Auckland District Health Board

A Report by the
Health and Disability Commissioner

(Case 16HDC00673)

Health and Disability Commissioner
Te Toihau Hauora, Hauātanga

Contents

Executive summary

1. This report concerns the care provided to a man during his admission to Auckland District Health Board (ADHB) for shoulder surgery. The man had an underlying liver condition, but the Orthopaedic Team did not consult the Liver Team before the shoulder surgery. Following the surgery, the man was given excess opiate pain relief, as no limit had been set on the total daily pain relief that could be administered. The report also examines the use of the Early Warning Score Chart when the man started to deteriorate, and application of the DHB's Opioids Policy.

2. The report highlights the importance of setting a daily upper limit of opioids, in particular for patients with known liver conditions. It also highlights the importance of the coordination of care between different teams, and the need for appropriate and timely escalation of care when a patient deteriorates.

Findings summary

3. The Commissioner found ADHB in breach of Right 4(1) of the Code for the following reasons: (a) no upper limit was set for the opioids prescribed to the man, and the choice of oral opioids warranted further consideration; (b) the Liver Team should have been consulted preoperatively, or earlier following the surgery; (c) the EWS Chart guidelines were not followed; (d) the Opioids Policy was not followed; and (e) the kidney test results were not reviewed.

4. The Commissioner was critical of the staffing level in place at the time (during a holiday period). He also commented on the use of a MELD score, and noted that if this is to be used, staff should be aware of its implications.

Recommendations

5. The Commissioner recommended that ADHB apologise to the family; consider the advice from HDC's pain expert in its review of the Opioids Policy, and provide HDC with a copy of the final Opioids Policy; report back to HDC on the changes implemented following ADHB's Root Cause Analysis report; conduct an audit of 100 postoperative patients seen by the Pain Team within surgical services; arrange training for its staff in the Orthopaedic Ward, Anaesthetic Team, and Pain Team on the updated Opioids Policy; and use this report as a basis for staff training at ADHB.

Complaint and investigation

6. The Health and Disability Commissioner (HDC) received a complaint from Mrs A about the services provided to her late husband, Mr A, at Auckland District Health Board (ADHB). The following issue was identified for investigation:

   - *Whether Auckland District Health Board provided Mr A with care of an appropriate standard in 2016.*

7. The parties directly involved in the investigation were:

Mrs A	Complainant
Mr B	Consumer's brother
Auckland District Health Board	Provider

8. Further information was reviewed from:

Accident Compensation Corporation	
Dr C	Liver Transplant Unit
Dr D	Department of Critical Care Medicine
Dr E	General Medicine
Dr F	Orthopaedics
Dr G	Anaesthesia & Pain Medicine
Dr H	Anaesthesia Department
Dr I	Department of Anaesthesia and Perioperative Medicine

9. Also mentioned in this report:

Dr J	Orthopaedic house surgeon
Dr K	Medical registrar
Dr L	House officer
Dr M	Registrar

10. Independent expert advice was obtained from Dr David Jones, Anaesthetist and Pain Medicine Specialist (Appendix A), and Dr John McKie, Orthopaedic Specialist (Appendix B).

Information gathered during investigation

Introduction

11. Mr A, aged in his late fifties, fell while at work, hurting his shoulder. Initially he was assessed at an accident and emergency clinic, and was then referred to ADHB Emergency Department (ED), where he presented at 3.45pm. On Day 2,[1] he had an operation to repair an avulsion fracture[2] of his right shoulder.

12. Mr A suffered complications following the surgery, and on Day 6 he was admitted to the Department of Critical Care (DCCM). Subsequently, he developed acute renal failure and multi-organ failure.

13. Mr A passed away on Day 28. This investigation concerns the care he received at ADHB.

Background — medical history

14. Mr A was diagnosed with Hepatitis C Virus[3] (HCV) in 1993, but did not receive any treatment following the diagnosis. Mr A's HCV diagnosis was next noted when, six week's prior to his admission in 2016 following an emergency event, he was referred to the ADHB Gastroenterology Department. Following investigations by a consultant gastroenterologist, Mr A was referred to the Liver Clinic.

15. Mr A was seen in the Liver Clinic by Dr C. Dr C stated that Mr A reported that he felt well, and examination demonstrated mild jaundice[4] and ankle oedema.[5] Mr A's Model for End-stage Liver Disease (MELD)[6] score was calculated as 11. Dr C stated: "[T]his is associated with an excellent 3 and 12 month survival and is well below the threshold for consideration for liver transplantation." Mr A was diagnosed with cirrhosis[7] and instructed to stop consuming any alcohol.

16. The treatment plan was to commence regular surveillance for cirrhosis complications, and for Mr A to be reviewed at three-monthly intervals, or earlier if DAA therapies[8] became available through PHARMAC or other sources.

[1] Relevant dates are referred to as Days 1–28 to protect privacy.
[2] An injury to the bone in a location where a tendon or ligament attaches to the bone.
[3] An infection caused by a virus that attacks the liver and leads to inflammation. Most people have no symptoms. Those who do develop symptoms may have fatigue, nausea, loss of appetite, and yellowing of the eyes and skin.
[4] A yellow tint to the skin or eyes caused by an excess of bilirubin, a substance created when red blood cells break down.
[5] Swelling caused by excess fluid trapped in the body's tissues.
[6] A MELD Score is used to estimate relative disease severity and likely survival of a patient who is awaiting liver transplantation. A MELD score ranges from 6 to 40.
[7] Cirrhosis is a late stage of scarring (fibrosis) of the liver caused by many forms of liver disease, and conditions such as hepatitis and chronic alcoholism.
[8] "Direct-acting antiviral" therapies, used for the treatment of chronic hepatitis C infection.

Day 1

17. Following the fall at work that injured his shoulder, Mr A was referred to the ED by the accident and emergency clinic. Mr A self-discharged at 4pm, indicating that he would return if his pain worsened. He returned to ED at 6.30pm, and was first transferred to the Admission Planning Unit, and then to the Orthopaedic Service for planned surgical repair.

18. On the evening of his admission, Mr A was examined by an orthopaedic registrar. The registrar organised analgesia, a sling for Mr A's arm, and blood tests, which included a full blood count, liver function tests, renal function tests, and tests for coagulation. A CT scan of Mr A's shoulder was also arranged.

19. The registrar documented the following:

> "1. Cirrhosis due to Hepatitis C, Child's Pugh[9] B(7) MELD 12 …
> 2. Hepatitis C
> — Diagnosed on blood tests 1993
> — Uncertain mode acquisition"

20. While under the Orthopaedic Team, preoperative prescriptions were written for tramadol[10] 50–100mg QID (four times daily) and Sevredol[11] 10–20mg Q2H (2 hourly). No Sevredol was administered to Mr A preoperatively.

21. ADHB said that "there was nothing on the physical examination [by the registrar] to indicate that [Mr A] was anything other than a reasonably fit and active [person]". Dr C told HDC that on Day 1, "[Mr A's] bilirubin and serum creatinine had increased slightly … As a result, his MELD score had increased to 15[12]."

Day 2

22. At 7.24am, a CT scan of Mr A's shoulder was undertaken. This confirmed an avulsion fracture.

23. ADHB said that following the CT scan:

> "The junior Orthopaedic staff had undertaken a comprehensive and appropriate assessment of [Mr A]. His situation was then presented to and discussed at the 7.30am acute orthopaedic handover meeting where a management plan was formulated. This situation and plan had been discussed with [Mr A] and he was consented for surgery. His name was placed on the list for surgery and this list was available to the Anaesthetic Service of the day."

24. At 8.30am on the same day, Mr A was assessed by the orthopaedic consultant. Mr A was confirmed for theatre.

[9] The Child–Pugh score is used to assess the prognosis of chronic liver disease, mainly cirrhosis.
[10] Opioid pain medication.
[11] Opioid pain medication.
[12] A MELD score of 12–15 is associated with a 30-day postoperative mortality rate of 25.4%.

25. Mr B told HDC that when his brother was assessed for shoulder surgery, the family were reassured that his liver issues were not a significant problem. Mr B stated: "We were told medications would be managed and would be fine. It was on this basis that [Mr A] agreed to proceed with surgery."

26. ADHB noted that up to this point of the examinations:

> "There was no observation that [Mr A] had jaundice. There was no comment about ascites[13] and his ultrasound three months previously had shown no ascites. The subsequent CT scan also showed no free fluid in the abdomen."

27. Mr A's surgery was performed at 3pm. The anaesthetist noted in the Anaesthetic Record that Mr A "had recently been diagnosed with liver cirrhosis secondary to Hepatitis C, that he had a significant alcohol intake but was fit and well otherwise", and that he was a "heavy drinker until this diagnosis".

28. The surgery was completed successfully at 4.56pm. The anaesthetist prescribed postoperative medications, including a reduced dose of tramadol at 50mg twice daily, fentanyl,[14] and up to 4 grams of paracetamol[15] every 24 hours. The anaesthetist noted that a reduced dose of tramadol was prescribed because of Mr A's cirrhosis. This was recorded in the Post Anaesthetic Care Unit (PACU) Record form. There was no limit stated on the total dose of fentanyl or tramadol that could be given. The revised tramadol prescription was not recorded on the main medicine prescription chart for Mr A.

29. ADHB told HDC that the PACU part of the anaesthetic chart was used only in the PACU area, and tramadol was not administered while Mr A was in PACU.

30. At 10.30pm, nursing staff recorded retrospectively that Mr A had returned to the ward at 6.20pm and was "alert and oriented, he was resting his arm in a sling and was up to the bathroom without assistance". At 11.30pm, Mr A was administered 100mg of tramadol.

Day 3

31. On Day 3, prior to 9am, Mr A was assessed by an orthopaedic house officer. It was noted in the clinical record that Mr A was "comfortable". He was administered 100mg of tramadol at 8.15am.

32. At 9.45am, Mr A was reviewed by the Pain Service Team (the Pain Team). ADHB said that the Pain Team prescribed Sevredol at a reduced frequency, and reduced the dose of paracetamol, but the tramadol prescription remained the same. Dr G said that the dose of paracetamol was reduced from 4 grams per day to 3 grams per day, and that this is the recommended dose for patients with liver disease.

[13] The abnormal build-up of fluid in the abdomen, most often related to liver disease.
[14] Opioid used as a pain medication and together with other medications for anaesthesia.
[15] Medicine used to treat pain and fever. Typically it is used for mild to moderate pain relief.

33. The drug prescription sheets show that Sevredol 10–20mg PRN was prescribed once hourly. No maximum dose limit is recorded on the drug prescription sheet. On this day, it was noted that Mr A received 20mg of Sevredol at 10am, 11.15am, 12.30pm, 2.50pm, 4.40pm, 6.30pm, 8.10pm, and 9.15pm. In total, 160mg of Sevredol was administered to Mr A on this date. He was also given 100mg of tramadol at 2.50pm and again at 9.20pm. In total, 400mg of tramadol was given to Mr A within two days postoperatively.

34. At 10pm, nursing staff noted that Mr A was "[alert], oriented, and appeared stable but requested analgesia many times".

Day 4

35. At 2.04am, it was recorded that Mr A was given another 20mg dose of Sevredol. By this time, Mr A had received 180mg of Sevredol within the previous 24 hours.

36. Around 2am, the overnight nurse retrospectively noted that Mr A wanted some fresh air and was walking around his bed space, and that he had felt nauseated and vomited. The nurse took Mr A's observations, which included a blood pressure of 104/54mmHg,[16] an oxygen saturation of 85% on air[17] (which improved to 90–95% with oxygen but kept dropping to 87–88%), and a respiratory rate of 4–5 breaths per minute.[18] However, these observations were not reflected on the Early Warning Score[19] (EWS) Chart. The total EWS scores were not recorded from 2am to 7.30am.

37. ADHB said that the nurse was concerned about Mr A, and she sought a medical review from a house officer. The nurse remained with Mr A for two hours while waiting for the doctor to attend. No code alert or repeat call to the house officer occurred over the two hours.

38. At 4am, Dr L, the on-call house officer for Orthopaedics, assessed Mr A. Dr L diagnosed sleep apnoea,[20] narcotic/narcosis,[21] and a primary respiratory problem. She also requested a chest X-ray and instructed that no more Sevredol was to be given for the next few hours.

39. The chest X-ray was taken at 8.54am, and showed "new patchy ground glass opacity in keeping with aspiration. There was no pleural fluid.[22]"

40. Around 8.30am, Mr A was assessed by a senior registrar, who noted that Mr A was "difficult to rouse, confused and not oriented", and that his differential diagnosis included narcosis.

[16] Normal blood pressure is 120/80mmHg or under; low blood pressure is considered to be less than 90/60mmHg.
[17] Normal oxygen saturation readings usually range from 95% to 100%.
[18] The normal respiration rate for an adult at rest is 12 to 20 breaths per minute.
[19] A guide used to quickly determine the degree of illness of a patient.
[20] A sleep disorder in which breathing repeatedly stops and starts.
[21] A state of stupor, drowsiness, or unconsciousness produced by drugs.
[22] Excess fluid that accumulates in the pleural cavity (the space that surrounds the lungs).

41. At 11.16am, a registrar with the Pain Service made a routine follow-up visit and noted that Mr A "was comfortable but sedated". The Sevredol prescription was stopped, and oxycodone[23] 5mg was prescribed hourly as required. No limit was set for the daily dose of oxycodone, and no reasons were provided for the change in pain medication. However, Dr G stated that the "standard policy is to move patients from intravenous to oral analgesia as soon as practical".

42. Another nursing entry follows the clinical note by the registrar, but no time is recorded. The note states: "[P]atient was found to be very drowsy at the beginning of the shift … has been stable though … Team H[ouse] O[fficer] is aware." It was also noted that the plan was for no more Sevredol to be given. From 11.16am to 5pm, no other entries were made in the clinical notes.

43. At 5pm, Mr A was assessed by Dr J, the on-call orthopaedic house surgeon, who noted that Mr A was deteriorating. Dr J undertook a complete assessment and included differential diagnoses of aspiration pneumonia,[24] acute kidney injury, and narcosis secondary to opiates. He also noted Mr A's history of cirrhosis and Hepatitis C, and that Mr A had been given 180mg of Sevredol in the past 24 hours. At the end of the notes, Dr J recorded: "I will contact general medicine to request an urgent review."

44. At 5.40pm, Dr J telephoned Dr E, the consultant physician on call for General Medicine. Dr J noted that Mr A had deteriorated, and sought advice. Dr E advised Dr J to examine Mr A and take bloods, and said that Dr K, the ward medical registrar, would review the patient and assist.

45. Around 7pm, Dr K reviewed Mr A and discussed his findings with Dr E. Dr K thought that Mr A was "narcotised secondary to prescribed and given opioids with a type I & II respiratory failure secondary to this, and a probable aspiration pneumonia". Dr K also recorded in the clinical notes that he agreed with Dr J that Mr A was drowsy after having been given 180mg of Sevredol the previous day. Following the discussion, Dr E reviewed Mr A immediately and requested that naloxone[25] be administered at the earliest opportunity. The Medication Chart records that 0.4mg of naloxone was first administered at 7pm. Dr E also noted that Mr A "felt like he ha[d] gone through a coffee grinder usually drank half crate per day not for 7 days".

46. Mr B told HDC:

> "[Mr A] did not drink 'half a crate per day'. He worked long hours on shift and would sometimes have a few beers, but not daily. He would drink up to half a box of 12 [beer] (i.e 6 bottles) which is significantly less volume than half a crate. He had stopped his intake totally well before surgery."

[23] An opioid medication used for treatment of moderate to severe pain.
[24] Lung infection caused by inhalation of foreign substances such as food, stomach acid, or saliva.
[25] A medication used to block the effects of opioids, especially in overdose.

47. ADHB said that naloxone is "immediately effective in reversing the effects of narcotic side effects such as respiratory depression that [Mr A] was experiencing".

48. Around 7.30pm, Dr E and Dr K reviewed Mr A again. Mrs A was present during the review. Dr E explained to Mrs A that they planned to "start antibiotics and treat [Mr A] for potential underlying sepsis[26] whilst organising a CT abdominal and surgical opinion".

49. Around this time, Dr E also discussed Mr A's case with the on-call senior medical officer in the Department of Critical Care Medicine (DCCM). Dr E was concerned about Mr A, and thought that he should be transferred to the DCCM High Dependency Unit. Dr E also informed the orthopaedic consultant of Mr A's condition and the treatment plan.

50. At 8pm, the senior medical officer and Dr E discussed Mr A, and they agreed "on a diagnosis of narcosis, aspiration, worsening acute kidney injury secondary to hypovolaemia[27] from poor oral intake and a possible upper GI bleed,[28] and a background of severe underlying liver disease". ADHB stated: "[T]he impression by [Dr E] was the underlying cause of the gastric ulcer or gastritis[29] was most likely due to physiological stress and the medications given." ADHB said that the treatment plan at this stage was "naloxone, IV[30] antibiotics, fluid resuscitation,[31] omeprazole[32] and Pabrinex[33]". Further investigation included a CT of the abdomen and a surgical review.

51. At 9.30pm a DCCM registrar reviewed Mr A. The registrar's diagnosis included "opioid narcosis and aspiration with resulting hypercarbic[34] and hypoxic[35] acute respiratory failure, a combined respiratory and metabolic acidosis[36] secondary to aspiration, opiate narcosis and worsening acute kidney injury and hyponatraemia[37]". The registrar asked the DCCM night registrar, Dr M, to review Mr A.

52. Dr L reviewed Mr A at 11pm, and again at 11.50pm. It was noted that Mr A was narcosed because 180mg of Sevredol had been given in the past 24 hours, and also that usually he drank half a crate of alcohol per day.

Day 5

53. At 12.45am, the nurse who had been on shift from 2.30pm to 11pm the previous day noted that Mr A was drowsy and confused as to time and place. She noted that naloxone

[26] A potentially life-threatening condition caused by the body's response to an infection.
[27] A condition in which the liquid portion of the blood (plasma) is too low.
[28] Bleeding in the gastrointestinal tract.
[29] An inflammation of the protective lining of the stomach.
[30] Intravenous (injected directly into the bloodstream).
[31] Replenishment of bodily fluid lost through sweating, bleeding, fluid shifts, etc.
[32] A medication used to reduce the amount of acid in the stomach and to prevent upper gastrointestinal bleeding.
[33] An injection that contains vitamins B and C.
[34] Abnormally elevated carbon dioxide levels in the blood.
[35] Absence of enough oxygen in the tissues to sustain bodily functions.
[36] Accumulation of too much acid in the body.
[37] Insufficient sodium in the blood.

400mg had been administered the previous day, and that Mr A's family had been advised of his condition.

54. At 1.30am, Dr M reviewed Mr A. Dr M noted that after naloxone had been given Mr A was responsive, and that the problems were morphine overdose, aspiration pneumonia, kidney failure, and hyponatraemia.

55. At 8.30am, Dr E handed over Mr A's care to the senior medical officer in the General Medicine ward, and arranged for Mr A to be transferred to the medical observation unit on the medical ward.

56. At 9.50am, the nursing observations showed that Mr A's heart rate, respiratory rate, and temperature were stable. At 10.20am, Mr A was transferred to the medical ward.

57. At 1.00pm, Mr A was assessed by the Hepatology registrar. At 2.15pm, Mr A was assessed by the Gastroenterology house officer, who noted that Mr A had stable vital signs and was oriented. The house officer advised that Mr A required an "urgent review" from the Liver Team, and recommended non-urgent gastroscopy.[38]

58. At 2.40pm, the registrar from the Liver Transplant Unit reviewed Mr A and confirmed that "he had decompensated cirrhosis[39] secondary to aspiration pneumonia which resulted from his reduced level of consciousness from hepatic encephalopathy[40] which had been precipitated by post-operative narcotic analgesia". The registrar suggested usual cares for hepatic encephalopathy and for hepatorenal[41] syndrome.

59. At 6pm, Dr C and the registrar assessed Mr A. Dr C noted: "[Mr A] had been functioning well prior to this admission despite evidence of early liver failure … he is now very ill … with his MELD score now 24[42]."

60. Dr C discussed Mr A's prognosis and clinical status with Mr A's family, and Mr A was transferred to the Liver Unit ward. Dr C also advised that further DCCM opinion would be sought. Mr A was transferred to the Liver Unit ward at 8.40pm.

Day 6

61. DCCM was asked to review Mr A in regard to his worsening hypoxaemia.[43] Dr M reviewed Mr A at 3.30am, and at this stage Mr A's condition had worsened. Mr A was given 80mg of IV furosemide,[44] and Dr M planned to review Mr A again in an hour's time. Mr A had not improved by this time, and he was admitted to DCCM at 5.30am.

[38] Visual examination of the lining of the upper part of the digestive tract.
[39] Advanced liver disease.
[40] Loss of brain function caused by a damaged liver not removing toxins from the blood.
[41] Progressive kidney failure seen in people with severe liver damage, most often caused by cirrhosis.
[42] At admission, Mr A's MELD score was only 12. The estimated three-month mortality for a MELD score of 24 is around 19.6%.
[43] An abnormally low concentration of oxygen in the blood.
[44] Medicine that promotes the increased production of urine.

62. ADHB said that at this stage:

> "[Mr A] was in multi-organ failure and the DCCM team thought that he would need escalating support and so had a discussion amongst the intensivists and subsequently with the liver team about whether this was appropriate given his underlying liver function. The liver team, in view of his high functioning prior to this episode, thought that multi-organ support would be appropriate and so [Mr A] was intubated and started on renal replacement therapy for his acute kidney injury."

63. A family meeting was held. Mr A's family was informed about his organ failure, and the impact of impaired liver function was discussed. Mrs A stated that she was advised to rally the family, as Mr A might not survive the next four hours.

Subsequent events (Days 16–28)

64. Mr A required "multi-organ support with ventilation, inotropes,[45] continuous renal replacement therapy, blood and blood products, nasogastric feeding and antibiotics". His condition improved slowly over the following week. On Day 16, Mr A was successfully weaned off ventilator support and extubated, and he was transferred to the Liver Unit ward.

65. On Day 21, Mr A showed evidence of an ongoing chest sepsis, with increased oxygen requirements. Mr A was reviewed by the Infectious Diseases team.

66. ADHB told HDC that from Day 24, "there was evidence of steady clinical deterioration with increasing drowsiness and haemodynamic[46] instability on dialysis".

67. On Day 27, a decision was made that Mr A was no longer able to be dialysed, and haemodialysis[47] was ceased. On the same day, a further family meeting was held to explain that Mr A was expected to die.

68. Mr A continued to deteriorate over the next 24 hours, and he died on the ward.

Information from ACC

69. Mrs A provided HDC with a report from ACC. The ACC Treatment Injury Medical Advisor was asked to explain whether treatment factors were the material cause of Mr A's injuries. The advisor stated:

> "There appears to have been interaction of treatment factors and underlying cirrhosis of the liver … It appears that the use of narcotics for postoperative pain relief along with effects of physiological stress of the surgery on the liver resulted in drowsiness as a factor in aspiration pneumonia — this associated with sepsis, acute kidney injury and multi-organ failure — this all in the context of decompensated underlying cirrhosis of the liver."

[45] A group of medicines that affect contraction of the heart muscle.
[46] Dynamics of blood flow.
[47] A process used to purify the blood of a person whose kidneys are not working normally.

Further information from ADHB

70. In relation to this incident, ADHB provided statements from Dr C of the Liver Unit, Dr D of DCCM, Dr E of General Medicine, Dr F of the Orthopaedic Department, Dr G of the Acute Pain Service, Dr H of the Department of Anaesthesia, and Dr I of the Department of Anaesthesia and Perioperative Medicine.

Orthopaedic Department

71. Dr F informed HDC:

> "Clearly in retrospect and considering the final disastrous outcome, advice from the Liver Service may have been well employed. From my review of the documentation, the Orthopaedic assessment and treatment plan was comprehensive and appropriate ..."

72. Dr F told HDC that the assessments of Mr A's condition by the junior medical staff over the 24–48 hours following his surgery were appropriate, and that the referrals to other teams were also appropriate. Dr F said: "[Mr A] was well monitored clinically from the time of admission until [Day 4]."

73. Dr F stated:

> "It would seem to be a matter of debate whether the Orthopaedic Team should have consulted with the Liver Team prior to surgery … This view does not mean that failing to contact the Liver Team was below the standard of care expected."

74. Dr F concluded:

> "[U]pdates from the Medical Service in general and the Hepatology Service in particular would be valuable and … further discussion concerning [Mr A's] case would be useful to everybody involved."

Anaesthetist and Pain Service

75. Dr G told HDC that despite Mr A's liver condition, the dose and prescription of drugs were appropriate, and all analgesics were prescribed and given according to ADHB standards of care.

76. Dr H told HDC:

> "[The anaesthetist] noted in his preoperative review of [Mr A] the fact that he was recently diagnosed with Liver cirrhosis 2nd to Hepatitis C … There is no record of a consideration of consulting the liver service before anaesthesia."

77. In relation to the daily upper limit of the drugs prescribed, including Sevredol, tramadol, and oxycodone, Dr I told HDC:

> "There is too much variation between patients and their response to surgery to limit dosage routinely and so we rely on ongoing assessment … we advise staff to reduce

> dose and/or frequency if they wish to limit overall opioid use rather than using a random number."

78. In relation to the Sevredol given to Mr A, Dr I told HDC that in view of Mr A's continuing severe pain, and his ability to mobilise, eat, and drink prior to being given the sedation, in real time (not hindsight) the Sevredol dose may not have been considered very high.

Liver Unit

79. Dr C stated in his letter to the Coroner dated 28 July 2016:

> "The Liver Unit team had [previously assessed this man] and were aware of his liver dysfunction. They were not consulted about his admission until the 3rd postoperative day. Earlier consultation for advice on perioperative management may have assisted to prevent this man's adverse outcome."

DCCM

80. Dr D of DCCM noted:

> "[T]he high dose of opiates given to [Mr A] on a background of a significant cirrhosis liver disease-impairing hepatic metabolism and an acute kidney injury impairing excretion of morphine metabolites would have predisposed him to a risk of aspiration."

81. Dr D commented: "[I]n [Mr A's] case early treatment with IV antibiotics may have been beneficial." He also said that at the time it was difficult to diagnose hepatic encephalopathy, as Mr A "had changes in level of consciousness secondary to narcotics". Nevertheless, Dr D stated that "given the fact that [Mr A] had cirrhosis and had the known precipitants", earlier treatment for Mr A's liver condition may have been beneficial.

General Medicine Department

82. Dr E stated that with the benefit of hindsight, and on review of the records, she agreed that the Orthopaedic Team could have consulted the Liver Team earlier in Mr A's admission.

Total dose of Sevredol given to Mr A

83. ADHB said that Sevredol was prescribed without a maximum daily dose and, according to the chart, four different nurses administered Sevredol over the 24-hour period. All four nurses followed the chart as prescribed. ADHB told HDC:

> "Whilst in retrospect it might seem obvious that the nurses should have identified the number of doses being administered, this must be considered in light of the other demands of the nursing staff at that time with other patients, the analgesia requests from [Mr A] himself and whether his observations gave any indication of opioid excess."

84. ADHB also told HDC that in hindsight, the prescriber should have added a maximum dose in 24 hours or some sort of indicator for medical review if a certain number of doses were

administered within a particular time period. However, ADHB said that this is not common practice.

ADHB's RCA Report

85. In 2016, HDC was advised that ADHB had formed a Root Cause Analysis (RCA) group to review the care provided to Mr A. A copy of the report was provided to HDC in March 2019.

Inconsistent use of a mortality risk assessment tool

86. The RCA report noted that Mr A's MELD score was congruent with the information provided from the clinic appointment six weeks previously. His actual MELD score on Day 1 was 15, given his condition on the day. This would have increased his peri-operative mortality risk from 10.3% at 30 days and 17% at 90 days, to 25.4% at 30 days and 32.3% at 90 days.

87. The RCA report stated:

> "There is no evidence that mortality risk score tools are routinely used … the use of a mortality risk score tool would have provided [Mr C] and his family an opportunity to consider whether they wished to progress with surgery or whether they wished to consider a more conservative therapeutic option such as physiotherapy."

Delay in detecting early signs of deterioration

88. The RCA report noted that there were delays in detecting Mr A's early signs of deterioration. Despite the recognition of Mr A's history of liver disease, "there was no consultation with the liver service preoperatively, or immediately postoperatively" and specialist medical input may have provided a different plan for postoperative management. Staff did not consider the need for referral to the Liver Team to be likely because the surgery was relatively minor.

89. Kidney function tests were performed preoperatively and on the first day after the surgery, but the results were not reviewed. The RCA report stated that Mr A's creatinine[48] level rose from a baseline of 70 micromol/L to 140 micromol/L, indicating acute kidney injury, which would be unexpected for a relatively minor operation. As a result, there was no change to the Sevredol dose in light of the newly deteriorating kidney function.

90. The RCA report stated:

> "Junior medical staff interviewed stated that the public holiday on call shift was very busy and no routine reviews could be undertaken unless identified as requiring review on the post take ward round, or by nursing staff concern."

[48] A chemical waste product in the blood that passes through the kidneys to be filtered and eliminated in urine. The normal level for creatinine in a blood sample is up to 110 micromol/L.

91. The report noted that the workload on the public holiday prevented earlier assessment on Day 4, and a medical review did not occur until late afternoon on that day. There was also a delay in formal review by the house surgeon given the clinical workload.

Administration of excess analgesia

92. The RCA report stated:

> "Had there been instructions around the potential risks of oral opioid administration in a patient with liver impairment documented on the medication chart or in the clinical record, such as an upper dose limit within 24 hours, the high levels of administration of oral opioid may have been avoided."

93. It was also noted that if clinical guidelines or organisational policy relating to oral opioid administration in patients with liver/renal impairment had been available, the oral opioids may have been prescribed differently, and a medical review may have been triggered earlier.

Timely escalation of Mr A's condition

94. The RCA report noted that in the early hours of Day 4, a respiratory rate of 4–6 breaths per minute was recorded, but this was not documented in the EWS, where it would have scored a 5 and triggered a code call. The RCA report also stated that it could find no documentation or evidence that the clinical nurse advisor had been called. Also, on several occasions, the EWS scores were not totalled.

95. The RCA report stated:

> "If the EWS score had been totalled it is possible that this would have resulted in nursing staff activating a code call between 2 am and 3 am on [Day 4]. This would have initiated earlier review and treatment by a wider team."

96. Staff were interviewed during the RCA process, and the RCA report stated that staff were unable to complete two-hourly observations alongside their current workload, and they used their clinical judgement to determine which patients to escalate.

97. The policy for oral opioids states that if a respiratory rate is less than 8 breaths per minute, an urgent medical review must be sought. However, no urgent medical review was sought when Mr A had a respiratory rate of 4–6 breaths per minute. The RCA report stated that there was an apparent lack of awareness and failure to follow the oral opioid policy.

ADHB policies

98. ADHB's Pain Opioids Oral for an Adult (November 2014) stated that patients specifically affected by this policy are those who have been prescribed oral morphine (morphine elixir or Sevredol), oxycodone, pethidine,[49] or tramadol. The policy provided a flowchart that stated that if the respiratory rate of a patient who is consuming oral opioids is less than 8

[49] Synthetic opioid pain medication.

breaths per minute, then clinicians should administer oxygen, seek urgent medical review, monitor closely, and consider IV naloxone.

99. ADHB's EWS Chart stated that if the total EWS score is 5 or more, the clinical staff should:

a) Notify the clinical nurse/midwife in charge;

b) Make a Code Red Call (call 777) or an Obstetric Code Call (call 777); and

c) Document the event in the clinical notes.

Changes made since incident

100. ADHB advised that as a result of the incident, the RCA report was provided to all the relevant teams, and the following changes or initiatives were implemented:

a) On 19 February 2019, ADHB discussed with its Clinical Board the implementation of an e-vitals programme with a trigger to the escalation system;

b) After consultation with the Liver Team and the Surgical Board, ADHB considered the development of a liver/renal specific analgesia guide and sticker, and agreed to implement this in September 2019;

c) ADHB reviewed the Pain Opioids Oral for an Adult policy to ensure that it contained guidance on sensitivity to opioids for renal/liver patients. A draft version of the updated policy was provided to HDC, and the updated version discusses the use of opioids for patients with hepatic impairment and renal impairment;

d) ADHB considered the implementation of mortality scoring tools to identify patients with surgical risk and develop a process for consistent use of a risk assessment score (MELD) across specialties to identify patients with peri-operative mortality risk in patients with cirrhosis. ADHB agreed to implement this in December 2019;

e) ADHB utilised Variance Response Management, [50] Care Capacity Demand Management,[51] and Trendcare[52] to escalate acuity on wards to ensure safe medical and nursing staffing on wards on public holidays. ADHB agreed to implement this in June 2019;

f) ADHB considered how peri-operative medical support is provided to patients in the surgical specialties. ADHB said that there has been significant change since this case, with the introduction of the patient at risk service, the NZ Early Warning Score and Vital Signs Chart, and a mandatory escalation pathway;

g) The NZ Early Warning Score and the subsequent training and mandatory escalation will assist in ensuring that patients at risk of deteriorating will be reviewed in a timely manner;

[50] A set of tools and processes. It is used when there is a mismatch between patient demand and the capacity to care. Variance response management helps decision-makers to provide the right staff numbers, mix, and skills for every shift, every day.
[51] A set of tools and processes that help DHBs to better match the capacity to care with patient demand.
[52] A workforce planning and workload management system.

h) A clinical forum was held by ADHB in 2016 in the Anaesthetic Department to follow up on education on the issues of presentation of liver failure patients to the operating room, and a formal follow-up lecture was given entitled "Patients with liver failure presenting for non-Liver Surgery". This has been condensed into a review authored by two members of ADHB's Anaesthetic Department, and concentrates on the preoperative risk assessment of patients with liver failure; and

i) Junior medical staffing in the Orthopaedic Service has been increased.

Responses to provisional opinion

Mrs A/Mr B

101. Mrs A was provided with an opportunity to comment on the "information gathered" section of the provisional opinion. Mr B, Mr A's brother, sent a response on the family's behalf, and, where appropriate, their comments have been incorporated above.

ADHB

102. ADHB was provided with an opportunity to comment on the provisional opinion. ADHB stated: "[W]e acknowledge you propose to find ADHB in breach of [the Code of Health and Disability Services Consumers' Rights (the Code)] and have made a number of recommendations and follow-up actions."

Opinion: Auckland District Health Board — breach

103. This opinion concerns the standard of care provided by ADHB to Mr A in 2016.

104. ADHB has an organisational duty to provide services of an appropriate standard. This includes providing adequate support to staff in respect of the application of relevant policies, and ensuring that all staff work together and communicate effectively.

105. The care provided to Mr A by ADHB was suboptimal in a number of respects.

Standard of care — breach

Sevredol prescribing

106. Mr A was a patient with an underlying liver condition. Mr A was admitted to ADHB for a shoulder operation. Postoperatively, whilst under the Orthopaedic Team, Mr A was prescribed 10–20mg of Sevredol 2 hourly PRN. At 9.45am on Day 3, he was reviewed by the Pain Service Team, and the dose of Sevredol was changed to 10–20mg hourly PRN. Both the Orthopaedic Team and the pain specialist noted Mr A's liver condition in his clinical notes, but no daily upper limits were set for the Sevredol prescribed to Mr A.

107. Following this prescription, on Day 3, nurses administered Mr A 20mg of Sevredol nine times within 24 hours. In total, Mr A was administered 180mg of Sevredol. Around 2am on Day 4, Mr A exhibited some concerning signs, and was reviewed by an orthopaedic

registrar at 4am. It was noted that Mr A was "narcotic", and the medical officer instructed the avoidance of any more Sevredol.

108. The ADHB Anaesthetic and Pain Service told HDC that the dose and prescription of the opioids prescribed, including Sevredol, tramadol, and oxycodone, were appropriate, and that the Sevredol dose administered may not have been considered very high at the time. In relation to the daily upper limit, ADHB said that there is too much variation between patients and their response to surgery to limit dosage routinely, so they rely on ongoing assessment by the clinical staff.

109. ADHB's RCA report stated that had instructions around the potential risks of oral opioid administration in a patient with liver impairment been documented on the medication chart or in the clinical record, such as an upper dose limit within 24 hours, the high levels of administration of oral opioids may have been avoided.

110. Expert advice was obtained from Dr David Jones, an anaesthetist and pain specialist, and he advised that the drugs that were prescribed were appropriate. However, Dr Jones stated:

> "I consider more thought could have been used in the choice, instead of relying on (their) standard protocol. Exceptions [or] variances need to be catered for more specifically. Because both morphine and tramadol require hepatic metabolism for some of their effect and their removal, with dependence on renal clearance, in my opinion those two drugs were not the wisest of choices."

111. I accept Dr Jones' advice. Mr A was a patient with a history of hepatitis C and liver conditions. Even though the drugs prescribed were considered appropriate, I am critical that no daily upper limit was set for the opioids prescribed, and that as a result Mr A was given 180mg of Sevredol within 24 hours.

Consultation with the Liver Team

112. From the time of Mr A's admission until Day 5, the Liver Team was not consulted when Mr A deteriorated significantly. There were no discussions with the Liver Team, by either the Orthopaedic Team or the Pain Service, prior to Mr A's surgery.

113. The Orthopaedic Team told HDC that its failure to contact the Liver Team does not mean that the care provided was below the standard expected. However, specialists from ADHB's Liver Team, DCCM, and General Medicine all agree that given Mr A's liver condition, earlier consultation with the Liver Team before the surgery may have been beneficial.

114. ADHB's RCA report noted that specialist medical input from the Liver Team may have provided a different plan for postoperative management.

115. Expert advice was obtained from Dr John McKie, an orthopaedic specialist, who advised that he would not have expected the Orthopaedic Team to have consulted with the Liver Team prior to surgery.

116. On the other hand, Dr Jones advised that "the right people and best time to have consulted with the liver team were the admitting orthopaedic team, as part of workup deciding what, if any, operation was suitable".

117. I acknowledge the advice from Dr McKie, and also the comment from ADHB's Orthopaedic Team that failing to contact the Liver Team does not mean that it was below the standard of care. However, in my opinion, Mr A was diagnosed with cirrhosis and hepatitis C, and this was acknowledged by the admitting orthopaedic staff. The RCA report and the specialists from the Liver Team, DCCM, and General Medicine all noted that it would have been beneficial for the Liver Team to have been consulted before the surgery, and similarly Dr Jones also advised this. In my opinion, it would have been reasonable for a person in Mr A's situation — a patient with significant co-morbidities — to have received a consultation with the Liver Team preoperatively. Accordingly, I am critical that this did not occur.

Failure to follow EWS Chart guide

118. On Day 4, around 2am, it was noted by a nurse that Mr A's respiratory rate was 4–5 breaths per minute and that his oxygen saturation kept dropping to 87–88%. The nurse immediately sought a medical review and remained with Mr A. At 4am, Mr A was reviewed by the orthopaedic on-call house officer. However, Mr A's deterioration was not reflected on the EWS Chart, and the total early warning scores were not recorded during this time. While the nurse waited for the medical review, no code call or repeat call to the house officer was made from 2am to 4am.

119. ADHB's EWS Chart stated that if the total EWS is 5 or more, the clinical staff should make a Code Red call and notify the clinical nurse advisor. The RCA report noted that given the observations by the nurse at 2am on Day 4, Mr A would have been given an EWS of 5, and this would have triggered a code call. ADHB could find no evidence that the clinical nurse advisor was contacted. The early warning scores were also not totalled on several other occasions.

120. Dr Jones noted the failures to total the early warning scores, and the anomaly of the EWS record not being consistent with the clinical notes is clear in the RCA report.

121. I am critical that the staff at ADHB failed to utilise the EWS Chart. An EWS was not calculated when Mr A deteriorated on Day 4 and, as a result, a code call was not made. This led to a delay in Mr A's care being escalated.

Failure to follow Pain Opioids Oral for an Adult policy

122. As discussed above, Mr A was prescribed Sevredol and tramadol, and at 2am on Day 4, his respiratory rate dropped to 4–5 breaths per minute.

123. ADHB's Pain Opioids Oral for an Adult policy (Opioids Policy) applies to patients who have been prescribed Sevredol or tramadol. The policy provides a flow chart that states that if a patient who is being administered opioids has respiratory rates that are less than 8 breaths per minute, then the clinician should administer oxygen, seek urgent medical review, monitor closely, and consider the administration of IV naloxone.

124. As noted in the RCA report, no urgent medical review was sought despite Mr A meeting the Opioids Policy criteria. I am critical that there was an apparent lack of awareness of, and a failure to follow, the Opioids Policy at ADHB.

Failure to review kidney test results

125. Kidney function tests were performed preoperatively and on Day 1 postoperatively, but the results were not reviewed. Subsequently, Mr A's creatinine level increased postoperatively from 70 micromol/L to 140 micromol/L, which indicated kidney injury. As the kidney tests had not been reviewed, there was no resulting change to the morphine dose in light of the newly deteriorating kidney function.

126. I am concerned that despite the kidney tests being ordered, the results were not reviewed. This meant that Mr A's kidney condition was not picked up by ADHB staff.

Conclusion

127. In summary, I consider that ADHB failed to provide appropriate care to Mr A for the following reasons:

a) No upper limit was set for the opioids prescribed to Mr A, and more consideration could have been given about the choices of oral opioids prescribed. As a result, Mr A was administered excess analgesia;

b) The Liver Team should have been consulted preoperatively or earlier after the surgery;

c) The EWS Chart guidelines were not followed;

d) The Opioids Policy was not followed; and

e) A review of the kidney test results was omitted.

128. As a consequence, ADHB staff failed to appreciate the extent of the risk presented by Mr A's underlying condition, and did not respond appropriately when his condition deteriorated. Taking into account these deficiencies, in my opinion ADHB did not provide services to Mr A with reasonable care and skill, and breached Right 4(1) of the Code.[53]

Staffing issues — adverse comment

129. During the RCA process, junior medical staff were interviewed as to why the kidney tests were not reviewed. It was found that the public holiday on-call shift was very busy, and that no routine reviews could be undertaken unless identified as requiring review on the ward round, or by concerned nursing staff.

130. On Day 4, after Mr A started to deteriorate, he received a medical review at 11.16am, but between 11.16am and 5pm, no other entries were recorded in the clinical notes. Mr A was next assessed by a medical officer at 5pm.

[53] Right 4(1) states: "Every consumer has the right to have services provided with reasonable care and skill."

131. The RCA report stated that there was a delay in formal review by the house officer on Day 4 owing to the clinical workload. The report also noted that nursing staff were unable to complete two-hourly observations alongside the workload at the time, and that they had to use their clinical judgement to determine which patients to escalate.

132. In my opinion, during the time of this incident there was clearly an issue with staffing levels. I acknowledge that it was during a holiday period, but nevertheless ADHB should have had in place a system to ensure that the staffing level was adequate. I am critical of the staffing level that was in place at the time, but note that since the incident, better systems have been introduced for staff roster modelling on public holidays, and there are now more junior medical staff in the Orthopaedic Ward.

Inconsistent use of MELD score — other comment

133. On Day 1, the admitting orthopaedic staff noted that Mr A had a MELD score of 11. This was the same MELD score that was recorded for him at an earlier consultation with the Liver Team. The RCA report stated that on Day 1, Mr A's MELD score would have been 15 (not 11) if his MELD had been assessed accurately at the time.

134. The RCA report also stated that there is no evidence that mortality risk score tools — in this case the MELD score — are used routinely when considering patients with liver disease for what is generally thought to be low-risk surgery.

135. Dr McKie advised that the MELD score of 12 listed in the admission clerking is incorrect as of the day of admission, but he advised:

> "It is unlikely that the admitting junior staff would have had a close knowledge or understanding of the MELD scores and I think it is most likely that this is a transcribed piece of information from previous hospital notes."

136. I accept Dr McKie's advice that the MELD score is not widely used by orthopaedic clinical staff. However, the MELD score was nevertheless noted by the Orthopaedic Team in Mr A's admission notes. In my opinion, if a MELD score is to be calculated and used, staff should be aware of its implication. As stated by the RCA report, this may offer patients with underlying liver conditions more options for their surgical treatments.

Recommendations

137. I acknowledge that since these events, ADHB has taken a number of steps to improve its systems. In my view, this investigation has identified some further areas for improvement. I recommend that ADHB:

a) Provide a written apology to Mr A's family for the breach of the Code identified in this report. The apology is to be sent to HDC, for forwarding to Mrs A, within three weeks of the date of this report.

b) In relation to the updated Opioids Policy (as stated above at paragraph 100(c)), ADHB is to consider Dr Jones' advice (in the Appendix to this opinion) and provide HDC with a copy of the final version within three months of the date of this report.

c) Report back to HDC regarding the changes implemented following its RCA report (as noted at paragraph 100), including whether the changes have been implemented as per the proposed timeline, within three months of the date of this report.

d) Conduct a review of the effectiveness of the changes, as stated in the RCA recommendations, and report back to HDC within three months of the date of this report.

e) Conduct an audit of 100 postoperative patients seen by the Pain Service Team within surgical services, to ensure its compliance with the Opioid Policy, and report the results of the audit to HDC within three months of the date of this report. If any issues are identified, ADHB is to inform HDC of the further actions to be taken to rectify the issues.

f) Arrange training for its staff in the Orthopaedic Ward, Anaesthetic Team, and Pain Team on the Opioids Policy referred to in (b) above, and on any new policies created and implemented (as per paragraph 100), and provide evidence of that training to HDC within six months of the date of this report.

g) Use this report as a basis for staff training at ADHB, focusing particularly on the breaches of the Code identified, and disseminate the learning and changes following this case via ADHB's existing forums for nursing and medical teams, and provide HDC with evidence that this has been completed, within six months of the date of this report.

Follow-up actions

138. A copy of this report will be sent to the Coroner.

139. A copy of this report with details identifying the parties removed, except the experts who advised on this case and Auckland District Health Board, will be sent to the New Zealand Orthopaedic Association, the Royal Australasian College of Surgeons, the New Zealand Pain Society, the New Zealand Society of Anaesthetists, the Australian and New Zealand College of Anaesthetists, the New Zealand Society of Gastroenterology, the Medical Council of New Zealand, the Ministry of Health, and the Hepatitis Foundation of New Zealand.

140. A copy of this report with details identifying the parties removed, except the experts who advised on this case and Auckland District Health Board, will be placed on the Health and Disability Commissioner website, www.hdc.org.nz, for educational purposes.

Appendix A: Independent advice to the Commissioner

The following expert advice was obtained from Dr David Jones, an anaesthetist and pain specialist:

"**Re: [Mr A]/Auckland District Health Board**
Your ref: 16HDC00673

Thank you for your letter 3 May 2019 inviting independent expert advice on this case.

I have read and agree to follow the Health and Disability Commissioner's guidelines for independent advisers dated March 2019.

My qualifications and relevant experience are appended at end of this report.

I have no conflicts of interest in relation to this case and enquiry. I do not know any of the practitioners involved with this patient's pre-DCCM management. I did work with [one of the clinicians] some decades ago but that management is not the subject of my report.

I have reviewed the following documents provided for this case:

1. Letter of complaint dated […]
2. Report to Coroner from Auckland DHB dated [2016] (Appendix 1 below)
3. Clinical records from Auckland DHB covering the period [of admission].
4. Some appendices as below were forwarded, described as coming from Auckland DHB
   - response dated 22 February 2018. These stood alone, mostly unrelated to this report;
   - where any relevant detail was used it is referenced in my report:

Appendix 2: DCCM — [Dr D]
Appendix 3: General Medicine — [Dr E]
Appendix 4: Orthopaedics — unidentified
Appendix 5: Acute Pain Service — [Dr G]
Appendix 6: Anaesthesia — [Dr H]
Appendix 7: HQSC — re patient deterioration program, 19 December 2017
Appendix 8: Resource NZ EWS Chart Training, October 2017 (post this case)
Appendix 9: ADHB Observation and Monitoring of an Adult 10 Nov 2014

Background as provided to me:

[Mr A] was diagnosed Hepatitis C Virus in 1993. His condition was then [noted again] when he visited the Liver Clinic at Auckland DHB and his liver condition was noted in his medical record.

On [Day 1], [Mr A] was referred to Auckland DHB after injuring his right shoulder. He was admitted to the orthopaedic service for planned surgical repair. His liver condition was recorded in the clinical notes and management plan by an orthopaedic registrar.

On [Day 2], a CT scan showed [Mr A] had suffered a small fracture and he was told he needed an operation. He underwent surgery on the same day. The anaesthetist for the surgery recorded [Mr A's] liver condition in the clinical notes. Following the operation, the anaesthetist prescribed Tramadol 50 mg twice daily, Fentanyl, and up to 4 grams of Paracetamol per 24 hours. This was recorded in the Post Anaesthetic Care Unit Record form.

On [Day 3], [Mr A] was reviewed by the Pain Service Team and changes were made to the previous medicine prescription. The dose of Paracetamol was reduced and Sevredol (morphine) was prescribed at a reduced frequency. The Tramadol prescription was kept.

On [Day 4], [Mr A] started to deteriorate. He was reviewed at 4 am by the on-call orthopaedic house officer. Around 8.30 am he was assessed by a senior registrar and spine fellow and at 11.16 am, the Pain Service team made a routine follow-up visit. Further changes were made to the medication by the Pain Service team. The Sevredol prescription was stopped and Oxycodone was prescribed at 5mg hourly as required [none was given]. [Mr A] deteriorated further and at around 7 pm the orthopaedic registrar sought further advice from the General Medicine department.

On [Day 5], the Liver Unit was consulted and it was confirmed that [Mr A] had decompensated cirrhosis and aspiration pneumonia. On [Day 6], [Mr A] deteriorated further and went on to develop acute renal failure then subsequent multi-organ failure. He was admitted to DCCM [Intensive Care Unit].

[Mr A] started to show signs of improvement over the next week and by [Day 17] he was transferred back to the Liver Unit Ward for further monitoring, [DJ added: and resumed Paracetamol 3 gm daily from Day 23].

On [Day 21], [Mr A] had developed chest sepsis. He was reviewed by the Infectious Diseases Team. There was a steady clinical deterioration from [Day 24] onwards. [Mr A] died on [Day 28].

1. Assessment of [Mr A's] condition prior to operation:

a. Liver function tests at time of admission dated [Day 1] showed marked derangement:

i.	Bilirubin	81	HIGH	[0–24]
ii.	GGT	235	HIGH	[0–60]
iii.	Alk. Phos.	213	HIGH	[40–120]
iv.	ALT	99	HIGH	[<45]

v. Creatinine 107 (connected with renal function) was normal. In cirrhosis a normal creatinine can be accompanied by reduced renal clearance of some drugs.

vi. Basic haemostasis screen showed slight increase of APTT (38 vs normal range 25–37) and PR 1.1 normal.

b. Taken together the first 4 tests suggest to me moderate to severe liver cell injury at the time of presentation.

c. The orthopaedic night registrar recorded ([Day 1] 22:45):

i. '[In fifties] LHD (later wrote RHD — Right Hand Dominant) ... [occupation] ... fall down […] ... NOT outstretched arm ... Cirrhosis due to Hep C, Childs Pugh B(7) MELD 12'.

ii. That MELD score (Method for End Stage Liver Disease) likely came from [prior liver/gastroenterology service assessment], also likely available to the anaesthetist, whose records indicate an awareness of his liver condition.

d. Results as at this admission via online calculator give a MELD 15 points score with estimate of 13% 90-day mortality. Therefore I gained the impression that at the time of operation [Mr A's] liver condition had probably deteriorated since the [previous] specialist assessment with the lower MELD score as above[1].

e. On admission [day 1] the 'Scannable Medication Chart' has the instruction 'NO NIGHT TIME SEDATION'. I found no corresponding clinical note indicating why that instruction was made, but it reflects a recognition that sedating medication is a known risk in severe cirrhotic liver disease which could produce or aggravate encephalopathy (brain dysfunction).

f. Details in the rest of the admission notes do not suggest encephalopathy existed at that time, so this indicated a prudent precaution.

g. On [Day 1] while under orthopaedic team preoperative prescriptions were written for:

i. Paracetamol 1gm QID (four times daily); received 3 doses till midday [Day 2].

ii. Tramadol 50–100mg QID ditto; ditto, administered at same times

iii. Sevredol (morphine) 10–20mg Q2h (2 hourly); none given preoperative

iv. Ondansetron 4–8 mg Q12h (12 hourly); none given preoperative

h. The last 3 of these medications are actually sedating, no matter when administered. Tramadol 300mg was given in the first 24 hours preoperative.

i. Nursing notes following day ([Day 2] 10:00) record [Mr A's] Pain score was 3–4:10, with Early Warning Score (EWS) = 0. This leads to my conclusion that encephalopathy was unlikely at that time.

1 A revised score method using sodium correction when higher than 12 came about on [Day 10], therefore just after this case was admitted. If it had been used, the prognosis prediction appeared worse: 19% 90 day mortality.

2. Day of operation, [Day 2].

a. The anaesthetist recorded 'Liver cirrhosis secondary to Hep C, recently diagnosed' and 'heavy drinker until this diagnosis'. I could not see reference to extent of alcohol intake in the orthopaedic admission notes, so probably the anaesthetist asked the patient before recording this. Elsewhere hypertension and Beta-blocker medication is noted, and that [Mr A] was a smoker. Risk category recorded ASA 3E — moderate to severe impairment(s), emergency case.

b. General anaesthesia was required, even if any local anaesthesia technique was used in addition. The choice for general anaesthesia was between a volatile agent (inhalational) or continuous infusion of propofol (total intravenous anaesthesia, TIVA) — each requiring adjuvant medications like analgesics and antibiotics.

c. Older volatile agents were considered hepatotoxic, but there is little to choose between a modern volatile (very low hepatotoxic potential) and Propofol TIVA (Total Intravenous Anaesthesia). Sevoflurane at normal concentrations was used in this case, and I do not see any problem with that choice.

d. One of several principles in anaesthesia with liver disease is to ensure adequate blood pressure (BP) so as not to challenge the liver further by ischemia (poor blood flow). Apart from the almost universal BP drop at induction which was rectified promptly, a brief BP fall at 16:10 (~40min from start) was also rapidly restored with regular doses of Metaraminol (blood pressure maintaining medication) without further significant hypotension (low BP) throughout the operation. The operation took around 90 min which is not prolonged.

e. In summary re anaesthesia: apart from initial difficulty securing the airway with an endotracheal tube (3 attempts recorded, but not relevant to 'care of the liver'), haemodynamic monitoring during the anaesthesia shows nothing concerning.

f. Opioids are a normal component of both the general anaesthesia methods referred to above, but do require informed drug choice and dose modification in liver disease.

g. For this patient's size (100kg), the magnitude and the duration of operation I consider Fentanyl 200mcg dose used was 'diminutive' compared with 3–5 mcg/kg (300–500mcg) in a similar individual without cirrhosis. Therefore the dose used

here was in keeping with the principle of reducing opioid dose in severe liver disease.

h. In PACU (post anaesthesia care unit) a pain score of 4:10 was recorded by the PACU nurse within 10 min of arrival. This is in keeping with not being over sedated immediately following recovery from anaesthesia in a relatively short interval after surgery finished (ie conscious and able to answer the query).

i. A brief oxygen desaturation early in recovery room (after 15min) while breathing only room air was rapidly improved with routine oxygen administration. This argues against (the later identified) aspiration having occurred during the operation, remembering there was the initial delay in sealing the airway due to difficult intubation.

j. The anaesthetist used a standard postoperative analgesia chart, on which he charted Fentanyl to be given IV by protocol (noting the cirrhosis), a reduced dose of Tramadol (50mg twice daily) and he deleted the otherwise standard paracetamol dose regimen.

k. Fentanyl by IV PCA was also an appropriate drug choice for his condition, and was set up in PACU at 17:17. In my opinion that was an appropriate choice, although I would have liked to see a limit on total fentanyl dose available.

l. I was unable to find how many demands the patient made for PCA fentanyl to be delivered, nor supply bag changes (ie detail of total consumption). I understand from [Dr G's] report (Appendix 5) that it was '800mcg, or approx. 40 successful demands at usually charted doses, until it was reviewed by the APS next day less than 24 hours from start.

m. Nursing shift note [Day 2] 22:30 indicates patient was returned to ward at 18:20 'alert, orientated ... mobilised to toilet (2) without aid'. Again, no evidence of excessive medication effects.

n. Overnight [Day 3] nursing notes (03:45 — a somewhat unusual time to make such a report?): 'Pt had minimal sleep ... given oral analgesia (as described above) ... PCA fentanyl ... mobilises independently'.

3. Day following operation, [Day 3]:

a. Morning Orthopaedic Consultant Ward Round noted [Mr A] was 'Comfortable'.

b. Acute Pain Service (APS) visited a short time later (09:45) and left a routine visit stamp in the notes (unsigned) indicating: 'PCA, Oral Analgesia' in use. Drug prescription sheets show a corresponding prescription for Sevredol (morphine) 10–20mg PRN hourly, where the first dose is recorded 15min later at 10:00.

c. By implication, as there were no later references to Fentanyl, this oral analgesia presumably replaced it, with an expectation to titrate it to effect.

d. Within the next 24 hours, a total of 180mg Sevredol morphine was recorded as administered until 02:04 on [Day 4].

e. I note this prescription was unlimited as to total dose. The choice of morphine and the total administered is discussed in context of standards and recommendations below.

f. OPINION: By any standard that was a large dose of morphine over 24 hours, in any patient. Even more so in the light of morphine's greater bioavailability in patients with liver disease, known to be more sensitive to opioid effects and liable to encephalopathy. If developing acute renal impairment the effects would be greater still due to reduced metabolite excretion.

g. Paracetamol 1gm x 3 doses was given concurrent with that. This was a reasonable dose, and still from original orthopaedic team prescription. The anaesthetist deleted paracetamol from the standard post op analgesia prescription form to prevent double-up.

h. PLUS: Tramadol 400mg was also administered, from the original orthopaedic team prescription. I concluded that exceeded what the anaesthetist had prescribed (50mg twice daily), and that the prior prescription must have been left in place.

OPINION: That is a high dose of Tramadol, a drug which also requires liver metabolism for some of its efficacy and removal. It is four times what the anaesthetist prescribed. Tramadol in some patients is very emetogenic (provokes vomiting), which would have been unhelpful here.

4. Nursing records were studied to try to understand what circumstances led to so much Sevredol morphine being administered from a 'PRN' (as needed) prescription.

a. Two notes were found, first dated [Day 3], without time, and the next 22:00 same day:

i. The first: 'OBS stable ... wife assisted with showers. On oral analgesia now and tolerable pain as stated'.

ii. The next: 'alert, orientated, appears stable but request (sic) analgesia many times. Visited by wife ... went to level 5 and walk around with wife sometimes ... oral analgesia given as charted ...'

b. From these 2 notes, it seems that from an unlimited oral analgesia prescription to be given hourly PRN (ie titrating till pain relief obtained), the patient's requests for more analgesia has driven the total given, until around 02:00 on [Day 4]. The nature of this high request rate is examined later.

c. Following nursing request, based on reduced respiratory rate and falling oxygen saturation, the on call night house officer (Dr L) reviewed [Mr A] at 04:00 on [Day 4]. Although not specifically described in the notes as such this would be equivalent to an Early Warning Score (EWS) response.

d. I note this occurred at a time common for these events in postoperative patients, often related to opioid analgesia.

e. [Dr L] noted a similar issue had occurred on the preceding night, when PCA Fentanyl was being used. She recorded the main items of medical history plus 'Large BMI + snorer' as risk factors for such events. In particular she recorded 'good breath sounds, pupils (Normal)'. [Dr L] ordered a chest X-ray and 'no more Sevredol for 2 hours'.

5. Discussion/Comment on the events up to this point:

a. The OCHS's diagram and comment on the breath sounds does not clearly support an aspiration pneumonitis at that time. The usual signs include 'crackles' and wheeze noises over the lung fields. More commonly these are unilateral.

b. Aspiration [of stomach content] pneumonitis is always a consideration at anaesthesia induction, and in over narcotised-sedated patients not able to protect their airways.

c. The pupil size she recorded (in the eye) is not clear support for being over narcotised (too much opioid effect). Pupil size is quite sensitive to opioid effects, with small pin-point size pupils the sign of too much.

d. If the OCHS had been seriously concerned about excessive opioid narcotisation, then treatment with Naloxone (opioid antagonist) would have been appropriate at that time. In my experience house medical staff tend to use it early to see if improvement occurs, rather than fail to use it when it should have been given. Naloxone was in fact not used until more than a day later.

e. There is no reference to a Sedation Score, considered the most sensitive monitor of impending Opioid Induced Ventilatory Impairment (OIVI) which occurs ahead of reductions of respiratory rate from opioid. Ability to maintain a conversation, or not, during this assessment would have been the main warning.

f. Apart from in the initial admission ward before transfer to the orthopaedic ward, no Early Warning Score (EWS) is mentioned. I have not been provided with patient observation charts, so they could exist. I could not assess oxygen saturation other than from what nursing notes recorded.

g. In retrospect I think if [Dr L] had calculated the total morphine dose given, the order might have alternatively been to cease it altogether, and possibly try naloxone.

6. Second postoperative day [Day 4]:

a. The 07:00 overnight nursing shift notes on patient condition begin the day thus:

   i. 'wants some fresh air' [DJ: ie restless]

   ii. 'Pain score 7–8/10, analgesic given' [=paracetamol 1gm at 05:10]

   iii. 'Walking around bedspace to the toilet, feel nauseated. ... vomited browny, volume small'

   [DJ: not too obtunded if able to walk like that]

   iv. Obs: 'BP 104/54 Saturation oxygen 85% Air.

   Improved with oxygen given [unreadable] % — 95%'.

   v. '... Sleep, Resp 4–5, SaO2 keep dropping to 87%–88%'. [DJ: 3 concerning signs]

b. Nurses apparently struggled to keep his oxygen mask on, with patient continuing to remove the oxygen, while they waited for the OCHS to review again.

c. This review is referred to as 'see Notes in the front'.

d. Some of the notes looked like out of chronological order, or someone made a mistake with date (not uncommon with night shift work). I wondered if this was the [Day 4] 17:00 [Dr J] assessment (see below), otherwise I did not find a corresponding alternative note.

e. Two further vomits occurred: 'small amount'. [No colour is mentioned in these notes. The letter of [Mrs A] confirms (p.2) he told her he had vomited 'dark stuff' during the night of [Day 3], and later told them (p.3) it was 'like coffee granules'.

f. Chest X-ray (CXR) was performed about this time

g. The orthopaedic fellow noted:

   i. difficult to arouse

   ii. confused

   iii. not orientated to time and place

   iv. ? narcosed

h. Nursing notes followed with similar:

   i. confusion at beginning of shift

   ii. 'patient keeps removing (the arm sling)'

   iii. 'keeps sleeping' ...

   iv. 'usual meds not given this morning due to drowsiness'

   v. 'walked to toilet to PU'.

COMMENT: clues to a deteriorating cognitive state, with confusion/delirium and/or progression to hepatic encephalopathy. But also surprising that the patient can walk to toilet at this time when supposedly over narcotised.

i. At 11:16 the Acute Pain Service ('[registrar]') reviewed:

   i. They ticked boxes on their visiting stamp for: 'Oral analgesia, Standard'

   ii. 'Comfortable' ...

   COMMENT: from the notes available, I could not interpret if the patient verbalised this to APS, or they assumed that because he was sleepy and not reporting pain.

   iii. 'Sedation noted' ...

   COMMENT: cannot interpret if they observed sedation, or repeated the fact from the earlier records eg orthopaedic fellow.

   iv. 'Plan: Reduce dose Sevredol' was written, then this was crossed out and replaced with 'change to oxycodone 5mg prn'.

   v. *COMMENT:* I note this is also an unlimited prescription

   vi. However according to the administration records no Oxycodone was given

OPINION: I would expect APS personnel (nursing and medical) to assess a sedation score, and whether or not it was deteriorating, in any patient receiving opioid analgesia. This is a key part of early warning for opioid induced ventilatory impairment (OIVI). Incipient encephalopathy adds a further reason to document this in a case with liver disease.

j. At 1700 House Officer ([Dr J]) documented an extensive review on request because of a deterioration, which included:

   i. 'Hyponatremia (low sodium) 129'

   COMMENT: probably indicates hepato-renal syndrome present

   ii. 'CXR consistent with aspiration',

   iii. BUT then he went on to record physical examination findings for the chest: 'clear posteriorly, nil added'.

   iv. He noted 180mg Sevredol past 24 hours

   v. He concluded elevated creatinine 148 was from 'Acute Kidney Injury'

   Under the heading of subjective (symptoms) an extensive functional enquiry was documented, including:

   vi. ... abdomen 'not distended more than usual' [my italics]

   vii. pupils mildly constricted

   viii. Glasgow Coma Scale 15 [=normal]

COMMENT: GCS scale not designed nor sensitive enough to assess opioid induced ventilatory impairment (OIVI)

ix. Oriented to time, person and place

x. Able to count backwards from 20 ...

COMMENT: some appear contradictory to opening statement 'Pt has delirium'.

k. At the end of [Day 4] (23:50), OCHS [Dr L] again reviewed [Mr A's] Multi-organ failure which included:

i. Lungs: right middle lobe changes on CXR

ii. Type I & II respiratory failure

iii. Sepsis: possibly from lungs/pneumonia, or gut problem

iv. Hepato-renal dysfunction: creatinine marked rise 344, Hyponatremia

v. Coffee ground vomits — indicating gastric bleeding ?gastritis, ?stress effect

7. Comment on events until just after midnight, second postoperative day ([Day 4]):

a. Patient has been extensively assessed by Medical Registrar, General Medicine Consultant, and Department of Critical Care Medicine (DCCM) Registrar.

b. From the responses recorded between this group of specialised attendants, in my opinion some retrospective conclusions can be made:

i. There are some satisfactory cognitive function observations as well as poor ones, meaning marked fluctuation in cognitive function.

ii. Good function examples: satisfactory orientation, counting backwards from 20.

iii. The responses recorded must have arisen from questions the patient answered. If he was too obtunded many of the items should have been silent.

iv. It was not until 02:00 on [Day 5] that anyone thought to use Naloxone (an opioid antagonist). Therefore the good cognitive moments described above could not be attributed to reversal of opioid effects. They appear to be spontaneous fluctuations.

v. Despite recording 'aspiration', none of these attendants recorded crackles/wheezes usually associated with same. Although I did not see the actual CXR images, several describe ground glass appearance; one later describes Rt Middle Zone (RMZ) effects which is a typical location for aspiration, and another describes patchy infiltration.

c. I would have expected opioid induced ventilatory impairment (OIVI) after 180mg morphine administered, but surprisingly none of the above unequivocally supports that as the only or main problem.

d. Clearly [Mr A's] cirrhosis underwent decompensation in the early postoperative period. Based on all the above I struggle to attribute all of the various multi-organ failures to a single cause of over narcotisation and aspiration pneumonitis. It is likely to be multifactorial.

8. Other factors which may have been operating in this case:

a. [Dr E] on [Day 4] obtained a history not previously recorded:

i. 'Feels like has gone through coffee grinder', and

ii. 'Usually drinks 1/2 crate/day, not for 7 days' and

iii. 'Coffee ground vomit (small amt in pottle)'

This suggests probable gastritis/bleeding — ?connected with stress of operation.

b. This is considerable alcohol consumption on top of the cirrhosis diagnosis made at the latest [six weeks previous to his 2016 admission], and suggests an alcohol use disorder (AUD) — ie continuing use despite recognised harm. I note in letter of complaint that family deny this, but I think it unlikely that [Dr E] would have made it up.

c. This heavy use of alcohol was almost until (or until) the time of this admission, depending on how literal '7 days' should be read. Being recent, one might expect an abstinence withdrawal problem somewhere during admission.

d. [Mr A's] high demand for analgesia, as recorded in nursing notes, likely reflects behaviour seen in persons with substance use disorders (SUDs), trying to ameliorate alcohol abstinence syndrome (was that the meaning of: 'like ... gone through coffee grinder'?) with other behaviourally reinforcing drugs like opioids. There is overlap.

e. From reading the records, the likelihood of withdrawal was not anticipated. It was not until [Dr E] asked the question when [Mr A] was already deteriorating that the extent of his use was uncovered and recorded.

f. The only likely prevention for the consequent high Sevredol opioid administration in the face of such a demand might have been having a limit on total dose in the prescription, although there is no guarantee that even morphine dose restriction would have averted all the subsequent problems.

g. With the benefit of hindsight, I believe that if the original fentanyl had continued, or oxycodone if an oral agent preferred, for post-operative strong analgesic these might have given less problems because these do not produce complicating metabolites, especially they do not depend on renal clearance for terminating their effects.

h. The hepatic toxicity of paracetamol has been highly debated, and literature messages are mixed — ie from no problem at low normal doses to descriptions of increased levels of a hepato-toxic metabolite under certain conditions.

i. The best known message seems to be that there is no increased risk of toxicity in acute alcohol intake mixed with paracetamol, except in significant paracetamol overdose.

j. However, chronic high alcohol intake has two compounding effects leading to increased risk of toxicity:

   i. One isoenzyme pathway (CYP2E1, Cytochrome P450 series) normally metabolises <10% of paracetamol to hepato-toxic metabolite. This isoenzyme is markedly induced (ie gains greater activity, producing more of the toxic metabolite) with chronic alcohol ingestion.

   ii. Even that would not be such a problem if there is sufficient glutathione (an antioxidant) present in the liver to facilitate a further detoxification step.

k. Glutathione is depleted[2] in chronic high alcohol intake, thus limiting that last detoxification pathway, a double whammy coupled with induced CYP2E1 isoenzyme.

l. This opens the possibility that some hepatic decompensation in this case could have occurred from paracetamol even at low–normal doses prescribed in this case.

m. On [Day 17] [Mr A's] condition had improved in DCCM (intensive care unit) enough to transfer back to Liver ward/team. He subsequently received Paracetamol there again in recommended safe doses for cirrhosis (3 gm/day between [Days 23–27]).

n. The liver team would have experience with what was/was not advisable in this condition. As they were willing to prescribe paracetamol, I concluded there could be no criticism of the earlier teams prescribing similar amounts.

o. None of that proves a case — I have simply raised this as a possible overlooked contribution in this case. From knowledge about other analgesic drug metabolism there are a very small number of individuals who have vulnerability at the extreme of a spectrum. e.g. there is a rare genetic variant of a very fast hepatic Cytochrome P450 metabolic isoenzyme for codeine that can cause serious events when maternal codeine is hyper-converted to excessive morphine levels, leading to infant mortality through breast feeding[3].

2 Lauterburgh B H, Velez M E. Glutathione deficiency in alcoholics: risk factor for paracetamol hepatotoxicity. Gut, 1988, 29, 1153–1157.

3 Koren G, Cairns J, Chitayat G, Leeder S J. Pharmacogenetics of morphine poisoning in a breast fed neonate of a codeine-prescribed mother. Lancet. 2006;368:705

p. A further little talked about adversity of glutathione deficiency (again from chronic high alcohol use) is vulnerability of the lungs to pneumonia infections [Guidot et al].[4]

q. [Mr A] developed sepsis as part of the multi-organ failure by the time of [Dr E's] assessment on [Day 4], with a presumed lung focus.

r. His pulmonary problems and deterioration were all attributed to aspiration due to opioid, but not all of the recorded examination findings seem consistent with that at some relevant times. It was probably multi-factorial.

4 Mehta A J, Guidot D M. Alcohol and the lung. Alcohol Res. 2017; 38(2): 243–254.

9. Your Question: the appropriateness of [Mr A's] analgesia management between [Day 1–4], in particular:

i. The amount and type of analgesia given to him;

ii. The changes made to his analgesia by different clinicians.

a. There is no universal method for choosing analgesia for persons with severe liver disease. There are no specific tests for who is at more risk than others. MELD score only helps predict overall mortality, not which drugs and how much to use. With concomitant renal dysfunction (eg hepato-renal syndrome) there are better known specific limitations, as also for pre-existing encephalopathy.

b. In such cases care with all medication types and amounts is important, even though challenging to achieve with high levels of reported pain. To quote an expert source [from Mayo Clinic][5]:

> 'Pain management in patients with cirrhosis is a difficult clinical challenge for health care professionals, and few prospective studies have offered an evidence-based approach.'

c. Principles of such management are learned as part of training, with readily accessible reference sources as guides for particular case types when met only infrequently.

d. ANZCA publication Acute Pain Management: Scientific Evidence 4th edition 20156 (APM:SE4) is a comprehensive summary of published evidence relating to all types of pain and co-morbidities for easy reference. It is endorsed by many international bodies, available publicly and to all ANZCA Fellows and Trainees. It is probably the best available indicator for a standard of care in drug choice and amounts [in] this case.

e. In addition I have referenced 2 further sources[5,7] one of which is cited in the above. They describe some controversies and expand on some points to illustrate variation in opinion exists.

f. For the drugs used and relevant to this case, APM:SE4 advice is as follows:

Fentanyl:	'no dose adjustment required'
	'elimination half-life unaltered'
Tramadol	'reduced clearance, dose adjustment may be required if impairment severe'
Morphine	'in most patients no dose adjustment required'
Oxycodone	'no dose adjustment required in most patients'
Paracetamol	'dose reduction for chronic use', BUT: indicates contradictions on whether need dose change

5 Chandok N, Watt KDS. Pain Management in the Cirrhotic Patient: The Clinical Challenge [Review]. Mayo Clinic Proc. May 2010; 85(5):451–458.

6 Schug SA, Palmer GM, Scott DA, Halliwell R, Trinca J. Acute Pain Management: Scientific Evidence 4th Ed. (2015), ANZCA & FPM Melbourne. Section 10.5.2 Patients with Hepatic Disease pp 566–569. [copy attached].

7 Dwyer JP, Jayasekera C and Nicoll A. Analgesia for the cirrhotic patient: A literature review and recommendations [Review]. Journal of Gastroenterology and Hepatology; 29 (2014): 1356–1360. This is an Australasian source.

g. Therefore, measured against the statements in this widely recognised ANZCA publication, all the drugs chosen could be considered acceptable. With the exception of Sevredol morphine which I will deal with separately, none of the doses were grossly excessive.

h. The anaesthetist definitely ordered an appropriate low Tramadol dose, but appears not to have seen a prior orthopaedic team order remaining for a higher dose, which seems to be the one followed by the nurses.

i. I think this was an unintended consequence of there being more than one place/system in which to prescribe medications, namely the ward version and a standard postoperative analgesia sheet which the anaesthetist used — printed, so likely computer generated.

j. The effect of this duplication could be eliminated with some electronic prescribing systems which warn of double ups, but don't necessarily prevent them all. It is important to note that a double up did not happen here, just a choice by nurses to use the higher dose prescription of the two.

k. Regarding morphine, in my opinion there are special considerations in a case of cirrhosis, [and/or renal impairment] and I think the above summary from APM:SE4 doesn't go far enough in advising extra caution with morphine. For instance the Mayo Clinic group[8] states for morphine:

> 'Metabolite increases toxicity in patients with renal failure; adjust dose in these patients'.

l. [Dr G] (Appendix 5) describes the hospital's APS standard postoperative pain management protocol being oral, sevredol morphine each 30min. He reported that what was prescribed in this case was less than the institution's standard regime frequency.

m. On the other hand, if compared to fentanyl, morphine has complex and variable pharmacology with well-known dependence on renal clearance.

n. Morphine metabolites can also vary according to genetically determined alternative metabolic isoenzyme pathways. These metabolites are active, some constructive, others disadvantageous and both can cumulate with renal impairment.

o. The normal clearance half-life of morphine is 1.5–2 hours, but doubles to 3–4 hours in cirrhosis, especially with hepato-renal syndrome.

p. For that reason I examined post-operative records up to the third day following commencement of morphine administration, as that would be an expected time of continuing influence from it.

8 Chandok N, Watt KDS. Pain Management in the Cirrhotic Patient: The Clinical Challenge [Review]. Mayo Clinic Proc. May 2010;85(5):451–458.

q. Although APM:SE4 does not specifically say so, literature it quotes[9] and others do advise care with all opioids to avoid encephalopathy, due to an inherent sensitivity in advanced liver disease.

r. Morphine is the most likely of the ones listed in APM:SE4 to have problematic accumulation in renal impairment.

s. It might be that institution's standard practice to keep delivering Sevredol morphine in small amounts frequently till analgesia is achieved, but the normal 'brakes' on total delivery failed here, most likely due to unrecognised substance use disorder [SUD] and the typical behaviour connected with that.

t. It is concerning for this case, liable to opioid sensitivity, that the morphine prescription had no reasonable daily upper limit.

10. Appropriateness of Oxycodone prescription by the APS on the second day:

a. Oxycodone has a much lower risk than morphine for active cumulative metabolites, so the choice to change to it by the 2nd day APS review person was appropriate; as it happens none was administered because other problems had already supervened.

b. However in my opinion the open ended prescription without an upper dose limit being specified is also subject to the same criticism as that for Sevredol above.

c. At the time that change was made, there was also under-recognition by the APS personnel of just how much morphine had been administered already. OR, if recognised, it was not recorded in the visit notes and no concerns/warnings ensued.

d. In my opinion the amount should have raised eyebrows and provoked some more thought about possible implications. A sedation score should have been assessed then, and if it had deteriorated then Naloxone would have been appropriate earlier than when it actually was delivered.

11. Was there a departure from the standard of care, as defined above?

Regarding which drugs were prescribed: I have already noted that none were specifically contraindicated in our most used reference source from ANZCA [APM:SE4]. Therefore I must answer: NO.

However, I consider more thought could have been used in the choice, instead of relying on (their) standard protocol. Exceptions/variances need to be catered for more specifically.

Because both Morphine and Tramadol require hepatic metabolism for some of their effects and their removal, with dependence on renal clearance, in my opinion those two drugs were not the wisest of choices. Neither Fentanyl nor Oxycodone have such complexity or magnitude of accumulation potential.

9 Dwyer JP, Jayasekera C and Nicoll A. [Review] Analgesia for the cirrhotic patient: A literature review and recommendations. Journal of Gastroenterology and Hepatology; 29 (2014): 1356–1360. This is an Australasian source.

12. Could the analgesia have been better managed?

a. In my opinion the answer is a clear YES, for the following reasons:

b. Regarding how much drug was prescribed: Whatever the standard protocols are in that hospital, with the widely known advice for care in cirrhosis because of encephalopathy risk, I consider unlimited prescription of any opioid drug was very unwise. That applies to both morphine and oxycodone in this case.

c. I believe many peers in this field would similarly place limits/boundaries on total opioid to be delivered in a 24 hour period without further review. The actual limit would normally be tailored to patient specifics [eg age, specific medical conditions, severity of illness, etc]. I suggest the concept that one size fits all appears fundamentally wrong.

d. In my opinion an unlimited dose morphine prescription is a moderate departure from the expected degree of judgement, in particular coupled with

e. The APS visit record gave very limited information. I consider it was an opportunity lost on [Day 4] morning not to have been alerted by the very high total Sevredol morphine dose already administered.

f. Although the finer details are beyond my scope, I understand it is important to keep the bowel moving in cirrhosis to limit ammonia build up. The records show [Mr A] used Lactulose at home, even without an opioid, yet none seems to have been prescribed with the opioid medications known to cause constipation. It would have been better to ensure it continued in hospital, primarily at the admitting team level.

13. Your question: Would you have expected the Anaesthetist and/or the Pain Service team to have liaised or consulted with the Liver team pre and/or post-surgery?

a. In my opinion the right people and best time to have consulted with the liver team were the admitting orthopaedic team, as part of workup deciding what, if any, operation was suitable.

b. Any opinion from them at that time should have filtered down to all other persons/teams managing the patient.

c. If that had been done, it is possible the liver team might have recalculated an updated MELD, which I suspect had worsened since he was seen by them [six weeks prior to his 2016 admission]. On reading [Dr C's] report (Appendix 1) his expressed opinion was that this was a relatively low risk case for surgery.

d. If anyone had obtained an accurate report of this patient's ongoing high alcohol use on top of his [recent] advanced cirrhosis diagnosis, the degree of risk and anticipation of problems from alcohol withdrawal effects might have made some difference.

e. Although wiser in hindsight, I am not sure the liver team would have obtained that history even if consulted, or would they have relied on someone else's history through a discussion about the case, and/or assumed their advice not to continue use of alcohol was adhered to?

f. [Dr C's] opinion in his report (Appendix 1) is silent on the retrospectively elicited recent high alcohol history as if it did not exist.

g. The patient derived history (assuming the patient told [Dr E] even close to his true intake) was not gained until after deterioration, so I doubt prior consultation would have changed that. I note 3 different patient reports recorded of his alcohol intake.

h. Once operation was decided upon, I doubt the anaesthetist would have gained much to alter 'direction' than I could see was actually applied in the course of the anaesthesia. He chose drugs and modified doses appropriately, as evidenced by the patient's condition in the early recovery. The initial fentanyl PCA analgesia was likely the best of what was available at that point.

i. Even if the liver team had been consulted and suggested to use Tramadol sparingly, because it requires hepatic metabolism to render effective and be eliminated, the anaesthetist did prescribe sparingly. The fact this patient got more than he intended derives from a system problem with having more than one prescribing sheet.

j. On the first APS visit there was nothing (recorded) to suggest a significant problem at that time. If the liver team had been consulted pre-operatively as in (a) above, and if their experience was that morphine gave more problems than other opioids, that would have filtered through the whole of this case's management. I would not have ordinarily expected that APS team to have consulted with the liver team then.

k. By the time of the second APS visit, I concluded that person demonstrated at least that oxycodone was a more favourable opioid than morphine. In addition, the record indicates there were by then deterioration features, coupled with the very high already administered morphine.

l. In my opinion that warranted further inter-team discussion between the surgeons still responsible for [Mr A's] overall management, the pain service medical person(s) and one or more of a physician, liver service specialist or intensive care doctor. That seems to have been a lost opportunity for earlier intervention, although may not have altered the eventual course.

14. Suggestions for future improvement:

a. Review of the 'standard strong opioid for acute pain is morphine at a dose of 10–20mg half hourly' protocol, with a view to:

   i. Including upper dose limits, pending further review of the patient

   ii. Alternative drug choices that might be more suitable in specific disease states eg renal and/or hepatic [it is already widely accepted that morphine is a poor choice in renal impairment — so did the standard protocol account for that?].

b. Electronic prescribing:

   i. Is better at flagging double-up prescribing and conflicting prescriptions from different services.

ii. Difficult learning curve, but as experience grows its benefits become apparent.

iii. [Could it have already have been introduced in the 3 years since this case?]

c. Awareness for obtaining as accurate as possible alcohol use history:

i. Anticipate potential problems: eg withdrawal effects

ii. Chemical coping and its effect on patient demand for reinforcing substances, like opioids in PCA, sedatives etc

iii. Interactions on other drug effects

Signed:

David Jones FANZCA FFPMANZCA 16 June 2019
Specialist, Anaesthesia & Pain Medicine

Appendix

David Jones

I qualified Fellow of Faculty of Anaesthetists, Royal Australasian College of Surgeons (FFARACS) in 1980, subsequently Fellow of Australian and New Zealand College of Anaesthetists 1992. Foundation Fellow of the Faculty of Pain Medicine (FFPMANZCA) 1999. I have practised at Dunedin Hospital as a specialist in Anaesthesia and Pain Medicine since 1983."

The following further advice was obtained from Dr Jones:

"**Re: [Mr A]/ Auckland District Health Board**

Your ref: 16HDC00673

Thank you for your letter 27 August 2019 inviting further comment or amendment to my original independent expert advice on this case. The further documents provided by you are added to the list below.

I have read and agree to follow the Health and Disability Commissioner's guidelines for independent advisers dated March 2019.

My qualifications and relevant experience were appended at end of my original report. I continue with no conflicts of interest in relation to this case and enquiry.

I have reviewed (for the first report dated 16 June 2019) **the following documents provided for this case:**

1. Letter of complaint dated […]
2. Report to Coroner from Auckland DHB dated [2016] (Appendix 1 below)
3. Clinical records from Auckland DHB covering the period [of admission].
4. Some appendices as below were forwarded, described as coming from an Auckland DHB response dated 22 February 2018. These stood alone, mostly unrelated to this report; where any relevant detail was used it is referenced in my report:

   Appendix 1: [Dr C] report to coronial services [2016]

   Appendix 2: DCCM — [Dr D]

   Appendix 3: General Medicine — [Dr E]

   Appendix 4: Orthopaedics — unidentified

   Appendix 5: Acute Pain Service — [Dr G]

   Appendix 6: Anaesthesia — [Dr H]

   Appendix 7: HQSC — re patient deterioration program, 19 December 2017

   Appendix 8: Resource NZ EWS Chart Training, October 2017 (post this case)

   Appendix 9: ADHB Observation and Monitoring of an Adult 10 Nov 2014

On 27 August the following additional documents were provided for this review of my original report:

5. Auckland DHB's RCA report dated 11 March 2019

Letter from Auckland DHB dated 26 August 2019 and its attachment

Additional advice requested:

1. Whether it causes you to amend the conclusions drawn in your initial advice, or make additional comments.
2. Any comment regarding Auckland DHB's RCA report and whether this causes you to amend your initial advice.
3. The appropriateness of the policies/guidelines at Auckland District Health Board regarding pain medications.

Responses:

1. In summary the main points of my original advice were:
   a. [Mr A's] cirrhosis condition made him particularly vulnerable to any opioid, therefore only very low doses should be considered
   b. A standard dose regimen without an upper limit is especially inappropriate for such a patient, no matter which opioid is chosen

c. With hepato-renal pathology (the actual severity in [Mr A] was worse than originally assessed) morphine was contraindicated on account of inability to eliminate the active metabolites of morphine.

The new material does not cause me to change that advice.

2. Regarding the Auckland DHB's RCA report:

a. Apart from recognising and concurring with issues I raised in my report about morphine an inappropriate opioid drug choice for a liver disease patient, the anomaly of EWS record not being consistent with clinical notes reports (ie resp rate falling to 4–6/min whereas EWS records it in normal range) is well drawn out.

b. I was not provided the chart recordings for my original report, so that anomaly was not noticed. The nursing staff did however request help, and stay with the patient because of this observation. The issues are about communicating the degree of seriousness (5 on EWS ?? code call), and having sufficient staff to respond [I have left the subject of staffing levels alone, but ADHB is aware of it].

c. The ADHB report highlights the need for timely escalation of care. I consider EWS systems are maturing recently, ongoing training/education around EWS, including such anomalies as this, is vital as we nationally have rolled out better ones. The system is only good if it is used properly. The RCA report draws out failures to total the scores.

d. Page 8, last para: 'It is not known what was documented at the time of the HO review, or ...' is incorrect. [Dr L's] 04:00 [Day 4] notes were analysed in my report, and are reproduced in Appendix A below. They are also significant for another reason analysed below [items f–i].

e. The reference [page 9, para 2] 'All recordings indicated Alert/Asleep' in this case, as in other cases, continues to be a trap in patient on opioids and depends on which scale is used. Traditionally 'A' gets recorded for both Alert or Asleep, yet they are at opposite ends of sedation and safety scales. Education must include the need for clarity in this component.

f. The RCA report front cover footer reads '165149 — Death After Aspiration ...'. In my opinion that over simplifies the root causes in this case. It is true that there were indications suggesting aspiration later in the course.

g. The pathologist report section 4 describes 'lungs demonstrated organising pneumonia ... the precise aetiology (cause) ... was not revealed by the post-mortem'.

h. None of that says when it occurred, but in my opinion there are subtle indications that it may have been later and possibly superimposed on the background of vulnerability to pneumonia caused by alcohol induced glutathione deficiency [my original report section 9.p, with reference].

i. To recap [Dr L's] 04:00 [Day 4] record states 'Good breath sounds' and 'pupils normal'. At 17:00 on the same day [Dr J] records a chest diagram and 'Clear posteriorly Nil added'. Taken together these are not consistent with aspiration up until that time.

j. [Dr C's] report to coronial services (section 3.3) describes this as 'had crackles in the lung bases', also referring to 'constricted pupils' — both at odds with the records of [Dr L] and [Dr J] reproduced in my Appendix A.

k. The radiologist described 'new patchy ground glass opacity in BOTH lungs, which would be in keeping with aspiration' (quoted from Dr […] report, section 7). It could also be in keeping with other pathologies. A possible problem is bias from what was written on the request form as to what the CXR was querying, and there seems to be an uncritical repeat of aspiration as a simple explanation but which is not in keeping with the above OCHO records.

l. The RCA report is silent on the likely effects that alcohol withdrawal effects had on the patient's marked upturn in demand for more analgesia by 2nd postoperative day, irrespective of the appropriateness of the agent prescribed and apparent lack of dose limit. Initially his pain scores were good, but later deteriorated. This could reflect the type of pain from abstinence/withdrawal, independent of pain from operation. As it happened around the time the anaesthetist's PCA prescription ceased and was converted to oral sevredol morphine.

Re: [Dr I's] responses within [ADHB's] report dated 26 August 2019:

i. I accept his explanation (a) that the anaesthetist's postoperative prescription was on a dedicated PACU prescription sheet. I am more familiar with a single hospital-wide prescription chart. However, the anaesthetist charted 'Tramadol 50mg BD=twice daily' … so how does that play out if it is only for the short time in PACU? Previous report advice re electronic prescribing remains valid.

ii. In my opinion the response in (b) does not address the specifics of this case — the high vulnerability of cirrhotic patients to ANY opioid/sedating medication. Also it is misleading to consider he had a high 'tolerance of opioids due to his alcohol consumption.' His cirrhotic disease makes his tolerance very low ... that message will be lost if the above explanation is left unchallenged.

iii. [Dr I] in response (c) makes good points about the conflict between being seen mobilising at the same time as having consumed [*too much*] opioid. However he does seem to condone the AVPU method. I will reiterate what I have reported to The Commissioner in other cases of opioid induced ventilatory impairment (OIVI) that the AVPU scoring system — unfortunately included in the newly rolled out national EWS system — is insensitive to OIVI in opioid treated patients. We have had to make a special sticker for opioid treated patients to ensure a more sensitive Sedation Scale is used.

iv. [Dr L] only noted 'last sevredol 02:00'. That could have been told to her by the nurses. My suggestion of a lost opportunity related to the fact that it appears the total dose was not apparent to her (at least not recorded in the note). The drug administration chart was even difficult for me to read with the benefit of hindsight, daylight hours! The message is that reviewing total dose is instructive — I agree with [Dr I] it is not diagnostic of hepato-renal failure, but the reverse is a truism: in hepato-renal patients (i) certain drugs should be avoided and (ii) they are highly sensitive to opioids and sedatives. Rather than a criticism, I labour the point for its learning value.

v. Using the support of a world expert in pharmacology of analgesia, and the WHO ladder guidelines, to support the ADHB prescribing policy for morphine together with tramadol (f) is misplaced in respect of a hepato-renal patient. Firstly the WHO ladder was originally designed for cancer pain management, often terminal, in third world countries with very few medical options or medications. That is not our healthcare system with greater options and expectations.

vi. It *is* acceptable to combine Tramadol if morphine is used — but only if used *in patients without contraindications*, and Prof Schug still supports that view. But equally he is strongly opposed [Personal Communication] to morphine for routine use *because of its active metabolites and their risk in the renal impaired* patient — common in elderly patients, as well as in this particular case. Quoting him in support for the ADHB standard morphine protocol is misdirected/misquoted.

vii. [Dr I's] comment 'in hindsight' is not applicable in this case — it was always known [Mr A] had liver disease, even if its severity was greater than initially realised [misled by the seemingly normal creatinine as referred to by [the report to the Coroner], Section 1].

viii. Regarding accurate report of this patient's ongoing alcohol intake (g), [Dr I] refers to [Dr C's] report (Appendix 1). I do not know what [Dr I] is trying to submit about that. He is responding on behalf of anaesthesia and perioperative medicine department, so I note the anaesthetist recorded consistent with having enquired, and prescribed reasonably within that context. I reiterate my first report (13) f: '[Dr C's] opinion in his report (Appendix 1) is silent on the retrospectively elicited recent high alcohol history …'. All he said about alcohol intake was (section 2.5) '… was instructed to stop consuming any alcohol' in [2015]. Clearly the patient did not, evidenced by multiple reports after he started to decompensate postoperatively.

ix. Page 6 of 8, item 8: I accept the statement that nurses gave the medication according to the prescription. While the prescriber would be the person to impose any necessary limits, the underlying problem here is the fact that a standard protocol appeared to allow unlimited doses [notwithstanding RCA page 9 para 1 regarding policy for resp rate <8/min and >3doses within 2 hours should have had a brake effect on dose in even less timeframe than 24hrs].

3. Appropriateness of the policies/guidelines at Auckland District Health Board regarding pain medications (current):

a. In the table of recommendations page 7 of ADHB CMO report, items 2–4 are relevant to my assessment of this case, and are appropriate if implemented. Collectively these refer to liver/renal impairment and analgesia modifications relevant to that.

b. New Policy Opioids-Short-Acting-Oral-for-Adult version 22 March 2019:

   i. Table 3: it is not clear to me why the first 2 agents (Morphine & Oxycodone) do NOT require a daily maximum dose, where the last 2 agents (Tramadol and Pethidine) specify 'MUST include a maximum'. A daily maximum, subject to the patient being reviewed, would be sensible for them all.

   ii. Section 3.2 for renal impaired patients is appropriate, but 3.1 although consistent with some recommendations for morphine in hepatic patients there is some debate — see my original report (Section 9 k and reference).

   iii. Section 4 Flowchart: the AVPU conundrum is perpetuated. In AVPU, being roused by voice, but then falling straight back to sleep, is a danger sign compared to a sedation scale where being able to maintain a conversation after being roused is safe, but inability to do so a warning. This is a flaw with our national EWS rollout; and AVPU has been proven a poor detector of OIVI in Australia. We had to make our own solution by replacing AVPU scale on the EWS chart with a sticker overlay for patients receiving opioids — inconvenient, but safer.

   iv. In the same flowchart the box (left hand side) 'Have 3 doses been given within 2 hours?' is appropriate. In a roundabout way, this is a brake on doses, or in other words sets a dose limit within a shorter timeframe than 24 hours as referred to in (i) above.

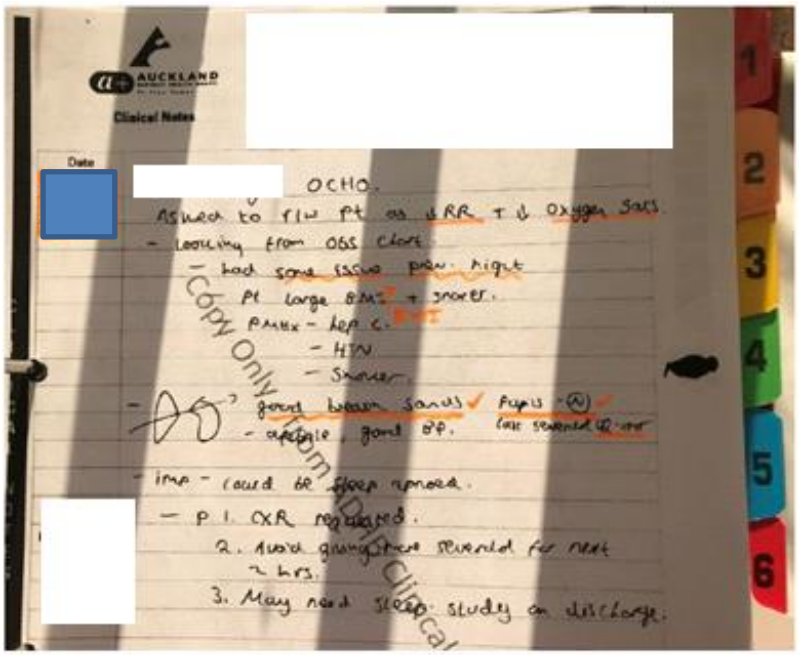
c. Human factors: even the best of policies will fail if there is a lack of awareness of and familiarity with their contents. As that is the challenge, this goes right back to undergraduate medical and nursing education — where pain management is given a very tiny slice of time in contemporary teaching/learning programs.

I trust this will help with further deliberations and decisions about this sad case.

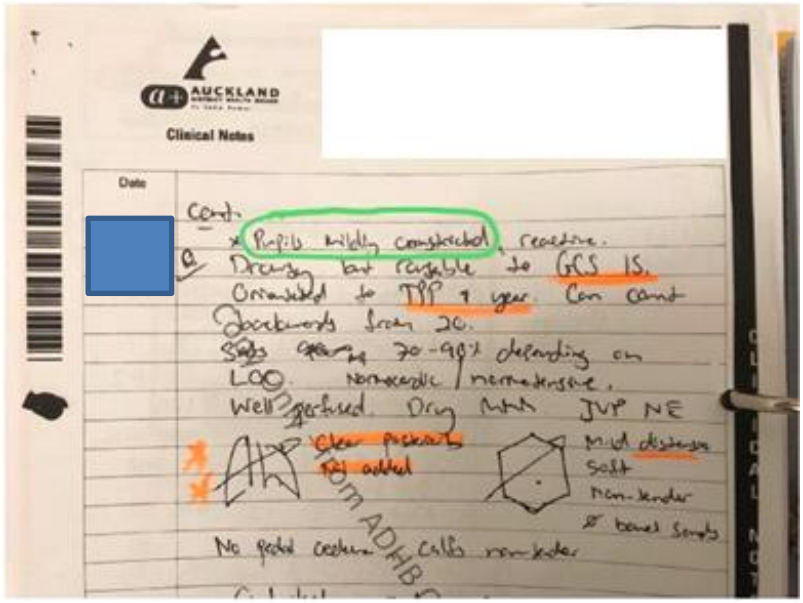
Signed:

David Jones FANZCA FFPMANZCA 17 Sept 2019
Specialist, Anaesthesia & Pain Medicine"

Appendix A: OCHS records of lung breath sounds, and pupil size observations.



[Dr L], [Day 4] 04:00



[Dr J], [Day 4] 17:00

Appendix B: Independent advice to the Commissioner

The following expert advice was obtained from an orthopaedic specialist, Dr John McKie:

"4 July 2019

RE: [Mr A]

Your Ref: 16HDC00673

Thanks very much for asking me to review the case records and provide an opinion on the above case.

I have now had the opportunity to review the case records provided and thank you for additional information that I have requested that was also provided.

My name is John Stuart McKie. I am a vocationally registered orthopaedic surgeon in public and private practice in Christchurch.

I am a New Zealand medical graduate and did my orthopaedic training in New Zealand, sitting the FRACS exam in 1991 and, after carrying out overseas Fellowships, I was appointed to the consultant staff at Christchurch Hospital in 1994 and have provided continuous service since then.

I note that [Mr A] was a [man in his late fifties] with a long history of Hepatitis C, thought to have been as a result of an historical contaminated blood transfusion. He was known to have chronic cirrhosis of the liver and I note was seen regarding this and had blood tests and ultrasounds done [six weeks] preceding his acute presentation. Notwithstanding his chronic medical issues, he was still able to do what sounds like a reasonably physical job […] up until the time of his injury and admission.

He was admitted to Auckland DHB under the care of the orthopaedic service on [Day 1]. The nursing notes record a long delay in waiting time for him to be admitted before he was seen and clerked by the night orthopaedic registrar dated 10.45 pm. The registrar gave an appropriate and adequate history of the injury, indicating that he had fallen directly onto his shoulder when he slipped […] earlier that day, that it was a closed and isolated injury, and that he had had no prior issues with his shoulder. He also noted the past medical history, including cirrhosis of the liver secondary to Hepatitis C, annotated a MELD score of 12 and relayed the findings of the ultrasound scan that was done [six weeks previously] confirming no definite portal hypotension. Examination findings and a plan of management were documented in the clinical record. The patient had already had an x-ray of his shoulder showing the avulsion fracture of the lesser tuberosity and a CT scan was arranged and performed early the next morning.

As would be the normal practice in most New Zealand hospitals, acute operative cases were discussed at the morning trauma planning meeting and a decision was made to

treat [Mr A's] shoulder fracture surgically, and this is recorded as having taken place uneventfully in the afternoon with the surgery concluding shortly before 5 pm.

At 10.30 pm on day of operation he was noted to be comfortable in the ward. The following morning he was seen by the orthopaedic house surgeon and there were no noted concerns. At 9.15 that morning he was reviewed by the Acute Pain Service, who placed a sticker in the notes indicating that he was having PCA as well as oral analgesia. From the records the PCA analgesia that he was having at that stage was Fentanyl. Oral analgesia was prescribed in the form of Sevredol (oral Morphine) at a dose of 10–20 mg every hour as required.

The nursing records note the patient was stable and he was mobile around the ward and dressing with assistance.

At 10 pm on the first post-operative day ([Day 3]) the patient was again noted to be alert and orientated, but requiring large quantities of analgesia. At 4 am the next morning ([Day 4]) the patient was reviewed by the on call house officer at the request of the nursing staff as he had decreased oxygen saturations and reduced respiratory rate. The house surgeon noted that the patient had had some similar issues the previous night, was obese and a snorer, and raised the question of possible excess opiate, noting that the last Sevredol had been two hours previously and suggested withholding for at least a further two hours. He also requested a chest x-ray.

The nursing notes for the overnight shift give indication to the patient being uncomfortable, recording a pain score of 7 to 8/10 and obviously agitated, walking around the wards, trying to get fresh air and feeling nauseated. His saturations on room air were noted to have dropped to 85%, but back on his oxygen went back to between 90 and 95%.

The morning house surgeon review on [Day 4] notes the patient was difficult to rouse, confused and disorientated, and the house surgeon also notes that the patient had had 180 mg of Sevredol orally in the preceding 24 hours.

At 11.16 the patient was reviewed again by the pain service, who again noted him to be comfortable, but acknowledged his sedation, and initially had suggested reducing the Sevredol dose, but this was then crossed out and changed to Oxycodone. The nursing notes record the patient remained drowsy through the day shift, had not had anything to eat, but had been able to walk to the toilet. His usual medications were withheld because of his drowsiness.

At 5 pm that evening he was reviewed by the house officer who noted that he was experiencing delirium and recorded a thorough evaluation of the patient and had a probable diagnosis of a combination of aspiration pneumonia, acute kidney injury and narcosis secondary to excessive opioid exposure. Appropriate investigations were requested and also an urgent referral to the general medical service. The patient was then reviewed by the general medical registrar, who similarly thoroughly assessed the patient, diagnosed probable narcosis secondary to Sevredol aspiration pneumonia and

after discussion with the consultant physician, [Dr E], gave Naloxone with good response.

At 8 pm [Dr E], consultant physician, reviewed the patient and noted he was going into multiple organ failure and that he was very unwell. At this stage she discussed his case with the Department of Critical Care staff, but the decision was made to leave the patient in the orthopaedic ward.

A CT scan of the abdomen was arranged, which showed a dilated stomach, but no evidence of ascites, and a chest x-ray showed changes consistent with aspiration. The findings were felt to be consistent with narcosis.

The records note the patient was reviewed by the Department of Critical Care registrar at 1.30 am and the case was further discussed with the Department of Critical Care staff at 4.40 am with a decision to continue monitoring.

At 9.15 am on [Day 5] [Dr E] indicated her willingness to take over the patient's care and noted the heart rate, respiratory rate and temperature all to be stable. The patient was further reviewed at 1 pm by the hepatic registrar, who again noted the patient had stable vital signs and was orientated in time, place and person. At 2.40 pm the patient was reviewed by the liver team registrar, who again noted him to be orientated with a non tender abdomen, no ascites, liver flap and no increase in his JVP.

On [Day 6] at 3.30 am, with a diagnosis of fluid overload, the patient was transferred to the Department of Critical Care.

With respect to the specific question asked of me, I believe that the care provided by the orthopaedic service at Auckland DHB was appropriate and reasonable in the circumstances. Others have clearly been asked to and have commented on aspects of the continuum of care provided by other services in what turned out ultimately to be a very tragic case where a man albeit with quite severe co-morbidities presents with an acute apparently relatively minor orthopaedic injury and ultimately dies in hospital, never getting home.

1. The appropriateness of care provided by the orthopaedic team to [Mr A] pre-operatively on [Day 2]. In particular:

a) The adequacy of [Mr A's] pre-operative assessment.

The details of the patient's history of the current acute presenting complaint, as well as the relevant examination findings, social history and past medical history and relevant co-morbidities is clearly documented on the scope entry by the acute registrar and in terms of an annotation of an acute assessment and admission in a busy department over a public holiday period represents an efficient, succinct and completely adequate recording. From the perspective of the orthopaedic injury, the patient was appropriately worked up with the CT scan confirming the exact nature of the injury and an appropriate management plan formulated.

In terms of assessment for anaesthetic, this role is usually and appropriately deferred to the anaesthetist. This was a man who, although he had well noted co-morbidities, was apparently functioning independently in the community, took little in the way of medication and had a relatively straight forward orthopaedic injury. The anaesthetic service felt happy to proceed with anaesthesia and surgery on the basis of their assessment which would normally be expected to be more learned and thorough from an anaesthetic and medical perspective than would be expected from the orthopaedic house staff.

b) Would you have expected the orthopaedic team to have liaised or consulted with the liver team prior to surgery?

In short, no. As noted above, the patient had been seen by the liver service and had had an ultrasound and assessment made as recently as [six weeks previously]. In the interim he had been continuing to live and work in the community and while, in retrospect, advice from the liver team may have altered the perioperative anaesthetic or analgesic management strategies employed, it is unclear whether this would have altered the subsequent consequences.

c) The accuracy of the MELD scores calculated on [Day 1]

Calculating the MELD score from the laboratory values provided in the notes gives a MELD score of 15. The MELD score of 12 listed in the admission clerking is incorrect as of the day of admission, but may well have been the calculated score when the patient was reviewed [six weeks previously] and was merely transcribed from other annotation by the admitting doctor.

The MELD score is used as an indication of the severity of disease and the life expectancy of patients with hepatic cirrhosis and also for prioritising patients who may benefit from transplant surgery. According to the Mayo Clinic calculator, a MELD score of 12 puts the patient at an 8% chance of dying within the next 90 days. A MELD score of 15 calculates the chance of death at 13%.

It is unlikely that the admitting junior staff would have had a close knowledge or understanding of the MELD scores and I think it is most likely that this is a transcribed piece of information from previous hospital notes. This is only supposition on my part as I only have copies of the current admission notes. Prior to being asked to submit this report, I was not personally aware of the existence or implications of MELD scoring for patients in hepatic failure.

2. The appropriateness of the care provided by the orthopaedic team to [Mr A] post-operatively, in particular:

a) The overall level of monitoring, review and follow up provided by the orthopaedic team.

[Mr A] had an injury on [Day 1], was admitted late that day, was assessed and operated on for his acute fracture the following afternoon and was reviewed and noted to be comfortable in the ward at 10.30 that night. He was seen the following

morning by the orthopaedic junior staff and there were no noted concerns. He was also later reviewed by the acute pain service.

It is the expected level of care that all inpatients will be seen by the resident medical staff on at least a daily basis and will have an annotation of that made in the clinical record. If a patient is progressing satisfactorily and as to be expected, there wouldn't be an expectation for additional observations or recordings unless there were matters of concern raised by nursing or other hospital staff.

As noted above, at 10 pm on the first post-operative day, the patient was reviewed again and noted to be alert, but requesting large amounts of analgesia. He was further reviewed by the house surgeon at 4 am on the morning of the second post-operative day with problems of reduced respiratory effort and the house surgeon appropriately both withheld Sevredol and noted that the patient had had 180 mg of Sevredol in the preceding 24 hours and raised the question of narcosis. The observations and annotations of the house surgeon at this time were appropriate and insightful. The plan to withhold Sevredol was similarly appropriate. The patient was then reviewed and notes made on the morning ward round with the fellow, that again noted the patient was confused and had had large quantities of Sevredol. Subsequent to this the patient was seen at 11.16 am by the pain service, who noted the sedation and switched the medication from Sevredol to Oxycodone. The next medical note in the patient's chart is a thorough house surgeon review at 5 pm. Clearly the patient's condition had deteriorated significantly and was now noted to be in delirium. While the patient's condition was noted to be confused on the morning ward round, this was reasonably put down to the large amount of opioid analgesia and this prescription was changed late morning by the pain service. The resident medical staff would not unreasonably expect there to be some delay in terms of the prescription change to the settling of confusion and while it may have been desirable if the house surgeon's subsequent review had been prior to 5 pm, the assessment was clearly very thorough and well documented and recognised the deteriorating condition of the patient.

b) The timeliness of the orthopaedic team seeking involvement of other teams in [Mr A's] post-operative management.

As noted already, the patient was reviewed by the acute pain service on both [Day 3] and [Day 4] and when the patient was assessed at 5pm on [Day 4], the house officer also clearly appreciated the worsening condition and appropriately contacted the medical team. On the basis of information I have, the timeliness of contacting the medical team for help was appropriate.

c) The level of senior clinician input and oversight of junior staff.

Other than the fellow ward round on the morning of [Day 4], there is no specific annotation of direct post-operative consultant input into the medical issues surrounding this patient. I am unaware of the exact systems employed in the orthopaedic service in Auckland DHB, however, in most orthopaedic departments,

senior medical staff would freely acknowledge their current level of knowledge or competence regarding non orthopaedic matters and defer them to junior staff or referral to other departments as indicated. There is nothing to suggest that the interactions with other departments were anything other than timely or appropriate. Further, from the time when [Dr E], consultant physician, first saw the patient and assessed him to be seriously ill, with evolving multi organ failure, there were a considerable number of interactions and discussions by other learned health professionals before the patient was ultimately accepted into the Department of Critical Care.

d) The timeliness and escalating care when [Mr A] started to deteriorate.

As noted above, I think the timeliness of this consultation on [Day 4] was appropriate. [Dr E], consultant physician, also notes the excellence of the house officer's assessment and referral in the record.

3. The standard of clinical documentation by the orthopaedic team.

I believe this to be satisfactory. There is a competent admission note, an appropriate management plan, annotation of the operative findings and procedure with post-operative instructions. The annotation of the post-operative medical issues, as discussed above, I believe, is absolutely fine.

4. Any other matters in this case you consider warrant comment.

Clearly this is a very sad case where a man with, albeit other co-morbidities, had an injury and subsequently died of complications following this. There are one or two things, however, that do concern me. The patient is recorded as acknowledging that he normally consumed half a crate of beer a day, although on admission suggested he hadn't consumed any for the previous seven days. I found this surprising in that someone who drank to the level of excess claimed would not have consumed any alcohol in the [preceeding holiday period]. Further, with the timing of his initial agitation and confusion in the beginning of his clinical deterioration post surgery, this would fit exactly as would be expected in a patient going into alcohol withdrawal who had been previously a heavy drinker and having 48 to 72 hours of abstinence peri-operatively. These factors may have been considered by some of the attending medical staff, but certainly don't make it anywhere to the annotated record. I wonder whether some of his agitation and desire for more analgesia was, in fact, a manifestation of alcohol withdrawal? Clearly we are never going to know the answer to that question.

I was also somewhat surprised at the very large doses of opiate analgesia, in this case Sevredol that this man was prescribed, although accept that these very large doses are now apparently commonly used by acute pain teams to endeavour to get oral analgesic control of patients' pain. These numbers, that while I accept are apparently not out of the ordinary, are well in excess of anything I have ever prescribed or had knowingly prescribed to a patient under my care.

I would be suspicious of drug abuse or tolerance with doses of this magnitude other than in a terminal care situation.

There is currently major public concern and a lot of media discussion in North America about the high dosage of oral opiates that are being prescribed for post operative surgical patients going out into the community, probably with the laudable intent to get people out of hospital and home more quickly, leading to major problems of opiate abuse and dependency.

Yours sincerely

JOHN MCKIE, MB ChB, FRACS
Orthopaedic Surgeon
Med Council No: 13530"

The following further advice was obtained from Dr McKie:

"**RE: [Mr A]/Auckland District Health Board**
Your Ref: 16HDC00673

I have now had the opportunity to read through all the additional reports and documentation that you sent me. I have also reviewed my previous report and the information on which this was based.

I see no reason to in any way alter or amend the report that I provided initially and stand by the observations and conclusions I have drawn.

After reading the reports in the file, I don't find any significant or important disagreements with the position that I have taken.

As with all medical problems, on microscopic analysis there are always things which are at times less than perfect and could be improved on and it is good to see action has been taken to try and minimise the risks of further problems or oversights occurring regarding the use of sedating opioid medications going forward.

Yours sincerely

JOHN MCKIE, MB ChB, FRACS

Orthopaedic Surgeon
Med Council No: 13530"