risks that come with general surgery. Mrs C does not believe her son was informed about the risk of respiratory failure, and that with his history of asthma and respiratory problems, had he known this, he would not have agreed to the surgery. She considers the only reason her son wanted the surgery was to return to work. She states that Dr E assured him that this would happen.

42. Mrs C also states that she and her son were under the impression that Dr E would be performing the surgery himself, and that her son had chosen Dr E because he was originally from the same country. Dr E advised HDC that he never told Mr A or his mother that he would be performing the surgery personally, and nor did he state the opposite. He said that, if asked, he would have told Mr A that the surgery would be performed using a "team approach". Dr E also asserted that, given the post mortem findings did not point to any surgical mishap, "the question as to whether [Mr A] was aware of the precise makeup of the surgical team or not is actually not relevant".

Consent for anaesthesia

43. Anaesthetist Dr H was responsible for Mr A's anaesthesia care. The pre-anaesthesia assessment was carried out by an anaesthetic registrar. This involved reviewing the self-assessment preoperative questionnaire, conducting an anaesthesia-specific assessment and examination, reviewing relevant clinical notes, and completing a written consent for anaesthesia.

44. On the written consent form under 'Discussion notes including risk discussion', the anaesthetic registrar wrote:

> "GA [General Anaesthetic] – Sore throat, PONV [postoperative nausea and vomiting] Pain, Adverse drug reaction.
> Rare + Serious +/- A line [arterial line]"

45. In a statement for the Coroner, Dr H noted that the pre-anaesthetic assessment did not reveal any particular issues of concern or previous untoward events with respect to the provision of a general anaesthetic.

Surgery

46. Mr A was admitted to theatre at about 8am on Day 2, and anaesthetic induction started at approximately 8.10am. Dr H stated that the course of the anaesthetic was unremarkable.

47. Drs G and F performed a decompression of the craniocervical junction, under the supervision of Dr E. Dr E subsequently explained that he has always allowed registrars to perform surgical procedures as part of their training, and will continue to do so. He notes that this is the only way neurosurgeons can be trained for the future, and this is an obligation under the Australasian Training Scheme of the Royal Australasian College of Surgeons. He also states that a neurosurgical registrar/fellow falls into the category of doctor with appropriate experience, as stated on the consent form. Dr E states that he was present in theatre during the surgery, that he inspected the critical parts of the operation, and that: "I was happy that the procedure was done appropriately and that I would have done it like that myself."

Initial postoperative care

48. Mr A was transferred from the operating theatre to the Post Anaesthesia Care Unit (PACU) at 11.10am. Dr H noted that Mr A was initially very sore, with pain scores recorded as five (worst possible pain) on three occasions between 11.35am and 12.35pm. Dr H states this was not entirely unexpected, as operations of this nature are extremely painful for most patients. Mr A was given 11mg of morphine and 90µg of clonidine intravenously in increments over approximately one hour.[15]

49. At 12.40pm a patient-controlled analgesia device (PCA) was connected. Dr H subsequently provided further information about the use of the PCA. He states:

[15] Mr A was administered multimodal analgesia (morphine, parecoxib, tramadol and paracetamol) toward the end of surgery. In his statement to the Coroner, Dr H noted that Mr A was initially slow to re-establish adequate spontaneous respiration and 100µg of naloxone was administered at approximately 11am, producing the desired effect.

> "It is my opinion that a PCA was both an appropriate and humane method of allowing [Mr A] to deliver himself a suitable and safe amount of morphine analgesia in the post-operative period. A literature review, and EBM (evidence-based medicine) guidelines supports the use of a PCA in neurosurgery."

50. The prescription was for morphine 1mg/ml, with each dose delivering 1mg of morphine up to a maximum of 12mg per hour and with a lockout time of five minutes. Dr H reviewed Mr A at 12.45pm, noting that his pain level was then two and that he was using his PCA appropriately. Dr H instructed the PACU nurses that Mr A could be transferred to the neurosurgical Special Care Unit (Neuroscience Unit).

51. The "Adult PCA Treatment Sheet" details standing orders. These include a requirement for hourly respiration, sedation score and oxygen saturations (SpO_2) to be recorded for the first 12 hours and then 4-hourly if stable.[16]

52. Dr F documented instructions for Mr A's postoperative care (**Appendix 4**). These included neurological observations every 15 minutes for the first hour, then every 30 minutes for two hours, then hourly, with no specified end time for those observations.

53. Dr F subsequently outlined the rationale for the postoperative neurological monitoring regime he prescribed. He notes that the regime was consistent with his initial training and subsequent experience treating cranial patients. Mr A's surgery had been completed without any difficulties, and accordingly Dr F prescribed his standard regime. Dr F states that in general, postoperative orders are effective from the immediate postoperative period until the surgeon's ward round review the following morning. If a patient has needed review by a surgeon prior to this, changes may be made to postoperative orders at that time. Dr F noted that it is departmental practice to follow the prescribed postoperative orders in addition to following the relevant departmental postoperative protocols.

Special Care Unit (SCU)

54. The SCU is a four-bed room designed to ensure "a high standard of specialist nursing care for neurosurgical and neurological patients who are seriously unwell, have the potential to deteriorate rapidly, or who require ongoing and/or escalating physiological monitoring".[17] It does not provide invasive monitoring or advanced airway care: these patients would be sent to the Intensive Care Unit (ICU).

55. The SCU provides for an increased nurse to patient ratio, and is staffed by "more experienced Neuroscience Nursing staff who have received an orientation to the SCU and are familiar with the assessment and management of neurosurgical and neurological patients".[18] The ratio of nursing staff to patients is one nurse to a maximum of four patients, depending on clinical demand and patient acuity. The SCU

[16] If the PCA is set to administer automatic doses (not the case for Mr A), observations should continue hourly.
[17] CDHB policy for Admissions, Discharges, Transfers.
[18] CDHB Neurosciences SCU RN Orientation Package.

does not meet the criteria for a "High Dependency Unit [HDU]".[19] The hospital does not have an HDU.

56. It is usual practice for patients who have had neurosurgery and for whom there are no apparent surgical or recovery complications necessitating admission to ICU to be admitted to the SCU for one night following surgery, and transferred to another room on the ward the following day.

57. CDHB states that nurses working in the SCU would be in their second (or more) year post-registration, with a minimum of one year's experience in neurosciences or related advance practice specialities of ICU/HDU/PACU. They must have worked on the ward for at least one year, and demonstrate a high level of skill in patient assessment.

58. CDHB notes that the titles used for different services and units can vary between hospitals, and that many nursing and medical staff have worked in hospitals around the world. However, it states that this does not imply that staff misunderstood the function of its SCU, as new staff were well oriented to the unit.

59. The SCU Orientation Package for nursing staff includes "Neurosurgical Postoperative Guidelines", and with specific information in relation to posterior fossa surgery. This includes the following:

> "Neurological Observations
> There is an increased potential for more sudden neurological deterioration with surgery done in this region because of a more direct pressure effect on the medulla with raised ICP [intracranial pressure].
> Half hourly obs for four hours (including obs done in Recovery)
> Hourly obs for four hours
> Two hourly for four hours or overnight until changed by the medical staff.
>
> Should there be a negative change in the patient's neurological status, then revert back to the previous recording sequence. Notify the medical staff, and then document the changes."

60. All nurses scheduled to start a shift on the ward attend a handover meeting, and all patients on the ward are discussed. At the time of these events, as long as the patients were stable, it was usual practice for morning handover to be held in the seminar room located near the entrance to the ward. The afternoon and evening handovers for the SCU patients would usually be carried out in their room, as the patients would still be in the acute postoperative phase.

[19] CDHB further explains that an HDU is a specially staffed and equipped section of Intensive Care which is capable of providing routine monitoring and support to include electrocardiograph monitoring, pulse oximetry, invasive measurement of blood pressure, low level of inotropic support and non-invasive ventilation. An HDU maintains a nurse-to-patient ratio of one to two, with medical practitioner support from ICU immediately available. CDHB notes that the SCU on this ward differs also from a surgical SCU, where patients require an even greater level of monitoring than patients on this ward, but which is still a step down from an HDU.

Continuing postoperative care, Day 2

61. Mr A was transferred to SCU at 1.30pm, by which time he was on half-hourly neurological observations. He occupied bed space four. The "Neurosurgery Observation Chart" is used to record specific neurological checks relating to level of alertness, pupil reaction and limb movement, as well as vital signs: blood pressure, pulse, respiratory rate, temperature, and oxygen saturations. Although the chart specifies respiratory rate as one of the vital signs to be checked, there is no specific place to record this. CDHB advises it was usual practice to record the rate numerically, at the bottom of the chart.[20] At 1.30pm, Mr A's vital signs were within acceptable ranges: his respiratory rate was 12 breaths per minute (BPM), oxygen saturations 100% at 5 litres per minute (L/min), blood pressure 122/72, and pulse 98 beats per minute (bpm). (See **Appendix 5** for a copy of the observation chart and **Appendix 6** for a summary of the observations).

62. At 2.30pm, RN Ms I came on duty, and was given a handover of the patients in SCU by RN Ms L.[21] This took place at the nurses' desk, which was next to Mr A's bed. Aside from Mr A, there was another patient who had had surgery that morning (bed space one). There was also a patient who had had surgery the previous day, who was moved out of SCU later that afternoon.

63. RN Ms I specifically recalls RN Ms L noting that Mr A's pupils were dark and that you needed to "have a good look to see if they were reacting (ie, dilating or constricting)". RN Ms L introduced RN Ms I to Mr A. They checked his eyes, which were reacting normally. RN Ms I recalls that Mr A's fiancée, Ms B, was present at this time.

64. At 3pm, RN Ms I checked Mr A's neurological observations and vital signs. She noted on the PCA treatment record that Mr A's respiratory rate was 16 bpm, his oxygen saturations were 99% at 5L/min via a Hudson (face) mask, and his sedation score was one.[22] RN Ms I recalls that at this time he was fully orientated and spontaneously opening his eyes, but that there was mild weakness when she asked him to squeeze her hand.

65. Dr F recalls that he and Dr G reviewed Mr A at about 3pm, although this was not documented. At this time Mr A was fully conscious, neurologically intact and had satisfactory vital signs. Dr F spoke with Mrs C, who was visiting, and said that he was satisfied with how Mr A was managing.

66. Dr E states that although he did not review Mr A in person postoperatively, before he left the hospital that afternoon he was informed by his registrars that Mr A had woken up and showed no neurological concerns.

[20] There is a specific column on the "PCA Record" to record respiratory rate.
[21] RN Ms I was a Level 3 RN, meaning she was in her third year post registration.
[22] Sedation scores range from 0 to 3, to represent increasing levels of sedation. A score of 0 indicates that the patient is alert. A score of 3 is defined as "somnolent, difficult to rouse", and require specific actions to be taken. A score of 4 is used to indicate that the patient is "normally sleepy, easy to rouse", on the basis that an attempt has been made to rouse the patient.

67. At 5pm, Mr A's observations were within normal parameters: blood pressure 131/60, respiratory rate 18 BPM, pulse 110 bpm and oxygen saturation levels 99% at 5L/min. Limb power was normal. This was the last time Mr A's respiratory rate was recorded.

68. Neurological observations and vital signs, excluding respiratory rate, were checked at 6pm, and again indicated no cause for concern. At 6.15pm, RN Ms I spoke with Mr A about the difficulty he was having passing urine. The bladder scanner showed that he was retaining 356mls of urine. RN Ms I instructed Mr A to continue trying to use the urine bottle.

69. Dr F reviewed Mr A again at approximately 7pm, before finishing work. Dr F was again satisfied with Mr A's status, and recalls that he was conversing and joking with a visitor, and texting on his phone. From 7pm, Mr A's Hudson mask was replaced with oxygen via nasal prongs at 3L/min. RN Ms I completed the neurological checks, and recorded Mr A's pulse, blood pressure and oxygen saturations. A new syringe was put into the PCA pump, and RN Ms I assisted Mr A with a wash.

70. Mr A's blood pressure, pulse and neurological observations were checked at 8pm. Mrs C recalls that she visited her son several times after surgery, and that on the last visit he was awake, conversational, alert, and in good humour. She left the hospital just before 9pm.

71. At 9pm, RN Ms I checked Mr A's neurological observations, pulse, blood pressure, oxygen saturations and temperature, and again no concerns were noted. RN Ms I recalls that between 9 and 10pm, Mr A wanted to try sitting up to urinate. She contacted on-call registrar Dr O, to confirm that it was all right for Mr A to sit up. RN Ms I recalls that she and Ms B then helped him to sit up, but that he was still unable to urinate. At 10pm, RN Ms I used the bladder scanner again, which showed that Mr A was now retaining 896mls of urine. As he had not been able to pass urine since surgery, RN Ms I contacted the duty house surgeon to insert a urinary catheter. Before the house surgeon arrived, Mr A vomited. RN Ms I was not concerned as postoperative vomiting is not uncommon, and she gave him anti-emetic medication. RN Ms I completed neurological checks at 10pm but did not record Mr A's vital signs.

72. RN Ms I recalls that she remained in SCU for the duration of her shift, except when she was relieved by another nurse for meal and toilet breaks. She states that throughout her shift, "apart from taking short naps, [Mr A] was awake. He was texting and interacting with his family, fiancée and friends. He did not snore while he napped". She notes also that aside from those occasions when Mr A was trying to use the urine bottle and having the catheter inserted, the curtain around his bed was pulled back and she was able to see him from the nurses' desk.

73. RN Ms I made an entry in the progress notes at the end of her shift, between 10 and 10.30pm, indicating that Mr A was now on two-hourly neurological observations. This was in accordance with the "Neurosurgical Postoperative Guidelines", but it was not consistent with Dr F's instructions.

74. At 10.30pm, RN Ms J came on duty and received a handover of Mr A's care.[23] The handover took place in the SCU. At the same time, the duty house surgeon was with Mr A, inserting the catheter.

75. RN Ms J states that following handover, she remained at the desk, read Mr A's notes, and checked the medications that were held in the SCU.

76. At 11pm, the PCA treatment record shows that Mr A's pain level was one, his sedation score was zero, and he had used the PCA three times in the previous hour. RN Ms J recorded Mr A's neurological observations and his vital signs, excluding his respiratory rate.

77. RN Ms J subsequently told HDC that although she did not record Mr A's respiratory rate during her shift, she checked this while she was taking his blood pressure. She states that checking respirations without Mr A being aware enabled her to get an accurate count, that she counted for at least 30 seconds each time, and that she observed the mechanism of his breathing and saw no use of accessory muscles, tracheal deviation, or cheek puffing. Each time she assessed the rate as being within the normal parameters.

78. In a statement for the Coroner, RN Ms J recalled that Mr A was awake between 11pm and 1am.

Continuing postoperative care, Day 3

79. At 1am on Day 3, RN Ms J recorded Mr A's vital signs excluding his respiratory rate: temperature 36° celsius, pulse 98 bpm, blood pressure 126/72 and oxygen saturations 98% on 3L/min. Neurological observations were normal and his sedation score was four. RN Ms J gave Mr A his last dose of IV antibiotics. Mr A had used the PCA pump throughout the afternoon and evening, receiving a total of 46mg up until 1am, after which he did not use it again. At 1.30am, RN Ms J left the ward to collect a patient from the PACU. She told her colleagues on the ward that she was leaving, and was away for about ten minutes. The patient she returned with went into bed space three.

80. RN Ms J recalls hearing Mr A snoring between 1.30am and 3am, and that this was at a regular rate with no apparent apnoeas. She thought he sounded as though he had a blocked nose, but this did not alarm her as his observations were all within normal limits, and he was easily awoken and often did so spontaneously. RN Ms J states that Mr A awoke as she approached to take his recordings at 3am. Mr A asked if he had been snoring because his throat was sore. RN Ms J said that it would be sore from the endotracheal tube inserted in theatre. Mr A responded that he usually snores anyway. RN Ms J recalls that from then until she checked his vital signs at 5am, he could be heard snoring. Vital signs at 5am were recorded as: temperature 36° celsius, pulse 96 bpm, blood pressure 138/73, and oxygen saturations 94% at 3L/min. RN Ms J subsequently stated that the drop in Mr A's oxygen saturations did not concern her

[23] RN Ms J was also a Level 3 RN.

given the PCA sheet prescription and the fact that Mr A was talkative, with no signs of drowsiness or tiredness.

81. RN Ms J's 5am entry in the progress notes states "O2 4*l* via NP, sats 94% on RA [room air], 98% on 4l, due to mouth breathing whilst asleep". On the "Neuroscience Documentation of Care", RN Ms J recorded that Mr A was having oxygen at 4L/min via nasal prongs. RN Ms J subsequently told HDC that this was an error in documentation, and that he was having oxygen at 3L/min as recorded on the "Neurosurgery Observation Chart".[24]

82. RN Ms J also notes that when a person is staying overnight in an unknown and unsettled environment, it is harder for them to sleep. She states the fact that Mr A was asleep each time she approached to check his vital signs does not mean he could not open his eyes spontaneously. She notes that in her experience, it is easier to assess a person's pupil size and reaction to light stimulus in a darkened environment. RN Ms J states that when she assessed the power in Mr A's arms throughout the night, he had the same power in both arms.

83. In her statement for the Coroner, RN Ms J states that she emptied Mr A's catheter bag at approximately 6.15am.[25] She recalls saying that she would see him that night when she was back at work, and that he replied "Ok, I'll see you then." RN Ms J left the room to assist her colleagues on the ward, and then to hand over to staff coming on for the morning shift. She returned to the room at approximately 6.35am to respond to a call from another patient. She recalls hearing Mr A snoring. He was due to have his next observations taken at 7am.

84. RN Ms J subsequently told HDC that Mr A was able to be seen and heard by her at all times during her shift, except when she was attending to other patients. She states that the curtain around his bed space was placed so that the light from the lamp on the nurses' desk did not shine in his eyes, but she was able to see him "from his nose down" from her sitting position at the desk. She said that by leaning forward slightly, she was also able to see his eyes. RN Ms J states that the pulse oximeter was attached at all times, the monitor was visible to her throughout the night, and the alarms were turned on but did not sound during the night.

85. RN Ms J also told HDC that the oxygen monitor was set to 92% as the low default setting for all patients, set at the time of installation by the clinical nurse educator. CDHB states that this is not correct, and that the default setting for monitors of the type used for Mr A is low 90% and high 105%. It therefore considers RN Ms J may have reset the monitor. RN Ms J subsequently responded to this, stating that at no time during her years of working on the ward did she change the default settings on monitors without instruction from medical staff. She states that she did not change the settings on Mr A's monitor at any time.

[24] RN Ms J recalls it was the patient she had collected from recovery who was on 4L/min via face mask.
[25] Clinical records show output of 400mls in the space on the form for 7am, although the time was not filled in.

86. The nursing handover took place in the seminar room at approximately 6.45am. RN Ms J told HDC that this had already become usual ward practice by the time of her orientation to the SCU two years earlier. Mr A's care was handed over to RN Ms K, who recalls being told that all of the postoperative patients had had uneventful nights.[26] The only point of note in relation to Mr A was that he snored heavily but was easily roused. RN Ms K recalls that she was told Mr A's vital signs were stable. Specific figures were not reported, as was usual when signs were normal and there was no apparent cause for concern.

87. RN Ms J subsequently told HDC that it was usual practice for one nurse to remain at the nurses' station during handover, and that it was possible from there to hear the alarms on the oxygen monitors in SCU. She states that following handover that morning, she relieved the RN at the nurses' station for a few minutes while that nurse gave her handover, and that Mr A's monitor did not alarm during this time. This indicated to her that Mr A's saturation levels were above 92%.

88. RN Ms K states that handover finished at approximately 7.05am, after which she and her colleagues went to the nursing office, where they discussed their workload, teams, and staffing for the shift. RN Ms K states that there were no specific concerns about workload or patient allocation, so she was in the nursing office for approximately one minute. She collected the clinical records and drug charts for the patients under her care, checked that none of the medications due at 7am required checking by two nurses or were medications not held in SCU, and proceeded to SCU.

89. All three patients were due to be observed at the same time. RN Ms K recalls that when she entered the room, she noticed that the curtain was pulled around Mr A's bed, although from her position in the room she could not tell whether it was completely drawn or whether there was a gap near Mr A's head. She later said it was not unusual for curtains to be closed for short periods, for example when a patient is having a catheter inserted, or has visitors. RN Ms K recalls that she did not hear any snoring, which she took to mean Mr A was either awake or sleeping in a position that did not partially obstruct his airway. His snoring had been reported as intermittent.

90. As she entered the room, the patient from bed space one was coming out of the bathroom. She spoke with this patient, who was keen to be discharged and had some questions about this. RN Ms K said at the same time she noticed that the patient in bed space three appeared to be sleeping. The sleeping patient's monitor was switched on, and indicated that his pulse and oxygen saturation levels were within acceptable levels. She therefore proceeded to record the observations of the ambulatory patient first. RN Ms K estimates that she would have been with this patient for approximately five minutes.

91. She then moved on to the patient in bed space three, who by this time had woken up and appeared to be in some pain. She was about to record his limb strength when she realised she had Mr A's chart. She crossed out the recordings she had already made in Mr A's chart, and re-entered the information on the correct chart. RN Ms K recalls

[26] RN Ms K was a Level 5 RN.

that the patient was in a substantial amount of pain and wanted to change position. She told him that she needed to attend to Mr A first, and that she would then return with pain relief and another nurse to assist with moving him. She made some minor adjustments to his position to make him as comfortable as possible in the meantime. RN Ms K recalls that she was with this patient for approximately ten to twelve minutes.

92. RN Ms K proceeded to Mr A's bed at approximately 7.30am[27] and pulled back the curtain. She noticed that Mr A was not connected to the oxygen saturation monitor, which was turned off. In her statement for the Coroner, RN Ms K stated: "It was immediately obvious that things were drastically wrong. Mr A's face and skin had a grey and waxy appearance. He had very pale lips, with an even paler ring surrounding his lips." RN Ms K noted no evidence of cyanosis or respiratory effort. She was unable to detect a femoral pulse. His skin felt very cold and waxy. RN Ms K stated that she rang three bells and pressed the cardiac arrest button. She could only get the bell to ring once and she then ran to the door and called loudly to the nursing staff to call the Clinical Emergency Team and get the crash trolley. She then returned to the bedside, inserted a gruedel airway,[28] turned the oxygen up to 15 litres and started respirations with an ambu bag. The resuscitation record shows that the arrest was discovered and CPR commenced at 7.34am.

93. RN Ms K subsequently told HDC that on finding Mr A in this state, her first instinct was to go back to what she had been taught for years: namely the ABC process, whereby the airway is secured, respirations commenced (breathing), and cardiac compressions commenced (circulation). RN Ms K states: "Any resuscitation is adrenaline driven but this was more so than usual because the patient was young and had been reported as being stable with no cause for concern." She is aware that the new guidelines provide that cardiac compressions should start before artificial respirations, but states that in this stressful situation, she reverted back to what she had originally been taught.

94. RN Ms K recalls that other nursing staff arrived almost immediately — "within seconds" — and that one of her colleagues took over the bagging while she used two hands to maintain an adequate seal between the mask and Mr A's face. The duty manager arrived soon after and began cardiac compressions. The rest of the Clinical Emergency Team arrived shortly after. RN Ms K maintained Mr A's airway while giving the team his history.

95. One of the nurses who responded to RN Ms K's call, RN Ms M, recalls that when she arrived, Mr A looked "deeply unconscious". She states that he was floppy and his colour was poor, but he was not cold. Another nurse involved in the response, RN Ms N, recalls that when she entered the room, Mr A was pale and had no colour. She

[27] The nursing note entered retrospectively at 9.30am on Day 3 by RN Ms K records the time as 7.30am. In a statement for the Coroner, RN Ms K notes the time was approximately 7.25am. The RCA report states that the clinical emergency call was activated at 7.35am.
[28] A device used to maintain an airway by preventing the tongue from falling back.

states that he looked as though he was not breathing, and as though he may already have died.[29]

96. The clinical note recorded in retrospect by Dr O states that he was on his way to the ward when he was informed of the emergency at 7.50am. Mr A was being attended to by the resuscitation team when he arrived.

97. RN Ms K states that an anaesthetist took over the airway and she became "the runner". She went with a resource nurse to check the PCA pump history. She recalls that the pump had last been used between 11pm and midnight.

98. Aggressive advance life support efforts were made, including intubation, artificial ventilation, intravenous adrenaline, intravenous atropine and intravenous calcium chloride. Resuscitation was unsuccessful, and Mr A's death was confirmed at 8.15am.

Family contact

99. CDHB advised HDC that following the arrest call, the duty manager arranged for family to be contacted. The first person contacted was Mr A's fiancée, Ms B. She arrived on the ward, provided staff with Mrs C's cell-phone number, and sent a text telling her to come to the hospital.

100. After Mr A had died, he was taken to a single room and the duty manager took Ms B in to see him. The duty manager was under the impression that the attending registrar had already spoken with Ms B, but this was not the case. When Ms B went in to see Mr A, she had not been informed of his death. CDHB states that the duty manager later spoke with Ms B's mother, and apologised for the way in which this happened.

101. Mrs C recalls that she was contacted at approximately 7.50am. When she arrived, the duty manager informed her that her son had died. Mrs C was taken to a private room to speak with the registrar. Ms B and a support nurse joined them, followed by other family members as they arrived.

102. Dr E spoke to Mrs C on the phone, and offered to meet with her and family at any time. Mrs C recalls that he offered to come in from home but at that stage she did not wish to see him. She states that she sat with her son until late that evening, and that no senior staff member or consultant came to speak with her.

103. CDHB states that Mr A's body was transferred to the hospital mortuary viewing rooms, and that support continued to be available to Mrs C through the afternoon duty manager.

104. The clinical record shows that after Mr A died, Dr O informed Dr E, and spoke with Mr A's parents and Ms B. Dr O spoke with Ms B's family over the phone. Mr A's

[29] RN Ms N states that as she was not required to assist with the resuscitation effort, she did not touch Mr A. It is noted that this information was obtained from RN Ms M and RN Ms N at a late stage in this investigation. It was obtained subsequent to, and in light of, concerns raised in the responses to my provisional findings.

parents agreed to a post-mortem, and to a meeting with Dr E after the post-mortem. Dr O contacted the Coroner's office and the duty Coroner.

Subsequent events

105. A post-mortem was carried out by a forensic pathologist, who concluded that Mr A's death was:

> "[An] (u)nexpected sudden death in the post-operative period. There is no evidence of surgical mishap (including haemorrhage), pulmonary embolism, excessive morphine administration or pre-existing cardiac disease. There was no other life-threatening pre-existing disease. He had surgical treatment for Arnold-Chiari Type 1 malformation of brainstem the previous afternoon involving enlargement of the foramen magnum. People with this malformation can exhibit difficulties in breathing control and clinical data may be available to support a contention that such a problem has led to a functional loss of breathing control while asleep with subsequent hypoxic injury to brainstem. Such functional (as opposed to structural) pathology cannot be directly discerned at autopsy."

106. A toxicology report showed that Mr A's post-mortem blood free morphine level was less than 0.02mg per litre. The pathologist subsequently stated that this effectively excluded a direct role for morphine in Mr A's death.

107. Mrs C requested and received a copy of her son's clinical records. CDHB confirmed it was undertaking a full investigation into Mr A's death.

108. In the weeks following her son's death, Mrs C sought further information from the DHB about the care provided to her son. She exchanged a number of emails with the Medical Director of Quality and Patient Safety. In May 2009, he provided Mrs C with a copy of the "Neurosurgical Post-Operative Guidelines" and the policy relating to PCAs. He noted that in general, rather than having a policy for each neurosurgical procedure, the specific detail for the postoperative care of each patient is specified in the postoperative instructions.

109. In January 2010, the Coroner decided to hold an inquest limited in the first instance to the cause of Mr A's death. There was a part hearing on 3 March 2010. On 30 June 2010, the Coroner ruled that he would defer any findings as to the cause of Mr A's death until the completion of his inquiry, but that this would not be completed before the outcome of HDC's investigation.

Further information

Chiari Malformation

110. It is noted that in the MRI and post-mortem reports Mr A was said to have had a Type 1 Chiari malformation. Dr E referred to a Type 2 malformation in his letter to Dr D.

111. In his report for the Coroner, Dr H notes:

> "Chiari malformation (CM) is a term that covers a spectrum of congenital (and occasionally acquired) malformations at the craniocervical junction, involving

> herniation of the cerebellum through the foramen magnum. Prevalence estimates are around 1:1000 population. The terminology used can be confusing and there is still ongoing debate about the cause or pathogenesis of Chiari malformation. Some authorities recognise Chiari 1–3, others five types: Chiari 1–4 + Chiari 1.5. In some texts the term Arnold-Chiari malformation is used interchangeably, while in others this term is reserved for the Chiari 2 malformation. Some authors use a more generic term of cranio-vertebral junction malformation (CVJM) covering a spectrum of lesions in this area."

112. Further information was sought from Dr E regarding his use of the term in relation to Mr A's presentation. Dr E states that he had been taught that if the brainstem itself is in any way herniated downwards into the top of the spinal canal, through the foramen magnum, the term Chiari Type 2 should be used. Dr E provided references supporting this, and states that he has continued to follow this principle. Dr E notes that Mr A's brain MRI showed that his brainstem was at least in part below the level of his foramen magnum and that the medulla extended to the top of the arch of the first cervical vertebra. Dr E states that on this basis, he considers Mr A had a Type 2 malformation.

113. Dr E stated further that there is a lot of controversy as to what constitutes Type 1 and Type 2 abnormalities, with little agreement in the literature, and among neurosurgeons and radiologists. Dr E concludes that:

> "The most likely solution to this problem is that since the advent of the modern MRI it has [been] shown that the anatomical descent is a continuum of disease that should be called Chiari Malformation only and all other abnormalities present (spina bifida, syringomyelia etc) described individually."

CDHB — Root Cause Analysis and follow-up

114. CDHB investigated Mr A's death using the Root Cause Analysis (RCA) methodology. Further information in relation to the RCA is included in **Appendix 7**, but several factors were identified, each of which contributed to "a lost opportunity to prevent [Mr A's] death":

- the routine recordings as undertaken in the ward for postoperative neurosurgical patients made it difficult to detect the progressive respiratory failure exhibited by Mr A, so that staff were reassured by his overall condition;
- it was established practice that patients who had had an uneventful first postoperative night did not require "specialling" after 6am;[30]
- there was a general lack of awareness of the rare potential for severe postoperative ventilatory respiratory failure, which meant specific monitoring for this was not instituted;
- the positioning of a curtain to prevent a night light shining in Mr A's face meant he was not able to be readily and constantly observed;

[30] "Specialling" is the close observation and monitoring of patients in the SCU, with a higher than standard nurse to patient ratio.

- handover was taken outside the SCU.

115. In its response to my provisional report, CDHB noted that the RCA was conducted to identify the factors that may have caused or contributed to Mr A's death, and that many of the factors identified in the RCA report "may not have related directly to the outcome, but have been identified as systems/process matters which could be improved for better patient care in the future".

Further information from CDHB

116. CDHB responded to preliminary independent advice from my nursing expert, RN Hewson. The DHB states that the RCA did not identify individual actions or inactions as having contributed to Mr A's death, and considers that Ms Hewson's comments appear to relate to the level of monitoring that would be expected in a high dependency situation.

117. CDHB notes that as Mr A was on a PCA pump, his blood oxygen level (SpO2) and sedation scores were being recorded in accordance with the plan and PCA protocol. The DHB states that while it does not condone the breach of protocol around respiratory rate, sedation scores have been shown to be a more reliable indicator than a decrease in respiratory rate. It notes that the other observations made by nursing staff (eg, direct visual observations, Mr A conversing and interacting with family and with staff, and snoring) indicated no deterioration in function or other cause for concern.

118. CDHB accepts that aspects of the documentation of Mr A's care were to a lesser standard than it would expect, and states that it regularly promotes the required standard and importance of good documentation for nurses across all areas of the hospital.

119. CDHB states that at the time of these events, there were some changes in nursing leadership on the ward, and a vacancy for a Nurse Specialist Educator for Neurosurgery. It does not consider this was a significant factor in these events, but states that these changes may have influenced the general ward environment.

120. CDHB also explains that it was usual practice for nursing staff to work on both the main ward and in the SCU, and that this supports the process of progressive recovery and ensures nursing staff have the opportunity to develop the full range of skills required. However, it acknowledges that this may have altered staff "thinking" around the role of the area. It states that this was illustrated by the practice of holding morning handover in the seminar room. CDHB initially advised that the reason for this was to maintain patient privacy and because of the layout of SCU at the time, but subsequently stated that it did not know why this practice had started.

121. CDHB also states that the medical round on this ward usually takes place at about 9am, and this is when the observation period – "specialling" – should end. However, where a patient had an uneventful first postoperative night, the practice had developed

for specialling to end at the time of the morning nursing handover, that is, approximately two hours earlier.[31]

122. CDHB stated that it was acknowledged practice for nurses to view all of the patients under their care at the commencement of their shift unless precluded from doing so by an emergency, and acknowledged that "RN [Ms K] should have sighted all patients before becoming involved in the provision of care". CDHB states that, in this case, RN Ms K became engaged in the provision of care before completing the handover review. However, in response to my provisional findings, CDHB stated that RN Ms K "quite rightly first attended to a patient who sought nursing help" and on the basis of the clinical record and the verbal handover she had received, she had no reason to be specifically concerned about Mr A. CDHB states it has since improved the handover systems to support the practice of bedside handover. There has been a change to the room layout, and all nursing handovers are now carried out in the SCU (assuming that those patients require "specialling").

123. CDHB also notes that it has introduced the Early Warning Scoring (EWS) tool. This assists staff, especially nurses, to identify patients who are deteriorating or who are at risk, in order to escalate the level of clinical intervention at the earliest opportunity. Respiratory rate is a component of this tool. CDHB has also introduced a standardised communication tool (ISBAR) to be used as a guide for all handovers. The use of these tools will be formally audited.

124. CDHB explains that it has a cardiac arrest team on 24-hour call, and for this reason, its nursing staff do not require the intubation and advanced resuscitation skills that nursing staff in the private sector may have. It states that its arrangements in relation to resuscitation are consistent with other DHBs.

125. CDHB reiterates that the RNs looking after the patients in SCU were all experienced and appropriately qualified practitioners with RN level 3 status and a minimum of 12 months' experience in neurosurgery, HDU, ICU, or PACU. It does not consider the singular actions or inactions of any of the RNs involved in Mr A's care could have prevented his sudden and unexpected death.

126. The ward's Nurse Manager informed HDC that if a patient removes the finger attachment for the oxygen saturation monitors, the alarm should sound. Patients sometimes turn oxygen saturation monitors off themselves to cancel the noise of the alarm, if they have observed how staff do this. Mr A would have had to get out of bed in order to reach his monitor, which was connected to the wall. He was not observed to do so.

127. The monitor next to Mr A's bed was checked following his death. It had a recertification label indicating that it had been checked recently and was functioning correctly.

[31] In the RCA report it is noted that it was not routine for nurses to remain constantly in the room after 6am, if there was no cause for concern.

128. CDHB provided HDC with details of changes made in light of the RCA recommendations, and updated this information in the course of this investigation. The following points are noted.

- A screening programme is under discussion with the respiratory and neurosurgical services in relation to preoperative respiratory function testing, (including sleep studies and CO^2 responsiveness) for patients undergoing cranio-cervical surgery for a Chiari malformation.
- All patients undergoing cranio-cervical surgery (or other major surgery identified as being of significant risk) are being identified as needing ICU care for 24 hours postoperatively.
- Appropriate parameters are to be established for the postoperative monitoring of all patients who have undergone cranio-cervical surgery for a Chiari malformation.
- The night light in SCU could not be modified but staff have been educated to use the angle poise lamp appropriately, especially for bed 4 as this is adjacent to the nurses' station and the only bed affected by direct light. All staff have been informed not to close curtains unless they are present and assisting with personal care.
- The consent process for Chiari malformation surgery is to include respiratory failure and death as potential risks.
- With consent from Mr A's family, a case report detailing Mr A's clinical course is to be prepared and submitted for publication in a recognised neurosurgical publication.
- The SCU is now known as the Progressive Care Unit (PCU). New monitors have been installed for all beds in SCU, which will improve the accuracy and efficiency of recordings. A portable pulse oximetry machine with an upgrade allowing for acoustic respiratory rate monitoring has been purchased, for use with cranio-cervical patients, to assist with accurate respiratory rate monitoring.
- The EWS is now widely established across the hospital, and the neurological observation charts have been modified accordingly. On this ward, this is an A3-sized colour coded form, allowing for trends and changes in readings to be identified more readily. Respiratory rate is a component of the EWS.
- A set of criteria is to be developed to determine when a patient should transition from the PCU to Intensive Care for HDU level care.
- Patients in the PCU now remain on "specialling" and a minimum of two-hourly observations until review by medical staff. As previously, all nursing staff rostered to work in the PCU are RN Level 3 and above, with a minimum of one year experience in neuroscience, recovery or intensive care. Appropriate Level 2 RNs are given the opportunity to work alongside the RN allocated to the PCU, to learn some of the complex issues for these patients and to provide additional support if needed. The orientation pack for the PCU was reviewed in early April 2011.

Additional information from Dr E

129. Dr E provided HDC with further details of his experience. He states that as a consultant he performed 30 transoral or craniocervical decompressions between July

1996 and May 2003, with several more as a trainee. Between June 2003 and October 2009, he performed five of the 26 decompressions carried out at CDHB's neurosurgical unit.[32]

130. Dr E also notes that he has worked at four neurosurgical units (two in New Zealand, two overseas) and in none of these was it routine to place patients who had had Chiari decompression surgery in intensive care postoperatively.

131. In response to Mrs C's concerns about her son straining and vomiting postoperatively, Dr E notes that straining, coughing, and vomiting are very common in patients who have had posterior fossa surgery, and this cannot always be prevented. He states that there is no benefit to keeping patients in bed for 72 hours after surgery. Patients are mobilised early and allowed to sit up and eat once swallowing is deemed co-ordinated after oral sips, and the patient is fully awake.

132. Dr E states that his subspecialty work revolves around complex neurovascular and tumour work, and a significant portion of these are related to the brainstem. He does not regard Chiari decompression as a highly complex procedure with an extreme to very high risk, but accepts that there is some risk to neurological function and a very small risk of fatality. In his experience, the most common complications are wound complications, followed by early postoperative headaches and failure to resolve presurgical symptoms.

133. Dr E notes the changes made following the RCA and consultation with other neurosurgical units. He states that since these events, he has made a point of requesting an 18–24 hour period of ECG or oxygen saturation monitoring, even if the patient seems completely well, fully conscious, and demonstrates no obvious features that cause concern.

Additional information from Dr F

134. Dr F had two and a half years' general neurosurgical experience prior to these events. He had started work as a neurosurgical trainee at the hospital in December 2008. Dr F explains the purpose of the training programme, noting that supervision is a crucial component of this and that his work was "continuously supervised". Dr F states that while he had been involved in the care of other patients having upper cervical laminectomies and posterior fossa decompression previously, his experience in managing Chiari malformations prior to the time of Mr A's surgery was "limited". He noted that the fact he was the assistant and not the surgeon for the operation reflected his level of experience.

135. Dr F notes the changes that had been implemented following the RCA. With regard to his own practice, he states that now ensures that all risks and complications that he has discussed are fully documented.

[32] Dr E noted that within the neurosurgical unit there are sub-specialties, and the majority of decompressions are done by his colleague who specialises in pediatric and pituitary/acoustic work.

Additional information from RN Ms I

136. RN Ms I states that she began working in the ward in March 2008, and has previous experience in neurological intensive care, medical and surgical nursing. At the time of these events she was a level 3 nurse. She recalls being advised during her orientation to the SCU that it was usual ward practice to hold morning handover in the seminar room, as long as all patients were stable.

137. RN Ms I notes that if patients are active and alert, recording respirations at prescribed intervals may not reflect actual respiratory status. She states that it is not difficult to assess if a patient is having difficulty breathing, and that throughout her shift it was clear that Mr A was not distressed in his breathing. She states that on reflection, she "could have written a more comprehensive narrative of [her] entire shift, including the fact that [Mr A] was fully interactive and showed no sign of respiratory distress".

138. RN Ms I notes that since these events she ensures that:

- handover in the SCU is always conducted at the patient's bedside;
- the curtains are not drawn for any length of time unless the patient is attending to hygiene matters or using a bed pan;
- observations are recorded by way of free text in the clinical notes;
- for patients using a PCA pump, observations are recorded on both the PCA and observations charts.

139. RN Ms I's legal counsel, Mr P, sought expert advice from Nurse Practitioner Alison Pirret. Ms Pirret states that respiration rate is an extremely important vital sign for the early recognition of respiratory depression due to narcotic narcosis or increased intracranial pressure. Accordingly, she considers that the failure to record respiratory rate in this situation reflected an unacceptable standard of nursing care. However, Ms Pirret states further that departmental or organisational factors may have contributed to RN Ms I's failure in this regard. She notes that the neurosurgical observation chart does not have a specific place to record this and states that "this risks sending messages to nursing staff that the respiration rate is of less importance when compared to other neurological observations". She also states that respiration rate has historically been poorly documented by nurses, and that the introduction of the early warning scoring systems into New Zealand hospitals in recent years has been "an attempt to ensure all vital signs are documented, and if abnormal, trigger a timely and appropriate response". Ms Pirret notes that there was no such system in place on the ward at the time.

Additional information from RN Ms J

140. At the time of these events RN Ms J had three years' postgraduate experience, most of which was in acute hospital nursing. She had worked on the ward since March 2007.

141. RN Ms J acknowledges that she should have documented Mr A's respiratory rate. She states that she was confident in her ability to recognise respiratory distress or deterioration in a patient, but appreciates that she must document the respiratory rate regardless of whether the patient is in respiratory distress, and especially when the patient is on IV narcotics.

Additional information from RN Ms K

142. RN Ms K is a senior registered nurse, who had worked on the ward since 2006. She has a postgraduate qualification in neuroscience nursing, ten years' postgraduate experience in nursing in the neurosciences and two years' experience in mixed general medical nursing.

143. RN Ms K told HDC that she felt confident in relying on RN Ms J's report that there was no cause for concern in relation to Mr A and that he had been stable all night. She notes that by this time it had been 18 hours since his surgery. With regard to the prioritisation of patients, she states that the patient she needed to prioritise was the patient who had returned most recently from surgery, and who was showing obvious signs of being in pain on waking.

144. RN Ms K states further that at handover, "you are relying on the handover nurse to provide you with all vital information about the particular patient", and that this reliance is "very much an act of trust".

145. RN Ms K has also been represented by Mr P, and the advice of his nursing expert, Ms Pirret, is noted on this matter also. Ms Pirret states that she has no criticism in relation to RN Ms K's prioritisation of patients. Ms Pirret considers that with the information RN Ms K had, she had no reason to be concerned about Mr A and to assess him earlier. Accordingly, Mr P submits that RN Ms K's actions at this time were entirely reasonable.

146. RN Ms K notes that when she found Mr A, he was "extremely cold". She does not consider that he would have been this cold had he died while she was in the SCU, especially as he was covered with a sheet and at least one blanket.

147. RN Ms K notes that since these events she:

- asks for specific figures when discussing a patient's vital signs at handover;
- checks all patients at the start of shift, before recording individual observations;
- always makes sure that curtains are not drawn for lengthy periods of time, and raises this issue in ward meetings if she notices this happening;
- raises in ward meetings any failures she observes of documentation of the respiratory rate;
- conducts and receives handover for all SCU patients.

Responses to provisional findings

148. A number of points raised in the responses to my provisional findings have been incorporated above. The following submissions are also noted.

CDHB

149. CDHB notes that, subject to some specific comments, it accepts the finding that it breached the Code. However, it considers the adverse criticism of the individual staff should be reconsidered.

150. CDHB outlines several reasons why, in its view, caution should be exercised in making any suggestion that Dr E had a responsibility to inform Mr A that his surgery was to be performed by Dr G and Dr F. It notes its understanding that in surgical disciplines in New Zealand and Australia, the majority of consulting surgeons "would not specifically note to patients that a specific procedure would be done by them entirely, or partially, and that their registrars/trainees usually do significant portions of the procedure under supervision".

151. CDHB notes further that: its surgical consent form specifically states that a procedure will not necessarily be done by a particular health professional; Dr E personally supervised the operation and was an integral part of the surgical team; and while the identity and qualifications of a provider are specified in Right 6(3), they are not specified in relation to Right 6(1).[33] CDHB considers there are potentially significant practical implications with any suggestion that Dr E should have informed Mr A that his surgery was to be performed by Dr G and Dr F.

152. CDHB states that Dr F's documentation regarding the frequency of neurological observations postoperatively was both explicit and correct. It notes that an end point is often not stated ahead of time, as the frequency and duration of observations will be determined by the patient's clinical course.

153. In relation to RN Ms I, CDHB notes that she was performing and recording postoperative observations more regularly than was required by the "Neurosurgical Post-operative Guideline", and that for much of her shift, Mr A was awake, alert, engaging with visitors, and there was no sign of breathing difficulties.

154. CDHB does not consider adverse comment in relation to RN Ms K is warranted in the context of her contact with Mr A. It notes the information she received at handover that Mr A was stable and the fact that she would reasonably have expected the oxygen saturation monitor to have alarmed if Mr A's oxygen saturation level was inadequate. CDHB states that nothing RN Ms K could have done would have made any difference as "[Mr A] was dead at this point (and had been for some time)", and that "it is difficult to see how her assisting other patients who specifically requested assistance could be seen as suboptimal care".

Dr E

155. In his response, Dr E states that he "never gave the family the impression that [he] would personally be performing the procedure". He states further that "the fact that the registrar did the informed consent, would, I suggest, lead any reasonable patient to conclude that the operation would not entirely or even partially be performed by me". Dr E states that Mr A's understanding as to who would be performing the procedure could easily have been clarified if he had asked, and the fact that he did not do so suggests he was not as concerned as Mrs C retrospectively suggests.

[33] Right 6(3) sets out the consumer's right to honest and accurate answers to questions relating to services, while Right 6(1) relates to information that a reasonable consumer in that consumer's circumstances, would expect to receive.

156. Dr E considers it unfair to conclude that patients should be explicitly told who is operating in "most" cases, "when there is an equally logical conclusion that can be drawn by reasonable patients … and a simple step reasonable patients can take if they hold concerns about the identity of the person performing the operation". Dr E states that "the reasonable patient in [Mr A's] circumstances would ask if this was an issue of concern". Dr E states that he has spoken to surgical and anaesthetic colleagues in New Zealand and Australia, and the majority state their registrars/trainees usually do significant portions of a procedure under supervision without this being specifically discussed with the patient. Dr E therefore considers his practice is "usual practice or even an acceptable standard of care".

157. Dr E also notes the surgery was being performed in a public training hospital where most patients expect that junior doctors and training specialists will be involved in the treatment process. In addition, the consent form clearly stated that the procedure would be performed by an appropriate, not a specific person. As the form was signed by Mr A, Dr E submits it is reasonable to conclude Mr A had read and understood this, or if he did not read it, that it was not a high priority for him.

158. Dr E states that a craniocervical decompression is essentially a high cervical spinal decompression, and in his view, this is "not a 'serious' operation in the spectrum of neurosurgical procedures".

159. Dr E disagrees with Dr Nye's advice that there was "an apparent lack of instruction given to nursing staff". Dr E states: "Instructions were clear on postoperative orders, the patient was also monitored as per PCA protocol and there is an overriding neurosurgical postoperative care protocol in place."

160. Dr E states that while the oxygen saturation probe is a useful tool it has many downfalls. He notes that oxygen saturation readings need to be considered in context with many other factors, and that "a single reading is essentially meaningless unless accompanied by other clinical concerns".

161. Dr E provided further information regarding his supervision of Dr G and Dr F. He states that registrars are instructed about the requirements for patient care and department protocols, both in writing and verbally. He states that Dr G and Dr F were both instructed as to the requirements of his postoperative orders long before they looked after Mr A. The postoperative orders were "according to" Dr E's expectations and wishes.

162. Dr E notes he was Mr A's initial contact point, and set his treatment plan in action. He states that he "oversaw and supervised the consent process", he was present during the surgical procedure, and he was happy with all stages of the operation.

163. Dr E notes he asked his registrars about Mr A's well-being before leaving the hospital, and that it is his usual practice to have any concerns about patients under his supervision directed to him in the first instance, rather than to the consultant on call. Dr E states that he does not consider the consultant in charge is responsible for "policing the instructions left for junior and nursing staff in the deep hours of the

night and early morning. This is what department and patient protocols are for…". Dr E does not consider there was any lack of supervision on his part.

164. Dr E states that "there is no clear evidence that [Mr A] died of a respiratory event, and […] it could equally have been a (sudden) cardiac or other event". Dr E states there is "definitely no consensus amongst the treating physicians with the [CDHB's] RCA opinion of a possible respiratory event".

Dr F

165. Dr F submits there was no indication that there was any confusion with regard to his postoperative instructions, and as such, he does not consider he should have been expected to clarify his instructions in this specific case. He states that in his experience it is usual practice for postoperative orders to be followed if there is a perceived conflict with the unit's protocol, "that is, where a protocol is expected to be followed, instructions directing staff to follow the specific protocol would normally be prescribed".

166. Dr F states that while he accepts the criticism regarding the lack of specific instructions in the postoperative orders, he considers "it is a reasonable expectation of all medical staff that regular general/vital observations would be performed in *all* postoperative patients regardless of whether they are on a PCA or have had cranial surgery".

167. Dr F also notes his concern regarding the fact that Mr A was found with no oxygen saturation monitor attached and with the monitor switched off. In these circumstances, he states, it is uncertain "whether specific postoperative instructions would have changed or prevented the outcome as prescribed parameters could never have triggered an alert".

168. Dr F notes that he is pleased to hear about the new measures and monitors that have been put in place at CDHB. He considers the "single most important change, which is indispensable, is the reinforcement of *continuous nursing* (including handover within the [SCU])".

RN Ms I

169. RN Ms I's legal counsel, Mr P, notes that RN Ms I conducted many of Mr A's observations on an hourly basis, and she was observing him regularly. Mr P submits that "RN [Ms I's] failure to record [Mr A's] respiratory rate on no more than a few occasions had no influence on the outcome of this tragedy" and was not a causative factor.

170. Mr P states that the advice of my nursing expert, Janet Hewson, that respiratory rates should be recorded at all times, is accepted. He submits that any disapproval of RN Ms I in relation to this matter would be mild, given the other observations undertaken by RN Ms I.

RN Ms J

171. RN Ms J notes she has previously acknowledged that she should have recorded Mr A's respiratory rate each time it was taken. She states she has reflected on her practice and now ensures respiratory rate is recorded each and every time she assesses a patient's vital signs. She suggests changing the neurological observation chart to include a space for recording the respiratory rate, to ensure that it is recorded by all nursing staff at all times.

172. RN Ms J states she did not change the default settings on the bedside monitor.

173. RN Ms J accepts that there were inaccuracies in her documentation of oxygen administration, again notes that this was a genuine mistake, and states that she now re-checks oxygen settings before documenting these.

RN Ms K

174. RN Ms K's legal counsel, Mr P, submits that "the criticisms of RN [Ms K] are unreasonable and unjustified, particularly in regard to the fact that they are not put into context". He states that the criticism of RN Ms K seems disproportionate, given the indications that Mr A had died some time prior to the commencement of RN Ms K's shift.

175. Mr P also states that it is difficult to comprehend how RN Ms K's care could be deemed suboptimal, when the delay in her seeing Mr A occurred because she was attending to a patient in pain.

176. Mr P notes that RN Ms K had been given no cause for concern about Mr A at handover, and she was reasonably entitled to expect that he was connected to the oxygen saturation monitor, which is standard practice, given the surgery that had been performed. Furthermore, RN Ms J had stated at handover that Mr A's saturations had been fine during the previous shift.[34]

Opinion: Introduction

177. Mr A was a fit and active 21-year-old. In late 2008, he was diagnosed with a Chiari malformation, a condition that prevented him from doing physical work. He reduced his physical activity and the symptoms improved. However, Mr A was keen to resume a more active life and return to work. He decided to proceed with surgery. The operation was performed, and Mr A's death less than 24 hours following surgery was wholly unexpected.

178. The exact cause of Mr A's death has not been confirmed. The post-mortem report refers to the possibility of a "functional loss of breathing control while asleep", and

[34] As noted in paragraph 86, RN Ms K recalls being told that Mr A's vital signs were stable. Neither RN Ms J nor RN Ms K advised HDC that the handover information included specific reference to Mr A's oxygen saturations.

CDHB's RCA notes the possibility of "progressive ventilatory failure". It is not my role to determine the cause of Mr A's death. The Coroner has indicated that he will consider this further.

179. We do not know whether Mr A's death could have been prevented. However, in its investigation, CDHB identified a number of factors each of which represented a "lost opportunity" to prevent his death.[35] As outlined below, I consider there were indeed a number of deficiencies in the care provided to Mr A, both by individual staff and by CDHB. In my view, no one action or inaction can be singled out, but together these failings significantly reduced the likelihood of recognising and responding effectively to any deterioration or change in Mr A's condition prior to 7.30am on Day 3.

180. The key issues considered in this investigation are whether Mr A was given sufficient information regarding the proposed treatment to enable him to give informed consent, and whether he received an appropriate standard of care at the hospital over three days in 2009.

Opinion: Breach — Canterbury District Health Board

Introduction

181. I consider that there were failings in the care provided to Mr A by individual staff, and these are outlined below. However, there are also several respects in which Mr A was let down by the processes and practices in place on the ward, and particularly in the SCU. These compromised the ability of staff to provide an appropriate standard of care, and CDHB must bear responsibility for them.

182. My concerns relate particularly to the postoperative monitoring of Mr A, including: the conflict between Dr F's monitoring instructions and the SCU protocol; the failure of nursing staff to check and/or document his respiratory rate; the practice of ending "specialling" prior to the morning medical review; the circumstances in which Mr A was changed to two-hourly observations overnight; and the practice of conducting morning handover for SCU patients in another room. Collectively, these factors resulted in suboptimal care being provided to Mr A.

Failure to document respiratory rate

183. Mr A's respiratory rate was not documented after 5pm on Day 2, and I will comment later on the two nurses directly responsible for this. However, it is concerning that there was no specific place on the "Neurosurgery Observation Chart" to record the respiratory rate. There is reference to respiration at the top of the chart, but unlike the other vital signs noted — blood pressure, pulse, and temperature — no clearly identifiable place to document this. CDHB states that it was usual practice for nursing staff to record respirations as a number at the bottom of the chart. I note that on Mr A's chart, it was recorded (prior to and at 5pm) on three occasions in one place and on two occasions in another place.

[35] See paragraph 114.

184. Ms Pirret, the nursing expert consulted by the legal representative for RN Ms I and RN Ms K, comments on this, noting that it "risks sending messages to nursing staff that the respiration rate is of less importance when compared to other neurological observations". I agree. Ms Pirret further states that while respiration is an important vital sign, it has historically been poorly documented by nurses. My nursing expert, Ms Hewson, similarly notes that it has been found to be "the most neglected vital sign". All the more reason, in my view, for CDHB to ensure its forms are designed to encourage, not discourage, the recording of respirations.

185. I note that the chart has since been redesigned to incorporate the Early Warning Score system, which includes respiratory rate, for the early identification of patients who are at risk or who are deteriorating.

"Specialling"

186. CDHB states that it had become established practice for the "specialling", or the close observation of SCU patients, to cease at the end of the first postoperative night (6am) or at the time of the morning nursing handover (6.45am),[36] rather than at the time of the morning medical review, which was usually at about 9am. This practice evolved in relation to patients who had experienced an uneventful first postoperative night. I consider that this practice was not acceptable. I note also that under this arrangement, a patient who had undergone surgery during the night would also have ceased to be "specialled" at 6am, regardless of how long that patient had been in the SCU.

187. CDHB has now changed this practice, and patients continue to be "specialled" until they have been medically reviewed.

Postoperative monitoring regime

188. There is also the issue of the adherence by nursing staff to the postoperative monitoring regime documented by Dr F. Dr F's instruction was for neurological observations to be checked every 15 minutes for one hour, every 30 minutes for two hours, and then hourly. He did not specify when the hourly monitoring should end, but subsequently told HDC that if there were no concerns warranting an early review, "in general", postoperative instructions are effective until medical review the next morning. However, Dr F also acknowledged that the nursing staff moved to two-hourly monitoring overnight in accordance with the SCU protocol.

189. This protocol, contained in the "SCU Clinical Information & Nursing Management Guidelines", sets out the regime for postoperative neurological observations following posterior fossa surgery: half-hourly observations for four hours, hourly observations for four hours, and then two-hourly observations for four hours or overnight until changed by medical staff. I have some concern that the wording of the instruction in this policy is potentially ambiguous in relation to the need for medical review. CDHB states that it was "usual practice" in the unit to change to two-hourly monitoring overnight if there were no concerns.

[36] The RCA report refers to 6am, while other correspondence to HDC refers to the time of nursing handover, ie, 6.45am.

190. The decision to move to two-hourly observations overnight was therefore consistent with the SCU guideline and usual practice, but not with Dr F's documented regime for Mr A. Dr F's instructions should have taken priority. I would be more critical of the nursing staff in relation to this if it was clearer from Dr F's written instructions that hourly monitoring should continue until the next medical review, and if he had given some explanation as to why his proposed regime differed from the general guideline and usual SCU practice.

191. Given that there was no such explanation, the best course of action would have been for the nurse to seek clarification from Dr F or, if he was not available, from the on-call doctor. There is clearly potential for problems to arise if there is not a clear and shared understanding, documented in the relevant guidelines, in relation to what should occur when the postoperative monitoring regime prescribed for a particular patient differs from the generic instructions and usual ward practice.

192. The responses to my provisional opinion from Dr F, Dr E and CDHB have reinforced my view regarding the potential for confusion. Dr F states that in his experience it is usual for the documented orders (specific to the patient) to take priority where there is "a (perceived) conflict", while Dr E refers to the "overriding neurosurgical postoperative care protocol". CDHB states that Dr F's instructions were explicit and correct, and suggests there was no need for him to specify the end point for observations. However, CDHB has previously stated that Mr A was moved to two-hourly monitoring in accordance with the SCU guideline and usual practice, while Dr F previously stated that postoperative instructions are generally effective until medical review the next morning. The differences between these understandings underline the need for clarity.

193. My neurosurgical expert, Dr Darrell Nye, states that his personal view is that hourly monitoring should have continued for a period of 24 hours postoperatively. Accordingly, he considers the decision to move to two-hourly observations overnight was inappropriate. However, he states further that this is his personal view, that the change to two-hourly observations was consistent with CDHB's neurosurgical guidelines, and that these guidelines are consistent with policies in the neurosurgical units in private and teaching hospitals in Melbourne. My primary concern about the decision to move to two-hourly observations overnight is that it was not consistent with Dr F's apparent intentions.

194. It appears to me that the communication between Dr F and nursing staff in relation to Mr A's postoperative monitoring regime was deficient.

Handover practice

195. CDHB explains that where there were no concerns about a patient's status, it had become usual practice for the nurses responsible for the SCU to attend the ward's morning handover in the seminar room. It does not know why this practice started. RN Ms J states that it had already become usual ward practice by the time of her orientation to the SCU two years earlier. Afternoon and evening handovers for patients in SCU took place in SCU.

196. On Day 3, RN Ms J had no concerns about the patients in SCU and accordingly went to the seminar room at 6.45am to give the handover. (We do not know whether Mr A's respiratory rate would have constituted a concern had this been checked and documented throughout the night.) Her actions were therefore consistent with usual ward practice.

197. However, this suggests a laxity that was not appropriate for the SCU. While holding handover in a different room may be preferable in terms of optimising patient confidentiality and privacy, these issues can be managed by the nursing staff. My nursing expert notes "a picture of delays in 'seeing' the patients first thing". The handover practice that had evolved on the SCU did not support nurses to maintain an appropriate level of surveillance.

Oxygen saturation monitoring

198. There is an important matter that I have been unable to resolve. RN Ms J states that Mr A was on an oxygen saturation monitor throughout her shift, and she believes he was still on the monitor during morning handover. She recalls that the monitor was set to alarm if Mr A's oxygen saturation levels fell below 92%, and the fact that the alarm did not sound during her shift indicated that his oxygen levels did not fall below this level. RN Ms J last saw Mr A at 6.15am. RN Ms K recalls that when she found Mr A at 7.30am, the monitor was switched off and not attached.

199. CDHB states that it is possible for patients to turn monitors off if they have observed staff doing this. Mr A had had a disturbed night and was awake on several occasions. There is nothing in the records or information provided by staff subsequently to indicate that the monitor bothered him.

200. I have been provided with no information to indicate that the monitor was faulty and it is known with certainty that the monitor was on at 5am as recordings were taken at that time. There are a number of other possible explanations as to what occurred subsequently: Mr A got up and turned the monitor off; someone else turned the monitor off; RN Ms J's recollection that Mr A was connected to the monitor throughout her shift is incorrect; or RN Ms K's recollection that the monitor was off is incorrect.

201. It is unlikely that RN Ms K was mistaken. If Mr A had been connected to the monitor and it was on, it would presumably have alarmed when Mr A stopped breathing, some time between 6.35am (when RN Ms J heard Mr A snoring) and 7.30am (when RN Ms K found Mr A unresponsive).

202. Further than this, I have insufficient information to resolve this matter.

203. I note that my neurosurgical expert, Dr Nye, considers continuous oxygen saturation monitoring to be "desirable" for the first 24 hours postoperatively. Ms Hewson refers to the decision as to whether continuous monitoring is necessary as "generally resting with the nurses". She states further that continuous monitoring is desirable in patients who may not breathe deeply, who may breathe too slowly, or who have periods of no breathing. There is no evidence in the records that any of these applied to Mr A.

Nevertheless, according to RN Ms J, her intention was for Mr A to be on continuous monitoring throughout her shift, including when she left the SCU for morning handover.

Summary

204. In my view, a number of practices had evolved in the SCU that were not consistent with the unit's purpose and objectives and did not support the provision of an appropriate standard of care to patients. I accept that the SCU did not provide for the same level of monitoring as an HDU, but it was intended to provide a high standard of specialist nursing care for patients who were "seriously unwell, have the potential to deteriorate rapidly, or who require ongoing and/or escalating physiological monitoring".[37] My breach finding is not based on the premise that Mr A required a more intensive level of monitoring than was expected within the SCU.[38] Rather, it is based on the fact that he did not receive the level of care the SCU was designed and set up to provide. As outlined above, there were a number of organisational issues that impacted adversely on the quality of the postoperative care provided to Mr A in the SCU, and conspired to create an unsafe situation, in which appropriate monitoring did not take place. I note in particular the observation chart with no specific place to document respiratory rate; the practice of ending "specialling" prior to the morning medical review; the circumstances in which Mr A was changed to two-hourly observations overnight, including the conflict between Dr F's instructions and the SCU protocol; and the practice of conducting morning handover for SCU patients in another room. Accordingly, I find that CDHB did not take reasonable actions in the circumstances to ensure that services were provided to Mr A with reasonable care and skill, and breached Right 4(1) of the Code.[39]

205. The efforts made by CDHB to identify the factors that may have caused or contributed to suboptimal care in this situation, and the changes it has initiated to improve patient care, are to be commended.

Opinion: Dr E

Diagnosis and proposed treatment— No breach

206. Dr E diagnosed Mr A with a Chiari malformation in 2008. It is evident that there is a lack of consistency in the literature and among clinicians with regard to the categorisation of Chiari malformations. I accept the advice of my neurosurgical expert, Dr Darryl Nye, that Mr A was diagnosed correctly by Dr E and that the proposed treatment was appropriate.

[37] See footnote 17.
[38] Although I note that the decision has now been made to admit all patients undergoing cranio-cervical surgery to ICU for 24 hours postoperatively.
[39] See footnote 3.

Information and consent — proposed treatment — No breach

207. Under Right 6(1)(b) of the Code, Mr A was entitled to the information that a reasonable patient in his position would expect to receive, including an explanation of the options available, an assessment of the expected risks, side effects, benefits and costs of each option.[40] Under Right 7(1), services should have been provided to Mr A only if he had made an informed choice and given informed consent.[41]

208. Overall responsibility for ensuring Mr A was provided with sufficient information about the proposed treatment and obtaining informed consent lay with Dr E. As stated in a leading text: "Ordinarily each member of the team of doctors will be deemed to have separately undertaken the care of the patient when so assigned by the responsible consultant. However, the consultant as leader of the team remains responsible throughout…".[42]

209. When Dr E diagnosed Mr A with a Chiari malformation in 2008, he concluded that this would best be managed by surgery. Dr E states he did not go through the consent process at this point, but he noted in his letter to Dr D that he had outlined the risks and benefits of the procedure to Mr A.

210. On the day before surgery, Dr F initiated the written consent process. It was clear at the end of Dr F's discussion with Mr A, that Mr A had reservations about the surgery. Dr F did not ask Mr A to sign the consent form at that point, but suggested a further discussion after Mr A had had the opportunity to consider the information Dr F had provided.

211. When Dr E was informed of the situation, he went to speak with Mr A himself. Dr F and Dr G were also present, but Mrs C was not.

212. Dr E made it clear to Mr A that he did not have to have the surgery, noting that now that he had a desk job he was relatively asymptomatic, it would therefore be reasonable to have a period of "expectant observation". Dr E and Dr F both recall that Mr A's initial decision was to not proceed with the surgery, but that he then changed his mind. Dr E states that he reiterated that Mr A would be no better than he was then (clinically asymptomatic) and that the only benefit would be his likely return to physical exercise. Dr E was satisfied with the explanation of risks that Dr F had given to Mr A earlier (as documented by Dr F).

213. It is not possible to determine whether, following his initial discussion with Dr E four months earlier, Mr A had understood that the proposed surgery was not minor. However, it is evident that he did understand this following his initial discussion with Dr F. Mr A clearly had concerns, and was particularly anxious about the possibility of

[40] Right 6(1) — Every consumer has the right to the information that a reasonable consumer, in that consumer's circumstances, would expect to receive, including [...] (b) an explanation of the options available, including an assessment of the expected risks, side effects, benefits, and costs of each option.
[41] Right 7(1) — Services may be provided to a consumer only if that consumer makes an informed choice and gives informed consent, except where any enactment, or the common law, or any other provision in this Code provides otherwise.
[42] Kennedy, I. and Grubb, A. *Medical Law* (London: Butterworths, 2000), p 281.

paralysis. He had the opportunity to think about his situation, to discuss it with family, and to speak with his GP, before speaking with the responsible surgeon, Dr E. Mr A also had the opportunity to consider the matter further that evening after speaking with Dr E, and he was able to withdraw his consent.

214. I consider it is likely that Mr A was aware that the proposed surgery was not minor and that he knew it was not essential or urgent. It was made clear that surgery may not fix his problem with headaches, and I consider it reasonable to conclude that he would have understood that if the problem was not fixed, he would be unable to return to work. Although respiratory depression was not specified as a possible complication, other potential serious surgical complications were discussed and documented. It was made clear that there was a risk of death, even if the word "death" was not used. The consent for anaesthesia also noted the potential for rare and serious complications. The risk of serious complications was considered low.

215. The cause of Mr A's death is not known. CDHB submitted that respiratory failure after Chiari malformation surgery is not common or well-known.

216. I note the advice of my neurosurgical expert, Dr Nye, that respiratory depression is not among the most common complications of this type of surgery, and that the "frequency of the occurrence of respiratory depression as a complication of posterior fossa cranial surgery relates to at least in part the magnitude of the procedure undergone which in this instance would not be considered great". I note also Dr Nye's view that there were no other treatment options that should have been discussed with Mr A, aside from that which was discussed — the period of expectant observation.

217. It is evident that Mr A gave careful consideration to the information he had been given, understood that he did not have to proceed with surgery, and did not give his consent lightly. I consider that he appreciated the seriousness of the procedure and its associated risks. Ideally he should have been informed of the risk of respiratory depression, but overall I find that Mr A was provided with adequate information in relation to the nature of the surgery and its risks.

218. I note that the consent process for this type of surgery at CDHB now specifies the risks of respiratory depression and death.

Information and consent — involvement of trainee neurosurgeons — Other comment

219. Dr E and Dr F have provided detailed accounts of the consent process undertaken with Mr A. However, there is one issue in relation to preoperative information that was problematic: Dr E did not inform Mr A that the surgery was to be performed by Dr G and Dr F.

220. Mrs C states that she and her son were under the impression that Dr E would be performing the surgery personally. Dr E said that he did not tell Mr A that he would be performing the surgery, nor did he state the opposite. In his response to my provisional opinion, Dr E states that Mr A could have asked who was doing the surgery if he was concerned about this, and the fact that he did not do so indicates he was not as concerned as Mrs C suggests. Dr E notes that the relevant consent form

also gave no assurance as to which doctor would be performing the surgery; simply that the doctor concerned would be appropriately experienced.

221. Dr E told HDC that, if asked, he would have told Mr A that his surgery would be performed using a "team approach" and that given the involvement of Dr E, Dr G and Dr F in the consent and preoperative process, it is reasonable to conclude that Mr A may have understood that a team approach would be taken, with Dr E leading that team. This is, in fact, what occurred. Nevertheless, while it may be open to me to interpret what occurred as possibly consistent with Mr A's understanding, Dr E never expressly advised Mr A that Dr G and Dr F would actually be performing his surgery (albeit under Dr E's direct supervision).

222. Dr F provided the initial information to Mr A about the procedure and its potential risks. In response to my provisional opinion, Dr E submitted that "the fact that the registrar did the informed consent would, I suggest, lead any reasonable patient to conclude that the operation would not entirely or even partially be performed by me". However, Dr E responded to Mr A's concerns and provided further information and reassurance. This involvement could have led Mr A to believe that Dr E was performing the surgery. Certainly, there was no information provided to indicate to Mr A the extent of Dr G's involvement.

223. In his response to HDC, Dr E asserted that, given the post-mortem findings did not point to any surgical mishap, it was not relevant whether or not Mr A was aware of the precise makeup of the surgical team. There is no suggestion in this case that the operating surgeon lacked capability and the evidence is that the operation was technically sound. However, a patient considering surgery always has the right to receive the information that a reasonable patient in that patient's circumstances would expect to receive. In many circumstances, this will include information as to who will be performing that surgery.

224. In response to my provisional opinion, CDHB submitted that the identity and qualifications of the provider are not matters listed under Right 6(1) of the Code. I note that by virtue of the word "includes", the specific items of information listed in Right 6(1)(a) to (g) are examples of such information and are not an exhaustive list. Furthermore, Right 6(1) relates to information that the patient has the right to receive and does not require that the patient requests the information.

225. I do not accept that if a patient fails to ask who will perform their surgery this implies that this is not information that a reasonable patient in that patient's circumstances would expect to receive.

226. Dr E submitted in response to my provisional opinion that most patients having operations in a public training hospital "expect that junior doctors and training specialists will be involved in the treatment process". Patients may not necessarily be aware that a hospital is a training hospital and, even if they are aware of this, this does not mean the patient knows that the involvement of trainees "in the treatment process" will extend to trainees performing their surgery.

227. Given the serious nature of this surgery, the prudent course would have been to discuss the role of the trainee neurosurgeons and the extent of Dr E's supervision. The surgery may not have been at the complex end of neurosurgery, but this was surgery under general anaesthetic to relieve pressure on the brain. The rare but serious risks discussed and documented included neurological deficit, stroke, an acute heart event, and the risks of anaesthesia. In my view, most consumers would regard it as serious surgery.

228. CDHB considers there are "potentially significant practical implications" arising from any suggestion that Dr E should have informed Mr A that his surgery was to be performed by Dr G and Dr F, but does not explain what the implications are. In my view, there was ample opportunity to indicate how the team was to operate, and I consider it would have been better to do so.

229. As outlined above, Mr A was anxious about the surgery and had doubts about whether to proceed, in light of the risks. The surgery was elective and not urgent. I consider that a reasonable consumer in Mr A's circumstances (which were that he was facing elective surgery to relieve pressure on his brain and had expressed doubts whether to proceed with the surgery) would expect to be told that the surgery was going to be undertaken by neurosurgical trainees, rather than the consultant neurosurgeon. However, in this case there remains a degree of ambiguity about what was implied to Mr A. In these circumstances, I would expect patients to be informed as to who will be performing their surgery.

Surgery — No breach

230. Although the surgery was performed by Dr G and Dr F, Dr E had overall responsibility for the surgery and postoperative care of Mr A.

231. Dr Nye considers that that on the basis of the documentation,

> "…an appropriate procedure was performed in a technically sound manner by a senior neurosurgical registrar trainee under direct observation of the responsible surgeon. The standard of treatment in this regard could not be questioned and this is supported by the absence of any post mortem finding indicating a direct surgical complication such as haemorrhage, brain swelling, infarction or direct injury to neural structures."

232. I find no evidence that the surgery was not performed appropriately.

Postoperative care — Other comment

233. Dr E also had overall responsibility for Mr A's postoperative medical care, and it is here that several problems emerged. Dr Nye notes that this was the responsibility of both Dr E and Dr F, and I will comment further on Dr F in the next section. However, as the consultant surgeon, Dr E's responsibilities included oversight of the postoperative care provided by the trainee neurosurgeons under his supervision. This included the postoperative instructions documented by Dr F.

234. In response to my provisional opinion, Dr E stated that Dr G and Dr F had been instructed about Dr E's requirements for postoperative orders and that, in this case, the orders were in accord with his expectations and wishes. Dr E said he told the registrars that he was to be contacted if concerns about Mr A arose during the night and that he was available to be contacted at any time. Dr E said: "I do not see this as a lack of supervision."

235. Dr Nye considers that there were deficiencies in relation to "an apparent lack of instruction given to nursing staff regarding the postoperative care of the patient". He refers specifically to the monitoring of Mr A's respiratory rate and oxygen saturation levels. Dr E responded that the postoperative orders contained clear instructions, Mr A was monitored as per the PCA protocol and there was an overriding neurosurgical care protocol in place. He said he does not think that a consultant is expected to be "policing the instructions left for junior and nursing staff in the deep hours of the night and early morning".

236. Dr Nye considers firstly that given the nature of the surgery, specific instruction should have been given regarding the observation of respirations. I accept Dr Nye's advice, but in addition, I consider that the need to monitor Mr A's respiratory rate should have been quite apparent to the nurses responsible. It is clear from CDHB's response to this complaint as well as the advice from my nursing expert, Janet Hewson, that nursing staff should have known to check and document Mr A's respirations. The postoperative instructions documented for Mr A included "neuro obs". The PCA protocol includes a requirement to monitor respiratory rate. The generic guidelines for the postoperative care of patients who have had posterior fossa surgery include observations. In these circumstances, I consider that the treating doctors should reasonably have expected that Mr A's respiratory rate would be checked and documented as part of the "neuro obs", along with his other vital signs.

237. Dr Nye also considers that the response required in the event of falling oxygen saturation levels, on the basis of continuous pulse oximetry, should have been specified by the treating surgeons. He states that 24-hour oxygen saturation in this situation is "desirable", and considers that an oxygen saturation level lower than 95% should have prompted follow-up. The postoperative instructions for Mr A included no specific instruction with regard to oxygen saturation levels, but there was an instruction to "notify any concerns". In this sense, the required response was specified; the issue is whether the nurses were given sufficient guidance in relation to what constituted a concern.

238. I note the advice from Ms Hewson that the need for continuous oxygen saturation monitoring is usually a nursing decision. I note also the advice from CDHB that appropriate parameters are to be established for the postoperative monitoring of all patients who have undergone cranio-cervical surgery for a Chiari malformation. I accept that had nursing staff been provided with more specific instructions in relation to oxygen saturation monitoring, RN Ms J may have been prompted to seek medical advice when Mr A's rate fell to 94% at 5am. However, in response to the provisional opinion, Dr E stated that a single reading of 94% "is not on its own a concern as it is clear in HDU and ICU scenarios that saturation monitors alarm all the time". He

stated that it was necessary to assess the saturation reading in context with many other factors and that a single reading is essentially meaningless.

239. I do not consider that the lack of a more specific instruction with regard to oxygen saturation monitoring was a departure from expected standards that warrants a breach finding in relation to Dr E.

240. I have commented further on the decision to move to two-hourly observations in my findings in relation to CDHB and Dr F. As outlined in paragraphs 188–194 and 246–249 I have some concerns about this. However, overall, I consider that Dr E's oversight of Mr A's postoperative care was adequate.

Opinion: Dr F

Information and consent — No breach

241. As noted above, Dr E had ultimate responsibility for ensuring that Mr A was provided with adequate information about the proposed treatment and that appropriate steps were taken in relation to informed consent. The written consent process was initiated by Dr E's registrar, Dr F.

242. Dr F met with Mr A to undertake the written consent process on the day of his admission to hospital and the day before the planned surgery. Mrs C was also present. Dr F explained the procedure in detail, referring to Mr A's MRI scans, and using models to support his explanation. He explained that there was a risk that the surgery may not alleviate the headaches. Dr F then explained the risks, which included the risk of serious complications. They included general risks, risks specifically associated with surgery in this area, and the risks associated with general anaesthesia. Dr F recalls that although he did not specify respiratory depression or use the word "death", he referred to the risk of "breathing difficulties", and a "risk to life".

243. As a result of this discussion, Mr A had significant reservations about the surgery. He was particularly concerned about the risk of paralysis. Mrs C recalls that Dr F confirmed that her son was not committed to the procedure. Dr F states that in light of Mr A's concerns, he did not allow him to sign the consent form at that point. It was agreed that Mr A should consider his situation for a few hours, before meeting again for a further discussion.

244. Dr E was informed of Mr A's concerns, and met with Mr A for the subsequent discussion. Dr F was also present (along with Dr G), but the discussion was led by Dr E.

245. I am satisfied that Dr F took appropriate action when it was apparent that Mr A had reservations about the surgery, by suggesting he think about this for a time before discussing it further. Mr A's reservations were conveyed to Dr E. Accordingly, I do not consider Dr F breached Mr A's rights under the Code in relation to informed consent.

Postoperative care — other comment

246. The postoperative instructions were documented by Dr F, who states that the instructions were consistent with his usual regime. Mr A's surgery had been completed without any difficulties, so he found no reason to depart from this.

247. I have commented in paragraphs 235–238 above on the adequacy of the postoperative instructions given to nursing staff with reference to respiratory rate and oxygen saturation monitoring.

248. I have also commented in paragraphs 188–194 on the instructions from Dr F in relation to neurological observations. Dr F requested observations every 15 minutes for one hour, every 30 minutes for two hours, and then hourly. Dr F states that "in general" postoperative orders are effective from the immediate postoperative period until the surgeon's ward round review the following morning. However, it was unit protocol and usual practice in the SCU for patients to move to two-hourly monitoring overnight if there was no cause for concern. Given that Dr F's expectation in this regard appears to have been different from the unit protocol and usual ward practice, clearer instruction was needed. In response to my provisional opinion, Dr F stated that there was no indication from staff that there was confusion about the postoperative neurological orders and it was his experience that if the protocol was to be followed rather than the postoperative orders, staff would be instructed accordingly.

249. I remain of the view that if Dr F did not want Mr A to be moved to two-hourly monitoring until further medical review, he needed to make this clear, preferably noting the rationale. However, I accept that the usual practice was that nursing staff should follow the postoperative neurological orders and that Dr E stated that the orders were in accord with his expectations and wishes.

Opinion: RN Ms I

Postoperative care — Adverse comment

250. RN Ms I was the nurse allocated to look after Mr A from 2.30pm until 10.30pm on Day 2. She received a handover from the nurse finishing the morning shift, at Mr A's bedside. RN Ms I checked and documented Mr A's neurological status hourly throughout her shift, but there were some omissions in the checking and recording of his vital signs. Most notably, RN Ms I did not check and record Mr A's respiratory rate after 5pm.

251. The generic "Neurosurgical Postoperative Guidelines" allowed for Mr A to be moved to two-hourly observations from 7pm. However, Dr F's instructions for Mr A indicated that he should remain on hourly observations. In addition, Mr A was on a PCA, which meant his sedation score, oxygen saturations, and respiratory rate should have been checked hourly for the first 12 hours postoperatively — ie, until 11pm.

252. In these circumstances, RN Ms I should ideally have spoken with Dr F or an on-call doctor to check whether it was reasonable to move to two-hourly observations in

accordance with the generic guidelines. Until she had done so, RN Ms I should have adhered to Dr F's instructions. I note that although Mr A's sedation score was not documented at 9pm or 10pm, it is clear from the notes that Mr A was alert because it was during this time that RN Ms I was attending to Mr A in relation to the difficulty he was having urinating.

253. I note RN Ms I's comments that during the evening Mr A was alert and interacting with people. This is consistent with Mrs C's recollection that when she left the hospital just before 9pm, her son was awake, conversational, alert, and in good humour. I note also RN Ms I's comment that it is not difficult to assess if a patient is having difficulty breathing and at no point was this the case for Mr A.

254. However, as my nursing expert Janet Hewson explains, while sedation scores and the Glasgow Coma Scale were documented regularly, this did not absolve the nurses from deliberately counting respirations. It was important to know whether Mr A's respiratory rate was trending up or down — a key aspect of clinical judgement and decision-making. Ms Hewson states that for patients in the SCU, whose condition may change suddenly or slowly over a period of hours, "the most significant competency the nurse will have is that of surveillance. Regular, purposeful looking at your patient and watching for signs and symptoms of change are the hallmark of nursing practice in a SCU". Ms Hewson also notes that while measurement of respiratory rate requires no complex technology, it is the most difficult vital sign to obtain, and it takes deliberate attention and patience on the part of the clinician.

255. There were several CDHB forms relevant to Mr A's care that specify respiratory rate as a parameter to be measured and documented. These include the "Neurosurgery Observation Chart" and the "PCA Chart". As outlined in my findings in relation to CDHB, I am concerned that while the "Neurosurgery Observation Chart" showed respiration as one of the vital signs to be recorded, there was no clearly identifiable place to document this (see paragraphs 183–184). Nevertheless, it is evident that nursing staff knew that observations should have included respiratory rate.

256. The fact that Mr A was on a PCA was a further reason for RN Ms I to have checked and recorded this more frequently than she did.

257. Submissions made on behalf of RN Ms I in response to my provisional opinion emphasise that RN Ms I's failure to record the respiratory rate had no influence on the outcome. That is not the issue. The issue is whether RN Ms I provided services to Mr A of an appropriate standard.

258. RN Ms I's entry in the progress notes at the end of her shift indicated that Mr A was now on two-hourly observations. This was consistent with usual ward practice and the SCU protocol, but not consistent with the specific instructions given by Dr F. My concerns about this issue have been addressed in my findings in relation to CDHB and Dr F.

259. In summary, my primary concern in relation to RN Ms I is her failure to check and record Mr A's respiratory rate. In addition, I consider that given the postoperative

instructions documented for Mr A regarding monitoring frequency, RN Ms I should have checked with a doctor before changing Mr A to two-hourly monitoring. However, her actions need to be considered in the context of other relevant factors, as outlined above.

Opinion: RN Ms J

Postoperative care — Adverse comment

260. RN Ms J looked after Mr A from 10.30pm on Day 2, until morning handover the following day. It had been noted by RN Ms I at the end of her shift that Mr A was now on two-hourly observations. The PCA standing order to record Mr A's sedation score, oxygen saturations and respiratory rate changed from hourly to four-hourly soon after the start of RN Ms J's duty.

261. RN Ms J checked and documented Mr A's neurological status, pulse, oxygen saturations, temperature, blood pressure and sedation score at 11pm on Day 2, and then at 1am, 3am, and 5am on Day 3. However, RN Ms J did not document Mr A's respiratory rate at any time throughout her shift. RN Ms J states that she checked Mr A's respiratory rate while taking his blood pressure, and recalls that on each occasion it was within the normal parameters.

262. I refer again to the comments of my nursing expert, Ms Hewson, in relation to the importance of careful surveillance, including monitoring of respiratory rate, as detailed in paragraphs 254–255 above. These are similarly relevant to RN Ms J. Even if RN Ms J checked Mr A's respiratory rate as she states, not documenting those observations means it was not possible for her, or the nurse on the next shift, to discern any trend. RN Ms J's monitoring and documentation of Mr A's status was therefore incomplete. Mr A's respiratory rate could have been within the normal parameters but still trending downwards.

263. The submissions made on behalf of RN Ms J in response to my provisional opinion state that she has acknowledged that she should have recorded Mr A's respiratory rate each time it was taken and that she has reflected on her practice and now ensures that all vital signs are recorded.

264. Again, I note my concern that the absence of a specific place on the "Neurological Observation Chart" to record respiratory rate may have encouraged nurses to consider this was of lesser importance than other vital signs (see paragraphs 183–184).

265. There were also inaccuracies in RN Ms J's documentation of Mr A's oxygen administration, which she has acknowledged. RN Ms J stated that this was a "genuine mistake". The oxygen administration had been reduced from 5L/min to 3L/min by RN Ms I during the afternoon shift, and was documented accordingly. It was recorded by RN Ms J on the "Neurological Observation Chart" at 3L/min, but on the "Neuroscience Documentation of Care" and in the progress notes at 4L/min. RN Ms J's recollection is that it was being administered at 3L/min and that the observation

chart was correct. There is no evidence that these inaccuracies impacted on the care provided to Mr A.

266. RN Ms J had no concerns about the status of the patients in the SCU at the time of the nursing handover. She believed Mr A was on a monitor with an alarm that would sound if his saturation levels fell below 92%. Accordingly, she attended the ward handover meeting in the seminar room. While the basis on which she concluded that there were no concerns about Mr A was flawed (due to the incomplete monitoring and recording of his respiratory rate overnight), her decision regarding handover location was consistent with usual ward practice. I have commented further on this in my findings in relation to CDHB.

267. My main concern in relation to RN Ms J is that the monitoring and documentation of Mr A's respiratory rate throughout her shift was incomplete. The inconsistent recording of the oxygen rate is also noted. Nevertheless, in the circumstances, I do not consider a finding that RN Ms J breached the Code to be warranted.

Opinion: RN Ms K

Patient observation — Adverse comment

268. RN Ms K came on duty at 6.45am on Day 3, attending the handover meeting in the seminar room from 6.45am to 7.05am. RN Ms K received the handover of Mr A's care from RN Ms J. Both nurses are agreed that there was nothing in the information RN Ms J provided to RN Ms K at this time to indicate any cause for concern in relation to Mr A. RN Ms K cannot be held responsible for the fact that this information was based on the incomplete assessment and recording of Mr A's vital signs.

269. Ms Hewson has raised a general concern about the possible delays that occurred at handover time, and a specific concern in relation to RN Ms K's prioritising of the patients in SCU after handover.

270. RN Ms K provided further details of her actions following the handover, and her recollection of the time that elapsed before she entered SCU. RN Ms K states that on this morning there were no particular concerns about workload or patient allocation, so she was in the nursing office for about one minute only. She then collected the clinical notes, drug charts and observation charts, checked that there were no intravenous medications due at 7am, and proceeded to SCU. Bearing in mind my earlier comments in relation to the matter of the SCU handover being held in another room (paragraphs 195–197), I accept that RN Ms K was not, by her own actions, unduly delayed at this point.

271. With regard to RN Ms K's actions on entering SCU, there is some disagreement as to whether these were reasonable.

272. All three patients in SCU were due to be checked at 7am. RN Ms K states that the patient with the highest priority was the patient who had most recently returned from surgery — the patient in bed space three. When RN Ms K first entered, she observed that this patient was sleeping and she noted that his pulse and oxygen saturations were well within acceptable levels.

273. The curtain had been pulled around Mr A's bedspace to prevent the night light shining in his face. RN Ms J states that throughout her duty, the curtain was drawn but with a gap such that she was able to see Mr A when she was sitting at the nurses' station. RN Ms K states that when she entered SCU for the first time, the curtain around Mr A was closed if not fully, then at least to the point that she was unable to see Mr A from where she was standing. She states further that although it was not her practice to allow patients in SCU to have the curtains closed for any length of time, it was not unusual for this to occur for short periods of time when patients wanted a degree of privacy.

274. Ms Hewson states that RN Ms K's actions on entering SCU were unreasonable. One patient was ambulatory. One patient was visible, as was his monitor. The third patient, Mr A, was not visible. Ms Hewson considers RN Ms K should have verified Mr A's condition in the first instance. CDHB also notes that RN Ms K had no reason to be concerned about Mr A, but acknowledges that she should have sighted all of the patients in the room before becoming involved in the provision of care. Ms Pirret, the nursing expert consulted by RN Ms K's legal representative, submits that RN Ms K's actions at this time were reasonable on the basis that the information provided at handover gave no reason to be concerned about Mr A.

275. I appreciate that having been given no information at handover to suggest any cause for concern about any of the three patients, the highest priority for RN Ms K was the patient who had most recently returned from surgery. However, I agree with Ms Hewson and CDHB, that RN Ms K should have visually observed all of the patients in the room before becoming involved in their care. The curtain had been pulled around Mr A's bedspace to prevent him being disturbed by the light. It had apparently not prevented Mr A from being observed by RN Ms J during her shift, because she was seated at the nurses' desk. RN Ms K was in a different position, and the curtain did prevent her from sighting Mr A. I agree that RN Ms K's judgement in this regard was poor, but in my view, this must be seen in the context of the concerns I have previously outlined in relation to the functioning of the SCU at this time, and the handover advice that Mr A was stable.

276. I note also RN Ms K's actions on finding Mr A unresponsive. She explains that her first instinct was to go back to what she had been taught for years, namely the ABC resuscitation process. She states that she is fully aware that the new guidelines emphasise cardiac compressions over artificial respirations. I accept RN Hewson's advice that it is understandable that RN Ms K reverted to previous practice in this stressful situation. Once she saw Mr A, RN Ms K raised the alarm immediately and help arrived promptly.

277. In its responses to my provisional opinion, RN Ms K's legal counsel, Mr P, and CDHB submitted that it is unreasonable to comment adversely on RN Ms K, given the context of her involvement with Mr A, including the indications that he had died prior to the start of her shift. RN Ms N states that when she entered the SCU, she thought Mr A looked as though he had already died. However, RN Ms M, states that when she arrived, Mr A was deeply unconscious but not cold. Given this conflict, there remains a degree of uncertainty with regard to Mr A's condition at the time resuscitation commenced.

278. In addition, Mr P states that it is difficult to comprehend how RN Ms K's care could be said to be suboptimal when she was attending to a patient in pain. In fact, RN Ms K attended first to the ambulant patient, who she states was keen to be discharged and had some questions about this. CDHB states that RN Ms K "quite rightly" attended first to the patient who sought nursing help. However, it previously acknowledged that RN Ms K should have sighted all patients before becoming involved in the provision of care.

279. Mr P submitted that it was arguable that, had RN Ms J sighted Mr A at the start of her shift, "the outcome would have been any different" (sic). It is accepted that had RN Ms K checked Mr A when she first entered the SCU and initiated the emergency response sooner, the outcome for Mr A may have been no different. However, as stated above, that is not the issue. The issue is whether the failure to sight all patients was a departure from the expected standards of a registered nurse. I remain of the view that RN Ms K should have sighted Mr A when she first entered the room.

280. In summary, the care provided to Mr A by RN Ms K was, in the respects identified above, suboptimal. Her failure to check her patient on entry to the room reflects a poor choice within a pattern of prior decisions by others (as to monitoring), reassuring information that his condition was stable, and a culture that had subtly eroded the acuity with which patients were regarded. It forms part of, and was informed by, a pattern of suboptimal performance in the SCU, and in these circumstances is appropriately seen as part of an overall failure by the service to provide the care that Mr A needed.

Recommendations

281. As previously noted, CDHB's efforts to identify the factors that may have contributed to Mr A's death, and the changes it has initiated to reduce the likelihood of a similar event occurring again, are to be commended.

I recommend that CDHB:

- provide to HDC by **19 September 2012** a written apology for forwarding to Mr A's family.

- provide to HDC by **30 October 2012** a further update on action taken in relation to the recommendations from the RCA and this investigation, including:
  a. details of the parameters for the postoperative monitoring of all patients who have undergone cranio-cervical surgery for a Chiari malformation;
  b. a copy of the revised "Neurosurgery Observation Chart";
  c. a copy of the criteria for determining when a patient should transition from the PCU to Intensive Care for more intensive care.
- advise HDC by **30 October 2012** of any action taken or planned to ensure nursing and medical staff are clear about their responsibilities where there are discrepancies between the medical instructions given for a specific patient and a generic ward protocol or usual ward practice.
- undertake an audit of the postoperative instructions for patients in the SCU, and of compliance with instructions by nursing staff, and forward the results to HDC by **30 October 2012**.

Follow-up actions

- A copy of the final report will be sent to the Coroner.

- A copy of the final report with details identifying the parties removed, except CDHB and the experts who advised on this case, will be sent to the Medical Council of New Zealand and it will be advised of the names of Dr E and Dr F.

- A copy of the final report with details identifying the parties removed, except CDHB and the experts who advised on this case, will be sent to the Nursing Council of New Zealand and it will be advised of the names of RN Ms I, RN Ms J and RN Ms K.

- A copy of the final report with details identifying the parties removed, except CDHB and the experts who advised on this case will be sent to DHB Shared Services (formerly DHBNZ) and placed on the Health and Disability Commissioner website, www.hdc.org.nz, for educational purposes.

Appendix 1 — Independent advice — Neurosurgical care

The following expert advice was obtained from neurosurgeon Dr Darryl Nye

"I respond to your request and instruction and provide a report concerning the above matter following assessment of all documentation forwarded.

I am a Specialist Neurosurgeon and have practised in this capacity from 1974 in Melbourne, Australia. I graduated M.B., B.S. from Melbourne University in 1963 and subsequently trained in Neurosurgery at St Vincent's Hospital in Melbourne and obtained the Diploma Fellowship of the Royal Australasian College of Surgeons by examination in Neurosurgery in 1971. I undertook post graduate training in the United Kingdom with Registrar and Senior Registrar positions in the Neurosurgery Department of The Manchester Royal Infirmary in 1972 and 1973, and have subsequently practised in Melbourne in all fields of Neurosurgery. I was appointed to the Court of Examiners Royal Australasian College of Surgeons in 1986 and was the Senior Examiner in Neurosurgery from 1995 to 1997. Currently I have a Consultant Appointment to St Vincent's Hospital and am accredited to practice in St Vincent's and Mercy Private Hospital in Melbourne. In 2009 I was appointed to the Peer Review Panels of WorkSafe Victoria, and the Transport Accident Commission of Victoria.

I am a Senior Member of the Neurosurgical Society of Australia and New Zealand.

I acknowledge that I have read the Code of Health and Disability Services Consumers' Rights document and the Guidelines for Independent Advisors, and that there is no conflict of interest.

The following documentation was provided:
[List of documents reviewed omitted for brevity]

BACKGROUND
[Summary of events as omitted for brevity]

Prior to addressing specific questions posed the following comments are made in relation to the care provided to the patient (consumer).

DIAGNOSIS
The patient was correctly diagnosed on clinical and radiological grounds to have symptomatic Chiari type 1 congenital/developmental anomaly with descent of the cerebellar tonsils through the foramen magnum, unassociated with dysraphism. The literature is confusing with respect to classification of higher grades of this condition and this may have resulted in some misinterpretation of literature reports by the complainant.

TREATMENT PROPOSAL
The proposal for surgical treatment of the condition by posterior cranial fossa and foramen magnum and C1 arch decompression and duraplasty was appropriate.

INFORMED CONSENT
On the information available I am satisfied that informed consent was obtained from an adult male competent patient prior to surgery being consistent with the principles stated in the Code of Health and Disability Services Consumers' Rights document.

I am of the view that proper and adequate information was conveyed to the patient being a reasonable person capable of making a reasonably informed decision regarding the undergoing of the recommended procedure.

I believe that "material" risks of the proposed procedure were stated and that the patient's temperament, health, personality and level of understanding were considered in the consenting process which I believe was valid.

There is a possibility of a fatal complication occurring following any neurosurgical procedure of the magnitude suggested to the patient in this instance, however in consideration of an acceptable low risk provision of detailed information regarding such a possibility is not, in my opinion, essential to the consenting process and could in an anxious and apprehensive patient lead to a decision not to undergo surgery and to the patient's detriment.

SURGICAL PROCEDURE
The documentation indicates that an appropriate procedure was performed in a technically sound manner by a senior neurosurgical registrar trainee under direct supervision of the responsible surgeon. The standard of treatment in this regard could not be questioned and this is supported by the absence of any post mortem finding indicating a direct surgical complication such as haemorrhage, brain swelling, infarction or direct injury to neural structures.

POST OPERATIVE CARE — ANALGESIA/OBSERVATIONS
The use of patient controlled analgesia is an accepted technique for patients undergoing surgical treatment as employed in this case. The opiate Morphine was administered in a standard dose and the total dose administered was well within accepted levels, and in the hours prior to the patient's death use was limited, … [comments deleted as not relevant to the advice sought].

Notwithstanding the above comments monitoring of patients using PCA is essential in detection of adverse reactions or dose excess with consequences particularly respiratory depression and altered conscious state. It is currently recommended that observation of both respiration and arousal level be used in combination for purposes of monitoring, and in this instance it is apparent that the former was not the subject of specific observation and recording and this may have contributed to an unawareness of deterioration in respiratory function albeit unrelated to the PCA technique.

With respect to the recording of patient arousal levels I would express surprise that with the protocol used, the sedation score recording of level 4 (normally sleepy, easy to rouse) did not require specific response, but the lower recording of 3 (somnolent,

difficult to arouse) did indicate a response requirement by nursing staff. However in this instance if the correct protocol recommendations were adhered to at the time of assessment the nursing staff actions were consistent with the protocol requirements.[43]

PULSE OXIMETRY OXYGEN SATURATION

Pulse oximetry oxygen saturation recording post surgery is considered appropriate following surgery of the type undergone and analgesic technique employed, however no specific instruction was identified in regard to action to be taken if falling levels were recorded.

In this instance, the nursing notes record a fall in saturation to 94% at 5.00am from a level of 98% previously observed, and in a patient administered intranasal oxygen this fall is significant of an impairment of respiratory function. It appears that the significance of this fall in saturation was not appreciated.

It is noteworthy that subsequent to the incident under consideration a Root Cause Analysis has resulted in a change in protocols used at the treating Hospital.

[Section deleted as not relevant to advice sought]

RESPIRATORY FAILURE POST SURGERY FOR CHIARI MALFORMATION

There is literature evidence (reports) of respiratory failure due to central control disturbance of respiration following surgery for CM with adverse and fatal outcome unassociated with any direct surgical complication.

In response to specific matters raised in your request for advice I offer the following comments.

1. Please comment generally on the standard of care provided to [Mr A] at [the] Hospital [on Days 1-3].

The preceding comments have addressed a number of aspects regarding the standard of care provided to the deceased at [the] Hospital from [Day 1-3].

I would further state that I consider the decision to provide [Mr A's] post operative care in the Special Care Unit was appropriate, and consistent with current standards of management of patients following neurosurgical procedures as undergone in this instance.

Comment has been made with respect to an apparent lack of instruction given to nursing staff regarding the post operative care of the patient and I refer particularly to observations of respiration, and response to altered levels of oxygen saturation as indicated by pulse oximetry.

[43] See footnote 22.

It follows that there was a degree of inadequacy of the post operative observations and monitoring.

As stated the failure to monitor the patient's respiratory rate following surgery may have led to an unawareness of deterioration in respiratory function.

I would further comment as follows:

a. Post operative monitoring instructions should have been for quarter hourly neurological observations (Glasgow Coma Scale) and pulse rate, respiration rate and blood pressure for the first hour after surgery and then half hourly for two hours, and hourly for the remainder of the first 24 hour post operative period. The decision to reduce observations to two hourly at 11.00 pm on the day of surgery was considered inappropriate.
b. Responsibility to give post operative observation instructions including changes requiring action lies with the surgeons involved in treatment, namely [Dr F] and the supervising Surgeon [Dr E].
c. Continuous pulse oximetry would be desirable for the first 24 hours following surgery.

Telemetry would not be regarded as a standard practice, and I do not consider matters of colloid administration, patient position, mobilising and straining relevant to the issues at hand.

2. Please comment on the changes that Canterbury District Health Board has made since these events. In your view, have the concerns arising from [Mr A's] case been adequately addressed?

Reference has been to protocol changes made by the Canterbury District Health Board subsequent to the incident under consideration, and the issues raised have been adequately addressed.

3. Please comment generally on the standard of care provided to [Mr A] by [Dr E] from [the time of his diagnosis in 2008 to the day of [Mr A's] death].

As stated, I consider that the treating Surgeon [Dr E] provided the patient with adequate information regarding his condition and treatment options and that informed consent was valid.

I consider the treating Neurosurgeon had sufficient experience to [manage] the patient's condition.

The adequacy of care provided by the treating Neurosurgeon could be questioned on the basis of post operative instructions to nursing staff.

The treating Surgeon's documentation was considered satisfactory.

4. Please comment on the changes made by [Dr E] since these events, as outlined in his response to HDC dated 22 November 2009.

I would express some concern regarding the treating Surgeon's statements in his document of the 22 November 2009, item 4 Changes to Practice: with the statement "I have made a point of requesting a 18—24 hour period of ECG or Oxygen Saturation monitoring". I would consider both monitoring techniques to be desirable in addition to appropriate assessment of respiratory function.

5. Please comment on steps taken by [Dr F] in relation to information and consent.

I consider the steps taken by [Dr F] in relation to informed consent were appropriate.

6. Please comment on the changes made by [Dr F] since these events, as outlined in his response to HDC received 8 December 2009.

The statements made by [Dr F] in his document dated the 8 December 2009 do not require further comment.

7. If applicable, please outline any recommendations you may have to address the concerns in this case.

The information provided indicates that appropriate steps have been taken with respect to issues arising from this case and particularly changes in protocols concerning post operative observation and management.

8. Are there any aspects of the care provided by Canterbury District Health Board, [Dr E] and [Dr F] that you consider warrant additional comment?

Other aspects of the care provided by Canterbury District Health Board, [Dr E] and [Dr F] do not require additional comment.

Finally I would comment that an appropriate standard of care was not provided and the Canterbury District Health Board had a responsibility in that its agents, [Dr E] and [Dr F] did not provide appropriate post operative monitoring services for the patient under their care, the responsibility involved both the supervising surgeon and the trainee. The shortcoming is considered to be of moderate severity.

I trust the above comments are of assistance to you in this matter, please do not hesitate to contact the writer should any point require clarification or amplification.

Yours faithfully,
DARYL H NYE FRACS
Consultant Neurosurgeon"

Further information obtained from Dr Nye on 21 July 2010

"I respond to your communication of the 14 July 2010, and your query regarding my statement that the decision to move to two hourly monitoring at 11.00 pm the night following surgery was inappropriate. This opinion reflects a personal view regarding patients who have undergone posterior cranial fossa surgery in that I believe that the observation rate should not be less than hourly in the first 24 hours post surgery.

I have noted that the change to two hourly observations was not inconsistent with the CDHB's "Neurosurgical Post Operative Guidelines", and I would indicate that the recommendations contained in these guidelines are consistent with policies currently in use in Neurosurgical Units in both private and teaching hospital situations in Melbourne.

I would indicate that there is nothing specific in relation to the treatment of the deceased which prompted my comment, which reflects an entirely personal view.

I trust the above comments are of assistance to you in this matter, please do not hesitate to contact the writer should any further statement be required."

Further information obtained from Dr Nye on 22 November 2010

"

1. I consider it reasonable for [Dr E] to state that if surgery was successful [Mr A] would be able to return to [work]. This implies a complete recovery from surgery, and the condition for which it was recommended. The only other overriding matter might relate to [employment] protocols regarding the medical and surgical history of [employees], and I have no knowledge regarding any protocols that might apply.

2. Other than "a period of expectant observation" there were no other treatment options the [Dr E] should have discussed with the patient either at the time of initial diagnosis or when concerns were expressed regarding proceeding to surgery.

3. The most common complications of posterior fossa decompression surgery are:

   a. Haemorrhage
   b. Direct injury to posterior fossa neurological structures, cerebellum, brain stem and cranial nerves.
   c. Vascular injury arterial or venous with subsequent infarction of neurological structures, swelling, and development of secondary hydrocephalus.

   The frequency of the occurrence of respiratory depression as a complication of posterior fossa cranial surgery relates to at least in part the magnitude of the procedure undergone which in this instance would not be considered great; however as respiratory function control centres are within the posterior cranial fossa, respiratory depression can occur as a consequence of or indication of any of the identified surgical complications.

4. I am of the opinion that it is the responsibility of the doctors involved in the treatment to specify post operative observations, and having regard to the nature of the surgery undergone, the recording of respiratory rate.

   I am of the opinion that a fall of oxygen saturation below 95% is significant and that any monitor alarm should be set at this level, and that should a fall occur to 95% saturation further action should be taken to identify and remedy the cause."

Appendix 2 — Independent advice — Nursing care

The following expert advice was obtained from Janet Hewson, prior to the start of the formal investigation into the care provided by RN Ms I, RN Ms J and RN Ms K.

"I have read and agree to follow the Guidelines for Independent Advisors.

I am a registered nurse with a master's degree. I have been working full time as a nursing clinician and educator for over 40 years. My main practice area has been acute care of the adult. Presently I am the clinical coordinator of a 41 bed surgical ward. I regularly teach at a post graduate level (advanced health assessment) and hold a Level 6 instructor certificate with the NZ Resuscitation Council. I have been assessed as an expert practitioner by the Nursing Council of New Zealand (NCNZ) professional development programme.

I have been asked by the Commissioner to give nursing advice in the case of [Mr A], reference number 09HDC01565.

BACKGROUND
[Summary of events omitted for brevity]

SUPPORTING INFORMATION
[List of documents reviewed omitted for brevity]

EXPERT ADVICE

i. The standard of nursing care for [Mr A] at [the] Hospital from [Day 1-3].

[Mr A] was placed in the Special Care Unit (SCU) to ensure he received a higher level of nursing care. A higher level of nursing care means the nurses in the unit are skilful and knowledgeable in the care of patients whose condition may change suddenly or slowly over a period of hours. For this reason, the most significant competency the nurse will have is that of surveillance. Regular, purposeful looking at your patient and watching for signs and symptoms of change are the hallmark of nursing practice in a SCU. In order to provide surveillance, the layout of the unit, the monitoring equipment, the timing of data collection, the essential data to be collected and the prioritizing of work are all factors to be considered.

In this case, the evidence I have been provided shows that:

- [Mr A] was not visible to the nurses at all times as his curtain was drawn.
- Monitoring equipment was only used when the set of observations were due (e.g. Sp02)
- The respiratory rate (RR) parameter was never documented and by all statements, never specifically counted.
- Nurses did not give handover in the unit.
- Observations were 2 hourly, however not taken at 0700.
- The on-going and off-going nurses did not see the patients together after report.

- The on-coming nurse did not "go see" each patient immediately after report.

The issue of curtains around patients and the future use of more extensive monitoring have been addressed by the CDHB. However I will comment about this further in my report as it is significant in this case.

It appears that neuro observations including blood pressure, heart rate and temperature were taken regularly. However the respiratory rate was not documented as taken. Although sedation scores and the Glasgow Coma Scale were documented regularly, this does not absolve the nurse from deliberately counting respirations. Although the nurse states she heard [Mr A] snore at a regular rate, this does not tell us if the respiratory rate was trending up or down which is how clinical judgment and decision making is formulated. Respiratory rate (RR) is a sensitive and early predictor of deterioration. RR is an expected parameter to measure and document on the following CDHB forms: Early Warning Score; the adult Patient Controlled Analgesia (PCA) Treatment Sheet & Record; the Neurological Observation Chart (QMRO 100); the Drug Treatment Sheet for PRN drugs; and Neuroscience Documentation of Care. In this case the nurses did not meet the expected standard of care (e.g. respiratory rate) as required by the CDHB. The nurse has also failed to meet NZNO standards (1.10 & 1.11) which state the nurse provides documentation that meets legal requirements, is consistent, effective, timely, accurate and appropriate; and uses competent clinical judgment to implement all aspects of the nursing process, ensuring appropriate care. In this case the nurse failed to assess the respiratory rate on [Mr A].

As well, the nurse did not meet NCNZ Code of Conduct (principle 2; criteria 2.4, 2.5, 2.9) which state the nurse demonstrates expected competencies in the practice area in which currently engaged, upholds established standards of professional nursing practice, and accurately maintains required records related to nursing practice. And finally NCNZ Competencies (2.2, 2.3) for registered nurses state the nurse uses suitable assessment tools and methods to assist the collection of data and maintains clear, concise, timely, accurate and current client records within a legal and ethical framework.

Clinicians know that RR is a strong predictor of potentially serious clinical events. However even though the measurement of the RR requires no complex technology, RR is the most difficult vital sign to obtain. "Normal breathing is quiet and easy — barely audible near the open mouth as a faint whish. When a healthy person lies supine, the breathing movements of the thorax are relatively slight." (Bickley, 2007). Unlike blood pressure, pulse and temperature, to get an accurate RR one must closely look for a place on the patient where breathing can be detected then count for at least 30 seconds to ensure an adequate count is made to determine irregularities in breathing pattern and rate (Pirret, 2005). In the dark this is even more difficult. RR monitoring takes deliberate attention and patience on the part of the clinician. It has been noted to be the most neglected vital sign (Cretikos et al, 2008).

Although RR was not documented (and presumed not taken) falls short of the expected standards, as noted above, the evidence provided forms a picture of a patient being "seen" every 2 hours (until 0500 hours) for a set of neuro observations. As well

it was noted the patient could be heard snoring and that his condition did not significantly change. In my opinion the nurses would incur a mild to moderate disapproval from professional peers.

2. Were there any systemic factors impacting on the ability of nursing staff to provide appropriate care?

I note that recommendation 8.2 calls for a rename of the SCU to the Progressive Care Unit with upgraded equipment and specially trained nurses. While this is a positive proposal, there are issues that need to be addressed regardless of the where the unit is located, how it is equipped and the level of staffing.

Handover report should be given in the unit. This ensures that the time gap between handover is minimal and that the patients are still under surveillance. In this case not only was handover given outside the unit, the nurses did not directly return to the SCU after report. Nurse [Ms K] stated she chatted for a few minutes.. . . clinical records and drug charts, checked when medications were due. . proceeded to the SCU. Nurse [Ms J] states that after report she read his notes and checked medications with colleagues. This paints a picture of delays in "seeing" the patients first thing. Patients who are in the SCU are there for a reason. It is the responsibility of the nursing staff to avoid being away from the bedside area as much as possible. Once handover is completed, the **first priority should be to see the patient**, preferably with the on-going and off-going nurses going to the bedside together. Then notes can be read and medications sorted. It is not clear if the SCU has its own supply of medications but this would be an expected standard for the new Progressive Care Unit.

3. Do I have any concerns about the individual practice of any of the nursing staff involved in [Mr A's] care?

Following on the theme of prioritizing, I believe Nurse [Ms K's] actions on entering the SCU the morning of [Day 3] were unreasonable. [Mr A] was behind a curtain and [another patient, Mr X] had returned from recovery around 0130 hours; however she chose to attend to the ambulatory patient first. [Mr A] and [Mr X] were a higher priority. As I stated previously all patients must be looked at first thing, then the nurse can plan her care, In [Mr A's] case, about an hour had passed before he was seen and he was behind a curtain.

Nurse [Ms K] should have looked at him on entering the room, I also note that it had been passed on in report [Mr A] was snoring, I wonder if Nurse [Ms K] heard him snoring when she entered the room. If not, this should have raised suspicion.

Nurse [Ms K] is very experienced in neuroscience nursing (clinical, education, research and management). I would expect she is considered a proficient to expert practitioner by her peers. However her nursing actions in this case did not meet the competencies of a nurse with her experience and education (NCNZ competency 1.4 & 2.2) or the purposes and objectives of the CDHB Special Care Unit. In my opinion she would incur moderate to severe disapproval from professional peers.

4. Comment on the changes that CDHB has made since these events in relation to nursing care. In my view, have the concerns arising from [Mr A's] case in relation to nursing care been addressed?

In relation to the proposed Progressive Care Unit and the changes to lighting and curtain closure. Both are positive plans but do not take the place of nurse presence and surveillance. The shift handover, first rounds and prioritising work practice must be addressed. The development of PCU competencies is essential and these competencies must be regularly tested and monitored. The educator can take this opportunity to re educate nurses about respiratory rate monitoring (to include audit). This is not exclusive to CDHB as lack of RR monitoring and documentation is too common in practice.

The other comment I have is in relation to the statement from Nurse [Ms K] (12, 13, 14). The NZ Resuscitation Council Management Plan for Adult Collapse calls for external compressions to begin before airway management. It appears from Nurse [Ms K's] statement that this was not the sequence used. The educator needs to check staff knowledge and skill in adult collapse management. I would recommend that staff working in the PCU have Level 6 resuscitation certification.

Finally, I wonder if CDHB was aware that [Mr A] may have been using inhalers prior to admission. His mother commented that the inhalers were in his [work] belongings. Had the question been asked during admission history?

Thank you for the opportunity to give advice to the Commissioner in this very sad situation.

REFERENCES

Cretikos, M, et al, (2008). Respiratory rate: the neglected vital sign. Medical Journal of Australia; 188 (11): 657–659.

Bickley, Lynn .S. (2007) Bates Guide to Physical Examination and History Taking, 9 ed., p. 247, Philadelphia: Lippincott.

NCNZ Code of Conduct for Nurses (March 2008)

NCNZ Competencies for Registered Nurses (December 2007)

NZNO Standards of Practice (February 2008)

NZ Resuscitation Council Guidelines for Adult Collapse (2007).

Pirret, Alison. (2005). Acute Care Nursing.' A physiological approach to clinical assessment and patient care. p. 4. Auckland, New Zealand, Author.

Further advice was sought from RN Hewson, following the start of formal investigation into the care provided by RN Ms I, RN Ms J, and RN Ms K.

In response to your letter dated 2 July 2010 requesting further advice on case C09HDC01565 ([Mr A]).

I have read the additional documents supplied: notification letters to Nurses [I, J and K]; response from [Ms J's legal counsel]; response from [Ms I and Ms K's legal counsel]; statements from Nurses [I and K]; advice from Alison Pirret; Canterbury DHB response; Canterbury DHB correspondence.

I will group my comments: respiratory rate; handover practice; monitoring oxygen saturations; viewing all patients immediately after handover; resuscitation practice; time of death,

Respiratory rate (RR): My original comments regarding RR observation and documentation stand. I note that Nurse [Ms J], Nurse [Ms K], Nurse [Ms I] and Ms A Pirret agree on the importance of RR collection and documentation, All nurses involved have acknowledged they will improve their individual practice in relation to RR.

Handover practice: My original comments about handover were not directed at any individual nurse. Handover practice is part of the nursing service model of care. In this case it appears the afternoon to night shift report was given in the SCU (statement from Nurse [Ms I] and Nurse [Ms J]) and the night to day shift report was given in the meeting room (statement from Nurse [Ms J] and Nurse [Ms K]). I stand by my original advice that handover should be given in the SCU. Any issues of privacy and confidentiality can be managed by the registered nurses.

Monitoring oxygen saturations: I note an inconsistency about whether [Mr A] was on continuous oxygen saturation (SpO2) monitoring during the night, during morning report and when Nurse [Ms K] first saw [Mr A]. Night Nurse [Ms J] states "a pulse oximeter was attached at all times... the alarms were turned on". She says that while giving handover to the day shift, there was an RN sitting in the nurses' station (map shows this near the SCU) where, if the SpO2 monitor alarms, it could be heard. She said this did not occur (no alarm heard) during her handover. She did not return to the SCU after her report. However in the most recent statement by day shift Nurse [Ms K], she said that when she pulled back the curtain… "I noticed that the monitor for oxygen saturation monitoring equipment was not attached and was turned off". Certainly if [Mr A] had been on continuous SpO2 monitoring with alarms set, his deterioration would have sounded the alarm.

Continuous oxygen saturation monitoring is desirable in patients who may not breathe deeply, breathe too slow or have periods of apnea (no breathing). It is generally the nurses' decision as to whether continuous monitoring is necessary. I would expect a SCU / HDU to have such monitoring available at each bed space.

Viewing patients immediately after report: My original comments regarding Nurse [Ms K's] actions on entering the SCU stand. Despite comments from Nurse [Ms K] and Ms A. Pirret, the purpose of the SCU is to care for patients who are seriously unwell or have the potential to deteriorate rapidly and require skilled neuroscience care and observation. This care and observation should have included a visual of each patient after receiving report. I understand from Nurse [Ms K's] statement that she "felt confident in relying on RN [Ms J's] report that [Mr A] was stable". However clinical handover is the transfer of responsibility and/or accountability for patient care from one nurse to another nurse. To verify the accuracy of handover information the nurse should actually look and see for themselves. Nurse [Ms K] stated that on entering [the SCU] "all three patients were due to be observed at the same time". She saw one patient coming out of the bathroom and could see the other patient and his monitor. So why didn't she go see [Mr A], who was not clearly visible, to make sure all was OK (verify)? In reading her statement she states "it is easy to make a visual assessment immediately on entering the room"… but because his curtain was closed she decided not to look. I do not believe this is reasonable practice in this situation.

Resuscitation practice: Nurse [Ms K] has explained her variation in sequence upon finding [Mr A]. I understand why she would have reverted to the older adult collapse sequence under this stressful situation. It appears that the arrest team and all activities were carried out in a timely fashion.

Time of death: I am not qualified to determine time of death however Ms A. Pirret felt that from Nurse [Ms K's] description [Mr A] may have arrested "more than a few minutes prior to 0730 hours". On the other hand Nurse [Ms K] states "it was clear that he had been dead for some time". Because no one saw [Mr A] from 0615 to 0730 hours and there are conflicting reports as to whether he was on oxygen saturation monitoring, it would be difficult to determine when his deterioration and subsequent arrest occurred.

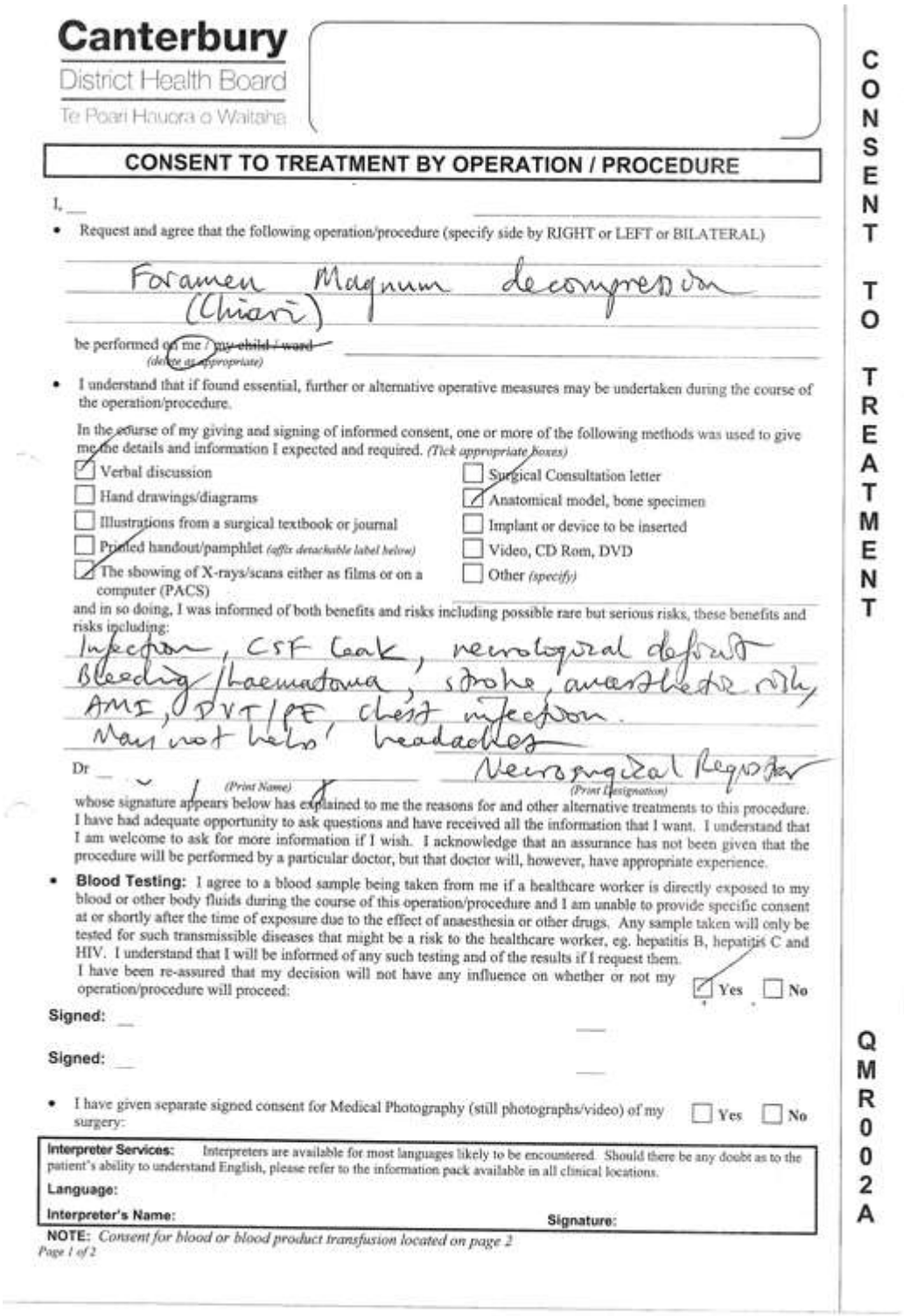
[The] CDHB customer services manager, is concerned that my original opinion suggests that some staff, by way of their individual actions (or in-actions), have contributed to [Mr A's] death. As the expert advisor my main concern in this case was that [Mr A] (or any patient) in the CDHB Special Care Unit was not seen by a nurse from 0615 to 0730 hours.

I commend the changes Nurses [J, K and I] have made relevant to their practice since this incident.

I am pleased to read that handover now occurs in the SCU at every shift.

Janet Hewson RN MN
Nurse Advisor"

Appendix 3 — Consent for surgery



Canterbury
District Health Board
Te Poari Hauora o Waitaha

CONSENT TO TREATMENT BY OPERATION / PROCEDURE

I, __

- Request and agree that the following operation/procedure (specify side by RIGHT or LEFT or BILATERAL)

Foramen Magnum decompression (Chiari)

be performed on me / ~~my child / ward~~ *(delete as appropriate)*

- I understand that if found essential, further or alternative operative measures may be undertaken during the course of the operation/procedure.

In the course of my giving and signing of informed consent, one or more of the following methods was used to give me the details and information I expected and required. *(Tick appropriate boxes)*

- ☑ Verbal discussion
- ☐ Hand drawings/diagrams
- ☐ Illustrations from a surgical textbook or journal
- ☐ Printed handout/pamphlet *(affix detachable label below)*
- ☑ The showing of X-rays/scans either as films or on a computer (PACS)
- ☐ Surgical Consultation letter
- ☑ Anatomical model, bone specimen
- ☐ Implant or device to be inserted
- ☐ Video, CD Rom, DVD
- ☐ Other *(specify)*

and in so doing, I was informed of both benefits and risks including possible rare but serious risks, these benefits and risks including:

Infection, CSF leak, neurological deficit
Bleeding/haematoma, stroke, anaesthetic risk,
AMI, DVT/PE, chest infection.
May not help headaches

Dr __ (Print Name) Neurosurgical Registrar (Print Designation)

whose signature appears below has explained to me the reasons for and other alternative treatments to this procedure. I have had adequate opportunity to ask questions and have received all the information that I want. I understand that I am welcome to ask for more information if I wish. I acknowledge that an assurance has not been given that the procedure will be performed by a particular doctor, but that doctor will, however, have appropriate experience.

- **Blood Testing:** I agree to a blood sample being taken from me if a healthcare worker is directly exposed to my blood or other body fluids during the course of this operation/procedure and I am unable to provide specific consent at or shortly after the time of exposure due to the effect of anaesthesia or other drugs. Any sample taken will only be tested for such transmissible diseases that might be a risk to the healthcare worker, eg. hepatitis B, hepatitis C and HIV. I understand that I will be informed of any such testing and of the results if I request them.
  I have been re-assured that my decision will not have any influence on whether or not my operation/procedure will proceed: ☑ Yes ☐ No

Signed: __

Signed: __

- I have given separate signed consent for Medical Photography (still photographs/video) of my surgery: ☐ Yes ☐ No

Interpreter Services: Interpreters are available for most languages likely to be encountered. Should there be any doubt as to the patient's ability to understand English, please refer to the information pack available in all clinical locations.

Language:

Interpreter's Name: **Signature:**

NOTE: *Consent for blood or blood product transfusion located on page 2*

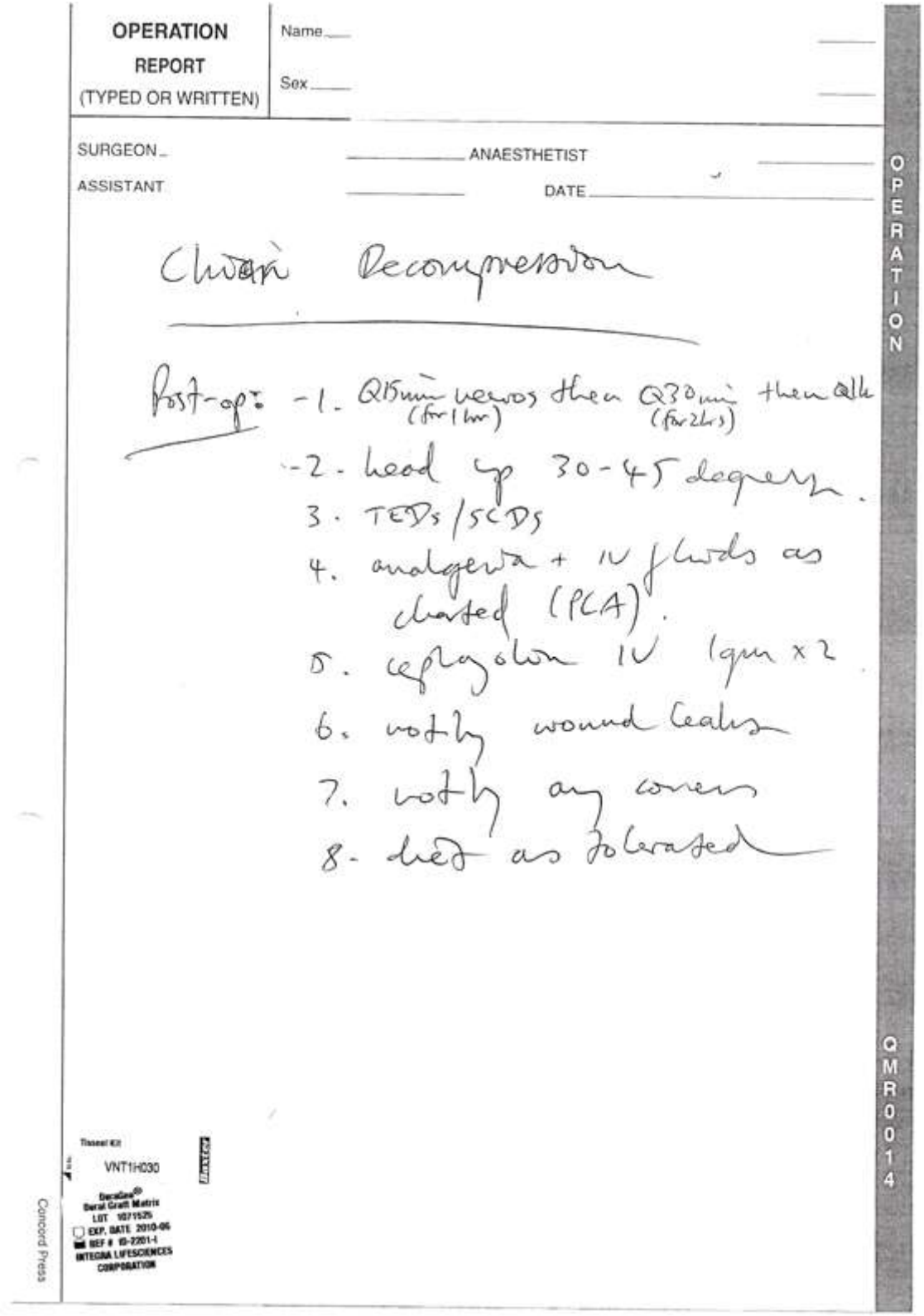
Page 1 of 2

CONSENT TO TREATMENT

QMR002A

Names have been removed (except Canterbury DHB and the experts who advised on this case) to protect privacy. Identifying letters are assigned in alphabetical order and bear no relationship to the person's actual name.

Appendix 4 — Postoperative instructions



OPERATION REPORT (TYPED OR WRITTEN)

Name ____ Sex ____

SURGEON ____ ANAESTHETIST ____

ASSISTANT ____ DATE ____

OPERATION

Chiari Decompression

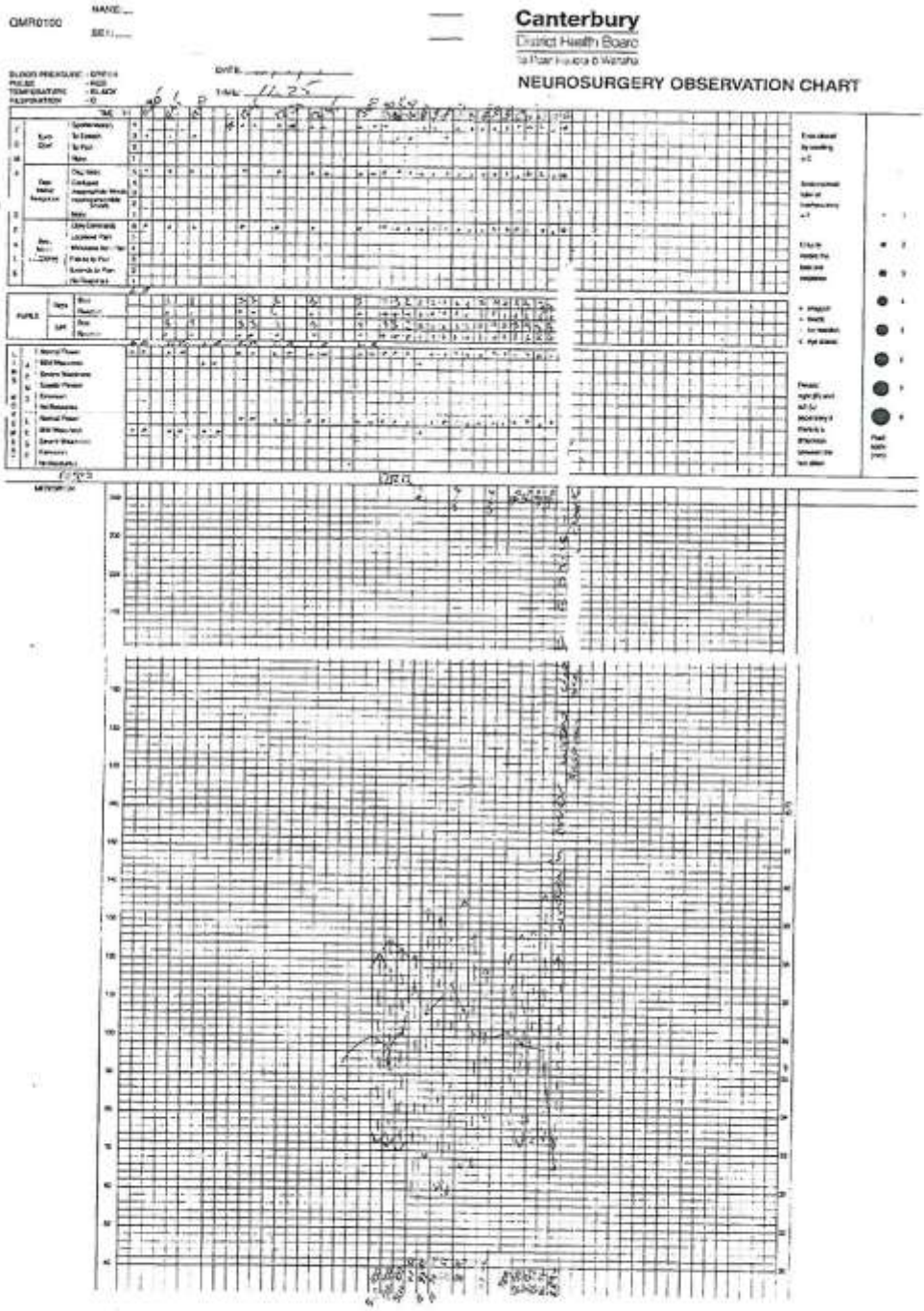
Post-op:
1. Q15min neuros then Q30min then 2hr (for 1hr) (for 2hrs)
2. head up 30-45 degrees.
3. TEDs/SCDs
4. analgesia + IV fluids as charted (PCA).
5. ceftazidime IV 1gm x 2
6. notify wound leaks
7. notify any concerns
8. diet as tolerated

QMR0014

Tissue Kit
VNT1H030
DuraGen® Dural Graft Matrix
LOT 10715Z5
EXP. DATE 2010-06
REF # 10-2201-1
INTEGRA LIFESCIENCES CORPORATION

Concord Press

Appendix 5 — Neurosurgery Observation Chart



Names have been removed (except Canterbury DHB and the experts who advised on this case) to protect privacy. Identifying letters are assigned in alphabetical order and bear no relationship to the person's actual name.

Appendix 6 — Summary of postoperative observations in the SCU

As recorded on the "Neurosurgery Observation Chart" (NO Chart) and "PCA Chart"

	Coma Scale, Pupils, and Limb movement	Pulse	Oxygen	Temp-erature	Blood pressure	Respira-tory rate	Sedation score	Pain at rest/activity
[Day 2]								
1.30pm	Checked	98	100% @ 5L/min		122/72	12		
2pm	Checked	93	100% @ 5L/min		124/71	12		
2.30pm	Checked	100	100% @ 5L/min		123/70	12[44]		
3pm	Checked – mild limb weakness	113	98% @ 5L/min	36.9	122/59	16[45]	1	1/1
4.30pm	Checked	106	97% @ 5L/min		134/68	18	1 (4pm)	1/1 (4pm)
5pm	Checked	110	99% @ 5L/min		131/60	18[46]	1	1/1
6pm	Checked	114	99% @ 5L/min	36.8	126/59		1	1/1
7pm	Checked	107	98% @ 3L/min		136/66		1	1/1
8pm	Checked	101			127/66		0	2/2
9pm	Checked	101	97% @ 3L/min	36.6	118/78			
10pm	Checked							
11pm	Checked	102	98% @ 3L/min	36	122/77		0	1/1
[Day 3]								
1am	Checked	98	98% @ 3L/min	36	127/72		4	1/1
3am	Checked	98	97% @ 3L/min	36	128/72		4	2/2
5am	Checked	97	94% @ 3L/min[47]	36	138/73		4	1/1

[44] This and the preceding two respiratory rates were recorded in the middle of the NO Chart
[45] This was recorded on the PCA chart
[46] This and the preceding respiratory rate were recorded at the bottom of the NO Chart.

Appendix 7 — Root Cause Analysis and other subsequent action

Canterbury DHB notes that the primary objective of the RCA is to identify systems failures and causal factors which contributed to what happened, and to make recommendations in order to prevent a similar event from occurring in the future. It also notes that the RCA is not a process for investigating individual accountability, and that if individual failing is identified as a major contributing factor it is investigated and addressed outside the RCA process.

The following points/findings are noted.

- No concerns were identified in relation to the decision to operate, and the operative procedure.
- Initial postoperative care was provided in the PACU, with transfer to the room in the ward at 1.30pm, in accordance with routine practice.
- Observations were reduced overnight from one to two hourly, in accordance with the "Neurosurgical Postoperative Guidelines", which state that recordings are reduced to two hourly if the patient has been stable for the preceding four hours.
- Postoperative observations were mostly recorded in their entirety, except for respiratory rate. The last set of recordings was made at 5am. Recorded observations were within expected ranges except for the oxygen saturation recording of 94% at 5am, which in hindsight was a potential indicator of abnormal respiratory function.

With regard to the cause of Mr A's death, the RCA states:

> "It is not possible to do other than speculate as to the cause of [Mr A's] death. Likely causes considered, given the post mortem finding, were an acute dysrhythmia (cardiac arrest), central apnoea (sudden cessation of breathing) and progressive ventilatory respiratory failure. Of these, only progressive ventilatory failure was considered to be consistent with the known facts."

Comment is made on the significance of the pO2 and pCO2 levels found in the analysis of blood taken during the resuscitation effort.[48]

Canterbury DHB identified several factors that contributed to lost opportunities to prevent Mr A's death:

- the routine recordings as undertaken in the ward for postoperative neurosurgical patients made it difficult to detect the progressive respiratory failure exhibited by Mr A, so that staff were reassured by his overall condition;
- it was established practice that patients who had had an uneventful first postoperative night did not require "specialling" after 6am;

[47] Progress notes show 94% on room air and 98% on 4L/min, and the am entry on the "Neuroscience Documentation of Care" form also shows 4L/min. RN Ms J subsequently stated that she recalls Mr A was on 3L/min ie, the NO chart was correct.

[48] The pO_2 (partial pressure of oxygen) level was 16mm/Hg and the pCO_2 (partial pressure of carbon dioxide) was 234mmHg. Normal levels are 100mmHg and 40mmHg respectively.

- there was a general lack of awareness of the rare potential for severe postoperative ventilatory respiratory failure, which meant specific monitoring for this was not instituted;
- the positioning of a curtain to prevent a night light shining in Mr A's face meant he was not able to be readily and constantly observed;
- handover was taken outside the SCU.

The RCA made seven recommendations to address the findings deemed to have contributed to Mr A's death, and six further recommendations to address issues identified in the course of the RCA but not directly related.

In correspondence to Mrs C's legal representative on 22 December 2009, the interim general manager for the Medical and Surgical Services Division stated that:

> "The recommendations made by RCA team acknowledge that the processes in place for the postoperative care that [Mr A] received required strengthening and weren't adequate for the detection, prevention or adequate management of the respiratory failure that led to his death. The staff caring for [Mr A] were functioning within those existing systems and whilst there are clearly components of this care which we would wish to have done differently, it is the collective of events within the established systems rather than actions of any individual which led to the tragic death of [Mr A]."

Report from Clinical Director, Neurosurgery
On 4 November 2009, Clinical Director for the Department of Neurosurgery completed a report as part of the consultation regarding the RCA recommendations. The following points are noted:

- The Neurosurgery unit database shows that between 1996 and 2009, 514 posterior fossa surgeries were performed, 48 of which were foramen magnum decompressions. Of the 514 posterior fossa surgeries, a small number developed postoperative haematomas requiring surgery, but none of these were patients who had had foramen magnum decompressions. Mr A is the only patient among the 514 to have died from a probable primary respiratory cause.
- The Clinical Director states that none of the surgeons in Canterbury DHB's neurosurgical unit, or at any of the other neurosurgical units in New Zealand have ever seen death from a probable primary respiratory cause occur in the absence of a postoperative wound haematoma. He refers to a personal communication from the Director of the Chiari Institute, New York, who also states he had never seen this occur in the absence of a postoperative wound haematoma.
- The Clinical Director states there is limited value in preoperative sleep studies as a tool for predicting the likelihood of a postoperative problem with respiration. He emphasises that the key is appropriate postoperative care. He outlines further details in relation to this, including that a requirement for care should include continuous pulse oximetry and continuous ECG monitoring for at least 24 hours postoperatively, depending on the type of procedure and the patient's clinical state.

He states that this care does not need to be in the ICU, but the ward area/SCU needs to be properly equipped.

Further information from Dr H

Anaesthetist Dr H informed the Coroner that he reviewed his management of Mr A's care with a senior neuroanaesthetist and with the Director of the Acute Pain Management Service, and presented his management for peer review at the Department of Anaesthesia Mortality and Morbidity Review. Dr H contacted colleagues in Sydney and London to establish whether they were aware of unexplained deaths following surgery for Chiari 1 malformations (they were not). He also conducted a literature review and sought information from the American Society of Anaesthesiologists (ASA) Closed Claims Project. The ASA states: "A search of the ASA Closed Claims Project database has no similar cases of Arnold Chiari Malformation and postoperative respiratory arrest yielded two claims in which patients with this condition sustained postoperative respiratory arrest. Neither patient was undergoing surgical correction of their malformation when the event occurred. Both events occurred in the early 1990s."

Dr H provided the Coroner with details of further action he has taken in light of Mr A's death. This includes confirming that appropriate education strategies are available for the ward's nursing staff, and offering to take an education session on the ward with a particular focus on PCA devices. He states he has reiterated that:

- in addition to sedation scores, monitoring of respiratory rate is important where PCAs are used, and particularly for neurosurgical patients; and
- that the clinical monitoring of patients by nursing staff is the lynchpin of patient safety in the clinical environment.