District Health Board

Orthopaedic Surgeon, Dr D

Dr D's Company

A Report by the

Health and Disability Commissioner

(Case 18HDC01671)

Health and Disability Commissioner

Te Toihau Hauora, Hauātanga

Contents

Executive summary

1. This report concerns the care provided by an orthopaedic surgeon at a private hospital, and subsequently at a public hospital.

2. The orthopaedic surgeon performed spinal surgery on the woman four times.

3. On 17 May 2017, the woman underwent a spinal fusion. There were issues with the computer navigation system, and the orthopaedic surgeon used a combination of the navigation method and standard anatomical points to insert screws.

4. On 1 June 2017, the woman was admitted to the public hospital having suffered a fall at home. A CT scan identified that the screws inserted during the spinal fusion had been misplaced, and on 7 June 2017 the orthopaedic surgeon performed surgery to revise the placement.

5. Subsequently, the woman experienced further ongoing pain, and an MRI scan on 19 June 2017 showed disc protrusion (bulging of a portion of the disc wall in the spine). On 20 June 2017, the woman underwent further spinal surgery. However, she experienced worsening paraplegia, and a CT scan on 17 July 2017 identified a dissociation in the spinal column. As a result, the orthopaedic surgeon and a colleague undertook further spinal surgery on 19 July 2017. Subsequently, the woman was transferred to a Spinal Unit. She requires ongoing care for paraplegia.

Findings

6. The Deputy Commissioner was critical that the orthopaedic surgeon misplaced the screws during the first surgery on 17 May 2017, and that decompression was performed without further protection during the third surgery on 20 June 2017. The Deputy Commissioner found the orthopaedic surgeon in breach of Right 4(1) of the Code.

7. The Deputy Commissioner was critical of the DHB in relation to the delay in seeking earlier input from the Acute Pain Service team.

8. The Deputy Commissioner considered that the errors that occurred did not indicate broader systems or organisational issues at the orthopaedic surgeon's company, and that the company did not breach the Code.

Recommendations

9. The Deputy Commissioner recommended that the orthopaedic surgeon report back to HDC regarding the changes he plans to undertake and how this has changed and/or improved his practice, and apologise to the woman and her family. The Deputy Commissioner also recommended that the Medical Council of New Zealand consider whether a review of the orthopaedic surgeon's competence is warranted.

10. The Deputy Commissioner recommended that the DHB report back to HDC on its plan to ensure that registrars and house officers are aware that it is the responsibility of medical staff to contact the Acute Pain Service for a review of a patient's pain.

Complaint and investigation

11. The Health and Disability Commissioner (HDC) received a complaint from Mrs A's husband and daughters about the services provided to Mrs A by Dr D, Dr D's company, and the district health board (DHB). The following issues were identified for investigation:

- *Whether Dr D provided Mrs A with an appropriate standard of care from 2017 to 2018.*
- *Whether Dr D's company provided Mrs A with an appropriate standard of care from 2017 to 2018.*
- *Whether the DHB provided Mrs A with an appropriate standard of care from 2017 to 2018.*

12. This report is the opinion of Deputy Health and Disability Commissioner Rose Wall, and is made in accordance with the power delegated to her by the Commissioner.

13. The parties directly involved in the investigation were:

Mr A	Complainant/Mrs A's husband
Ms B	Complainant/Mrs A's daughter
Ms C	Complainant/Mrs A's daughter
Dr D	Provider/orthopaedic surgeon
Dr D's company	Provider
DHB	Provider

14. Also mentioned in this report:

Dr F	House officer

15. Independent expert advice was obtained from Dr Tom Geddes, a consultant orthopaedic surgeon (Appendix A).

Information gathered during investigation

Introduction

16. This report concerns the care provided to Mrs A, aged in her sixties at the time of events, by Dr D, an orthopaedic surgeon. On 17 May 2017, Mrs A underwent spinal fusion surgery,[1] performed privately by Dr D at a private hospital,[2] during which multiple malpositioned screws were inserted into her spine.

17. In June 2017, Mrs A was admitted to a public hospital and received continued care from Dr D in his capacity as an employee of the DHB. Dr D performed further spinal surgery at the public hospital on three occasions, for screw revision and to manage complications.

18. Mrs A was transferred to a Spinal Unit and required further surgery and treatment. She now suffers from paraplegia[3] and spinal cord ischaemia.[4]

Background

19. In September 2012, Mrs A underwent stenosis decompression[5] at the lumbar 4/5 level[6] performed by Dr D. In 2015, Mrs A was noted to have postoperative degenerative spondylolisthesis,[7] and she underwent a further operation performed by Dr D.

20. Following this, Mrs A continued to experience significant problems with her back and left leg.

21. On 23 March 2017, Dr D sent a letter to Mrs A advising her that because of her lower thoracic spine pain and the severe degenerative changes in the upper part of her lumbar spine,[8] fusion surgery should be undertaken from about the T8 level in her thoracic spine[9] to her tailbone and pelvis. The letter also stated:

> "The CT scan[10] has helped us evaluate things in greater detail and should allow us to apply navigation system to ensure very accurate screw positioning. The operation being done under computer guidance [is] a bit like a pilot flying a plane on instruments."

[1] Spinal fusion is a surgical procedure used to correct problems with the bones in the spine (vertebrae). Essentially it is a "welding" process that fuses together two or more vertebrae so that they heal into a single, solid bone. This is done to eliminate painful motion or to restore stability to the spine.
[2] Dr D told HDC that he is not an employee of the private hospital. His company contracts with the hospital to use its facilities.
[3] Paralysis in the lower half of the body.
[4] Interruption of the blood supply to the spine.
[5] Opening of narrowed spaces within the spine to allow the spinal cord and nerves to move more freely.
[6] L4–L5 are the two lowest vertebrae in the lumbar spine.
[7] A condition in which one of the vertebrae slips out of place onto the bone directly beneath it.
[8] The segment of the spine above the pelvis that is involved in lower back pain.
[9] The vertebrae in the upper back.
[10] Computerised tomography (CT or CAT scan) creates cross-sectional images of the body.

First spinal surgery on 17 May 2017 at the private hospital

22. On 17 May 2017, Mrs A was admitted to the private hospital for the spinal fusion surgery. Her pre-admission nursing assessment noted that her BMI was 38,[11] and that she was on treatment for polymyalgia,[12] type 2 diabetes,[13] chronic airways disease, and arthritis.[14] The operation was performed under general anaesthetic and, as noted above, the plan was for a computer navigation system to be used to assist with the placement of the screws.

23. The operation took six hours and ten minutes. During the surgery there were some issues with the navigation system. Dr D told HDC that the navigation system did not give completely satisfactory guidance in the positioning of the thoracic pedicle screws,[15] but that it appeared to function satisfactorily in the lumbar spine. As a result, Dr D used a combination of the navigation method and standard anatomical reference points to insert the screws.

24. Dr D stated:

> "[U]nfortunately we did not get good guidance from the computer navigation system which at the end of the day is provided to try and give much more accurate and complication free screw placement, however no system is entirely full proof in this setting."

25. Dr D documented in the operation note:

> "As the computer system did not include the pelvis a combination of starting points using the computerisation and then II control the two S2 alar bolts[16] were positioned well clear of the sciatic notches.[17] The T12[18] spinous process was then used as the next registration point and screws placed up to T9 bilaterally. There were some technical issues with the axial imaging[19] so a combination of computer navigation and free hand technique was used and lateral II with the left screws in position was obtained to suggest satisfactory screw positioning."

26. Following the operation, Mrs A remained at the private hospital for 10 days, as she was suffering from chest pain. Dr D told HDC that postoperative imaging noted that the T9 screw on the right side may have been slightly lateral to the appropriate pedicle,[20] but he did not feel that this was necessarily responsible for Mrs A's high level of chest wall pain.

[11] The higher end of the "obese" category.
[12] An inflammatory disorder that causes muscle pain and stiffness, especially in the shoulders and hips.
[13] A condition that impairs the body's ability to process blood sugar.
[14] Inflammation of one or more joints.
[15] Screws sometimes used to add extra support and strength to a spinal fusion while it heals. Pedicle screws are placed above and below the vertebrae that were fused, and a rod connects the screws to prevent movement and allow the bone graft to heal.
[16] Bolts used for fixation of the spine.
[17] Indentations on the border of the hip bone.
[18] The largest of the thoracic spinal vertebrae.
[19] Scanned images.
[20] The cylinder-shaped projection (pedicle) of hard bone that sticks out from the back of the vertebral body.

Dr D said that investigations for Mrs A's chest pain were undertaken during her admission, but these did not indicate an acute myocardial infarction[21] or pulmonary embolism.[22]

27. Mrs A was discharged from the private hospital on 27 May 2017. On 29 May 2017, Dr D wrote a letter to Mrs A's GP advising of the outcome of the spinal operation. The letter noted that Mrs A had right-sided chest pain, and stated:

> "When [Mrs A] had her chest x-ray, we also x-rayed her spine and by and large I think the hardware from T9 down to the pelvis is satisfactorily positioned. We did navigate all these screws so should have achieved satisfactory positioning, although I note the right sided T9 screw is a little bit outboard of the pedicle. This shouldn't be in harm's way …"

Care provided at the public hospital

Admission to the public hospital

28. Mrs A's family told HDC that following her discharge from the private hospital, Mrs A continued to experience pain.

29. On 1 June 2017 at 2.56pm, Mrs A was taken to the Emergency Department at the public hospital by ambulance following a fall at home.

30. At 9.30pm, Mrs A was reviewed by an orthopaedic registrar, who decided that she needed to be admitted for pain management and further review in the morning by the Orthopaedics team. Mrs A was admitted to the Orthopaedics Ward at approximately 12.30am on 2 June 2017.

31. At 1.45am, a nurse documented that Mrs A's EWS[23] was zero and that she was on the on-call house officer's list for regular medications to be charted. At 4am, the nurse noted that Mrs A was awaiting an increase in OxyNorm[24] frequency or additional analgesia. The medication chart shows that Mrs A was administered PRN OxyNorm 5mg two hourly throughout the night.

32. Mrs A was reviewed on the morning ward round. The clinical notes document that she was to be discussed with Dr D, and that she would require assistance when mobilising.

33. At 4pm, Mrs A was reviewed by a house officer, who made adjustments to the medication chart, including the addition of m-Eslon[25] and the removal of OxyContin.[26] The house officer noted that Mrs A told him that OxyContin made her nauseous. He also noted: "[A]waiting plan from [Dr D]."

[21] A heart attack.
[22] Obstruction of a blood vessel in the lungs, usually by a blood clot.
[23] Early Warning Score — a guide used to determine the degree of illness of a patient based on vital signs (respiratory rate, oxygen saturation, temperature, blood pressure, pulse/heart rate). A score of 0 indicates no concerns.
[24] OxyNorm is a brand name for the medication oxycodone — used to relieve moderate to severe pain.
[25] Morphine — used to relieve moderate to severe pain.
[26] A brand of oxycodone.

34. At 8.30pm, Mrs A was again reviewed by another house officer, Dr F. He noted that Mrs A was experiencing worsening neuropathy-type pain and that m-Eslon would be administered at 9pm, and that input from the Acute Pain Service (APS) team should be requested. The DHB told HDC that Dr F's comment was handed on to the nursing staff.

35. At 10.30pm, a nurse documented that M-Eslon had been administered as per Dr F's instruction. She noted: "[F]or pain service input →needs referral from team. Settled at time of report."

36. At 2.40am, nursing notes record that Mrs A appeared to be sleeping and had not asked for any analgesia or assistance.

37. The clinical notes contain no reference to a request being made to the APS team. The DHB said: "There is no documentation that this referral had occurred or that the pain service had reviewed the patient." The DHB told HDC that nursing staff cannot request APS input, and it is the responsibility of the medical staff to contact APS or an anaesthetist (after hours) for a review of a patient's pain.

38. On the morning of 3 June 2017, Mrs A was reviewed by a consultant during the ward round. He noted the plan for a CT scan to be done and for Mrs A to be reviewed by Dr D.

39. A CT scan of Mrs A's thoracic spine was performed around 11.30am, and the radiologist noted in his report:

> "T9, T10 and L2 pedicle screws mal-positioned as described. Large fluid collection within the paraspinal musculature[27] and superficial subcutaneous tissues[28] of the back. This may represent infection, seroma,[29] haematoma[30] or CSF[31] leak."

40. At 9.30pm, a nurse noted that a registrar reviewed the CT scan and that Mrs A was advised that Dr D would review her in the morning.

41. On 4 June 2017, Dr D noted that he reviewed the CT scan and Mrs A. Dr D documented the malposition of the screws, and noted: "I have discussed this with [Mrs A] — for [illegible] revision of these screws when able."

42. On 6 June 2017, a house officer documented that Dr D reviewed Mrs A at 12pm and explained to her that an operation would be carried out at the public hospital, and that a chest X-ray would be undertaken and she was to be nil by mouth from 2am on 7 June 2017 in preparation for the surgery.

[27] Muscles that support the back.
[28] The layer of tissue that underlies the skin.
[29] A collection of fluid under the surface of the skin.
[30] A collection of blood that has leaked from a vessel into surrounding tissue.
[31] Cerebrospinal fluid.

Second spinal surgery

43. On 7 June 2017, Mrs A underwent surgery performed by Dr D for open revision of the T9 and T10 screws and new connecting rods and a cross link.[32]

44. The operation notes document:

> "PreOp diagnosis: Thoracic spinal pain following extensive T9–pelvic instrumented fusion from [the private hospital] 17 [May] 2017 with CT scanning suggesting mal-positioning of the T9 and 10 screws …"

45. Dr D said that the left T9 and T10 screws were re-oriented and positioned more appropriately, and the right ninth thoracic screw was placed more medially. He stated that short segment rods were then secured between the repositioned T9 and T10 screws. The operation took one hour and thirty minutes.

46. On 8 June 2017, Mrs A was reviewed during the morning ward round, and the house officer noted that she was feeling "much better today", and that the detail of the operation was explained to her. On 10 June 2017, the clinical notes record that Mrs A was feeling well but still had chest or thoracic rib pain. On 12 June 2017, an orthopaedic registrar initially noted that the plan was to prepare discharge planning, but Mrs A was then seen by Dr D as she reported ongoing pain, and the plan was for her to be reviewed further by Dr D postoperatively.

47. On 14 June 2017, Mrs A was seen by APS, and a clonidine patch[33] was charted. The clinical notes record that her medications were reviewed, and her current analgesia regimen was to be continued. The APS team also noted that Mrs A "appeared comfortable in bed chatting", and that she was awaiting a CT scan to investigate her ongoing back pain. A CT scan was attempted on 14 June 2017, but the CT scanner was faulty and the scan could not be completed on this date.

48. Dr D said that following the surgery there was some improvement in Mrs A's chest wall pain symptoms, but they recurred, and a further CT scan was completed on 15 June 2017. The scan showed fracturing of the posterior aspect of the left eighth rib. Dr D told HDC:

> "I am completely unaware as to why this should have occurred, but I suspect may have been related to the repositioning of the 9th thoracic pedicle screw on that side with abnormal stress going through the posterior rib, whose attachment is very close to the entry point of the pedicle screw."

49. On 18 June 2017, it was noted that Mrs A had ongoing pain and was reporting weakness in her legs, and that there was evidence of some urinary incontinence.

[32] Review of the positioning of the T9 and T10 screws.
[33] A medication used to lower blood pressure.

50. At 9am on 19 June 2017, a physiotherapist reviewed Mrs A and noted that she had grade 3–4 out of 5 muscle strength[34] in the lower limbs. During his assessment, Mrs A slipped off the edge of her bed. The physiotherapist recorded in the clinical notes: "[S]upported slip from bed to floor." The physiotherapist told HDC that he requested an urgent orthopaedic review for further investigations owing to red flags and new lower limb weakness.

51. Dr D reviewed Mrs A at 9.35am. He noted that she had no strength in her legs and could not weight bear owing to pain in her chest or back area. His documented plan included an MRI[35] of the lumbar and thoracic spine, which was undertaken that day and indicated a posterior T8 or T9 disc protrusion.[36] Dr D stated:

> "This is at the level immediately above the upper most screws in the construct. After discussion with [Mrs A] and the family further surgery was [to be] carried out, again by me on the 20 June 2017."

Third spinal surgery

52. At 7.40am on 20 June 2017, an orthopaedic registrar reviewed Mrs A and recorded that he had explained to her the results of the MRI scan and her possible operative management. The clinical notes also document: "[F]or [operating theatre] this afternoon."

53. Mrs A's spinal surgery that afternoon included removal the T9/10 pedicle screws, minor repositioning of the L2 pedicle screw, and decompression at the T8/9 level. The operation took two and a half hours. Following the operation, Dr F recorded at 10.20pm that Mrs A was "currently well", and noted a comprehensive treatment plan.

54. Dr D stated: "This operation seemed to result in some early improvement in Mrs A's overall condition."

55. Dr D reviewed Mrs A on 21 June 2017. A registrar recorded that Dr D had explained to Mrs A the outcome of the surgery, and that Mrs A was still experiencing pain. On the same day, a physiotherapist assessed Mrs A and noted that her muscle strength was stable, and that she reported improving sensation in her left leg.

56. On 22 June 2017, Dr D reviewed Mrs A and noted that her pain was improving but she could not feel her feet when on the floor.

57. Dr D said that within a week of the surgery Mrs A reported a worsening paraplegia, and ooze from her wound was noted. By 28 June 2017, Mrs A was febrile[37] and somewhat confused, and a routine sepsis screen[38] was performed and antibiotics prescribed.

[34] Muscle strength testing can reveal information about neurological deficits. Normal strength is classed as grade 5.
[35] Magnetic resonance imaging — a diagnostic test used to view detailed images of tissues in the body.
[36] Bulging of a portion of the disc wall, which can irritate or compress the spinal nerves.
[37] Feverish.
[38] Investigation of the presence of severe infection.

58. Dr D told HDC that although he acknowledges that Mrs A had a further deterioration after the operation on 20 June 2017, and that the result was not ideal, there was no gold standard as to what different procedure could have been performed.

59. On 29 June 2017, the clinical notes document that Dr D had a discussion with Mrs A and her daughter, and explained the role of the Spinal Injury Unit. It was noted that Mrs A's main problems were pain and the loss of leg function. Dr D planned for an MRI to be undertaken, but when this was attempted that day, Mrs A was too sore to lie flat. In response to the provisional report, Ms C told HDC that Dr D did not speak about spinal cord compromise, CSF leak, or paraplegia in any of his conversations about the revision surgeries. Ms C said: "[Dr D] never once said Mum was paralysed. We were only aware that she had no sensation or movement and this type of injury often resolved."

60. Dr D discussed with Mrs A that an MRI could be undertaken with anaesthesia, and this was arranged for 30 June 2017. However, on this day the anaesthetic gas system was not operating, and the MRI could not be done. The clinical notes documented at 4pm record that this was explained to Mrs A's family.

61. An MRI with general anaesthesia was undertaken on 3 July 2017. Dr D said that the scan confirmed the presence of an abnormal spinal cord signal from approximately T7 level inferiorly, without obvious spinal cord compromise. The reporting radiologist noted that there was either a spinal cord infarction[39] or ischaemic change.[40]

62. The clinical notes document that the result of the MRI was discussed with Mrs A's daughter on 3 July 2017.

63. On 4 July 2017, Dr D reviewed Mrs A and explained that given the MRI findings, no further surgery was indicated. Dr D said that he discussed Mrs A's situation with Mrs A and her daughter, including a referral to the Spinal Injury Unit when Mrs A improved medically. Dr D said that they acknowledged that the Spinal Unit was unlikely to accept Mrs A for treatment while she required ongoing intensive medical care.

64. On 6 July 2017, Dr D had a meeting with the family and noted that Mrs A had apparently experienced some spontaneous movements in her legs.

65. From 8 to 16 July 2017, Dr D was on annual leave, and throughout this period general physicians were involved in the decision-making regarding Mrs A's medical treatment.

66. On 13 July 2017, the clinical notes document that Mrs A and her family had a meeting with a house officer and the Nurse Manager about the family's queries and concern regarding worsening of the spinal cord injury by moving Mrs A. The notes record: "[E]xplained end goal will be [the] Spinal Unit once her pain and infection improves and she is able to engage in rehab."

[39] Destruction of a portion of the spinal cord as a result of an interruption of the blood supply to the spine.
[40] Change to tissue as a result of a lack of blood supply.

67. The Spinal Unit was contacted on 14 July 2017. The Spinal Unit suggested neurological referral, and advised that ongoing improved medical management would be required before Mrs A could be transferred to the Unit.

Fourth spinal surgery on 19 July 2017

68. On 17 July 2017, Dr D returned from annual leave and arranged for a further CT scan to investigate Mrs A's failure to progress.

69. Dr D told HDC:

> "It was found on the scan that there was essentially a disassociation in the spinal column at the T8/9 level, and I felt this likely to be on the basis of possible infective discitis[41] plus or minus vertebral myelitis[42] leading to significant spinal column instability and ongoing spinal cord irritation and compression."

70. The clinical notes document that on 18 July 2017 Dr D met with Mrs A and her family and discussed the results of the CT scan and explained that a further operation was needed to stabilise the spine. Dr D told HDC that further surgery was planned in an attempt to try to stabilise the spinal column in order to improve the chance of spinal cord recovery and give a higher level of comfort.

71. On 19 July 2017, Dr D and a colleague (a consultant orthopaedic surgeon) undertook further spinal fusion surgery with an extension up to T5.[43] The operation note recorded: "Multiple sepsis following surgeries with instability at T8/9 possible infected discitis/vertebral myelitis with ongoing cord compression symptoms and instability."

72. New pedicle screws and rods were connected to the rods already present in the spine. The operation took four hours and twenty minutes. Dr D said that he felt that this further procedure gave good stabilisation and alignment to the spinal column.

73. The operation note documented: "[W]e were satisfied with what was achieved."

<u>Subsequent event</u>

74. Following the surgery on 19 July 2017, Mrs A was transferred to the Intensive Care Unit (ICU). Her postoperative course was complicated, and she required the removal of a mucus plug from her left bronchus.[44] Dr D stated:

> "This certainly allowed an improved overall medical condition documented by improving blood perimeters but unfortunately no resolution of her essentially T8 paraplegia."

75. On 24 July 2017, Mrs A was transferred back to the Orthopaedics Ward.

[41] Inflammation of the intervertebral discs of the spine.
[42] Inflammation of the spinal cord.
[43] The fifth thoracic vertebra closest to the skull.
[44] The main branch of the windpipe leading directly to the left lung.

76. On 8 August 2017, Mrs A was transferred to the Spinal Unit for ongoing rehabilitation and treatment.

Further information

77. Dr D told HDC:

> "I … do accept responsibility for the very sad outcome. I have pointed out that the principle failure in her spine in fact occurred between the 8th and 9th thoracic vertebrae. This is at the level immediately above the long construct in her spine and the mobile unfused spine above. Of course I wouldn't have expected that to have occurred had she not had the extensive surgery and therefore the surgery I did elect to perform did result in the failure of her spinal column immediately above in a dramatic and sad way. I furthermore acknowledge the amount of pain that she had following the various surgeries, possibly at least in part related to screw malpositioning at the upper two levels in her thoracic spine, that is the 9th and 10th thoracic levels for which I do accept full responsibility."

78. Dr D stated:

> "I would like to offer my sincere regrets to [Mrs A's] family and to [Mrs A] herself in particular for the unfortunate outcomes from treatment of a complex spinal problem."

79. Dr D, on behalf of Dr D's company, told HDC that the company does not have policies or protocols that include adverse event management, as these are his personal responsibility as a practising orthopaedic surgeon.

80. The DHB told HDC that a review of Mrs A's care found that appropriate initial steps were taken to manage Mrs A's pain prior to notifying the pain service.

81. Ms B told HDC:

> "[I]n May 2017 [Mrs A's] life changed forever at the hands of a qualified surgeon. She is now a T1 Paraplegic fully dependent for all life cares, described by the Spinal Unit Consultant as a 'tragic surgical outcome'."

ACC report

82. ACC engaged an orthopaedic surgeon to provide advice about the orthopaedic care provided to Mrs A. The advice considers the link between the care provided to Mrs A, and the outcome, as the role of ACC is to determine whether injury occurred during the course of, or as a result of, being given treatment. ACC seeks to identify retrospectively whether a treatment injury occurred, and the information relied on by ACC did not include statements directly from the clinicians involved. This is not a criticism of the ACC process, but it is necessary to highlight the purpose and limitations of the ACC report when it is referred to in my opinion. HDC's independent advisors are asked to focus on the accepted standard of care, not the outcome, and they have the benefit of reviewing information

obtained over the course of the investigation, which includes statements from the clinicians involved.

83. A copy of the report was provided to HDC. In summary, the orthopaedic surgeon advised the following:

a) "In my opinion treatment injury has occurred and the main causation for the treatment injury is initially with the malalignment of the screws causing need for further significant surgeries and the replaced surgery and further fixation caused proximal junctional failure and then infection. In my opinion, there are multiple physical injuries which are directly related to her surgery …"

b) "Although this is one of the contemporary ways of improving pain and type of surgery depends on surgeon's choice, in my opinion most can be treated conservatively with pain management."

c) "[I]t appears that the surgeon has taken extreme care as the surgery itself has taken more than 6 hours. In my opinion, the indication for her subsequent treatment with multiple surgeries for malalignment or development of paraplegia or infection was appropriate."

Changes made since incident

84. Dr D told HDC that as a result of this incident he now works in a restricted scope of practice with respect to surgery on the spinal column. This includes both his public hospital and private hospital surgeries. He stated:

> "I am now confining my practice to more straightforward spinal procedures and all procedures that I plan to undertake in either hospital are discussed with one or other of my spinal surgical colleagues and this is confirmed by contact with the two respective hospitals before the surgery is undertaken."

85. The DHB told HDC that it will continue to provide orthopaedic services by credentialled orthopaedic SMOs, and that following these events Dr D's scope of practice reduced. The DHB also said that it plans to ensure that registrars and house officers are aware that it is the responsibility of medical staff to contact the Acute Pain Service or anaesthetist (after hours) for a review of a patient's pain.

Responses to provisional opinion

Mrs A's family

86. Mrs A's family was provided with an opportunity to comment on the "information gathered" section of the provisional decision. Ms C, on behalf of the family, provided a response to HDC. Where appropriate, her comments have been incorporated into this report.

87. Ms C told HDC that her mother was let down many times by the health system, and the injury that her mother suffered is T1 paraplegia ASIA[45] A.[46] She said that the Spinal Rehabilitation Unit spinal consultant who subsequently reviewed her mother stated that "this is a significant treatment related injury and a tragic surgical outcome".

Dr D

88. Dr D was provided with an opportunity to comment on the provisional opinion. He said that HDC's expert's opinion highlights the complex nature of this case, and that the malpositioned screws in themselves did not cause neurological injury. He told HDC that in around mid-2020 he retired from the DHB. He accepted the recommendations in the provisional report, and stated:

> "[A]ll proposed spinal procedures to be undertaken at [the private hospital] by me are discussed with colleague(s) to confirm that these cases fall within my agreed restricted scope of practice. This has been formally confirmed with the NZMC via provision of a Voluntary Undertaking."

Dr D's company

89. Dr D's company was provided with an opportunity to comment on the provisional opinion. It told HDC that it has no further comment to make.

DHB

90. The DHB was provided with an opportunity to comment on the provisional opinion. The DHB told HDC that Dr D retired from the DHB, and it accepts the recommendations proposed by HDC.

Opinion: Introduction

91. This opinion concerns the orthopaedic surgical care provided by Dr D, Dr D's company, and the DHB to Mrs A in 2017.

92. On 17 May 2017, Dr D performed spinal surgery on Mrs A. Unfortunately, during the surgery screws were misplaced and, as a result, three further surgeries were undertaken to re-align the screws and manage further complications including postoperative pain.

[45] American Spinal Injury Association impairment scale.
[46] Category A of ASIA A means that no motor or sensory function is preserved in the sacral segments.

Opinion: Dr D — breach

First spinal surgery on 17 May 2017

93. On 17 May 2017, Mrs A underwent spinal fusion surgery performed by Dr D at the private hospital. The operation took six hours, and during the operation there were technical issues with the computer navigation system. Dr D told HDC that at the time of the surgery he was not given satisfactory guidance in the positioning of the thoracic pedicle screws. He proceeded with the operation using a combination of the navigation system and standard anatomical reference points. Dr D told HDC that no system is entirely foolproof in this setting.

94. Following the operation, Mrs A suffered from chest pain and remained in the private hospital for 10 days to monitor her condition. At this stage it was thought that all the screws had been positioned satisfactorily. She was discharged home on 27 May 2017 for ongoing convalescence and rehabilitation.

95. Mrs A's chest pain persisted, and on 1 June 2017 she was admitted to the public hospital via ambulance following a fall at home. A CT scan performed on 3 June 2017 identified a malposition of the left T9 and T10 and right T9 screws, and lateral misplacement of an L2 screw.

96. Dr D told HDC that he accepts full responsibility for the malpositioning of the T9 and T10 screws.

97. Expert advice was obtained from Dr Tom Geddes, an orthopaedic surgeon, who advised that the orthopaedic or spinal workup for Mrs A was extensive and appropriate, and that "the spinal fusion surgery performed on the 17 May 2017 on a number of criteria was well done except for the very significant problem of the medially misplaced pedicle screws in the thoracic spine". Dr Geddes noted that very small medial breaches of the pedicle are common, and in general are relatively well tolerated. However, he considered it a serious technical flaw for Dr D to place screws into the canal by such an amount at the T9 and T10 levels on the left-hand side. Dr Geddes said that there was also lateral misplacement of the left L2 pedicle screw, but that this is much less likely to cause any significant harm.

98. Dr Geddes advised:

> "In consideration of the misplaced pedicle screws at the T9 and T10 levels, this would be considered below an acceptable standard of care given the degree of medial penetration. However this would be mitigated by the fact that every attempt was made to place these screws correctly including the use of a navigation system so this would be considered only a moderate departure from an expected standard.
>
> With regards to the lateral misplacement of the left pedicle screws, once again this would be considered a departure from an ideal or acceptable standard but only at a mild level as there is a tendency to deliberately err towards a safer position for the screw."

99. Dr Geddes considered that Dr D had taken all reasonable steps to ensure safe placement of the screws, but he had organised a navigation system that unfortunately failed, and he had to resort to a more traditional method of inserting the screws. Dr Geddes believes that was the path that all other orthopaedic spinal surgeons would have had to take.

100. I accept Dr Geddes' advice. I note that Dr D tried to utilise the computer navigation system to reduce the chance of an error occurring, but there were technical issues with the system. Dr Geddes advised that it was appropriate to continue the surgery using a more traditional method of inserting the screws. In any event, Dr D accepts that he was responsible for the misplaced screws, and I am critical that he misplaced the pedicle screws at the T9 and T10 levels and misplaced the L2 pedicle screw during the surgery on 17 May 2017.

Spinal surgery at the public hospital on 20 June 2017

101. Mrs A was admitted to the public hospital and subsequently underwent three further operations performed by Dr D on 7 June, 20 June, and 19 July 2017. She remained in the public hospital from 1 June 2017 to 8 August 2017.

102. Dr Geddes advised that appropriate tests, investigations, and treatment were carried out once it became evident that screws had been misplaced in the initial surgery. He considers that the operation on 7 June 2017 and the final operation on 19 July 2017 were appropriate. However, he noted some concerns about the third operation on 20 June 2017.

103. Dr Geddes advised:

> "The [third] operation where removal of screws and decompression was performed, I would question whether this was the most appropriate treatment. Given the long stiff construct below the level of where the screws were removed in conjunction with further destabilisation of this region by a decompression and the knowledge that there was damage to the supporting rib structures also, would raise concern of the significant chance of developing a proximal junctional failure. I believe that the decompression was a sensible and appropriate part of the procedure but that this level should probably have been further protected by potentially extending the fusion more proximally.
>
> With regards to the [third] surgery at [the public hospital], it is my opinion that a consensus opinion of spine surgeons is likely … that protection[47] of this decompressed area is ideal and while this might be considered a departure from acceptable standards leaving it unprotected, again this would be considered mild as there is really no ideal or gold standard set out for this situation."

104. Dr D acknowledged Dr Geddes' comment and noted that there was no gold standard as to what different procedure could have been performed.

[47] See the final paragraph of Dr Geddes' advice for his explanation of "protection".

105. I accept Dr Geddes' advice and am mildly critical of the operation on 20 June 2017, as decompression was performed without further protection.

Conclusion

106. As outlined above, I am critical that:

a) Dr D misplaced the T9 and T10 screws and laterally misplaced the L2 screw during the first operation on 17 May 2017; and

b) For the third operation on 20 June 2017, decompression was performed without further protection.

107. As a result of the misplaced screws in the first operation on 17 May 2017, Mrs A had to undergo further surgeries and treatment, and suffered ongoing pain and loss of mobility. Accordingly, I find that Dr D did not provide services to Mrs A with reasonable care and skill, and breached Right 4(1) of the Code of Health and Disability Services Consumers' Rights (the Code).[48]

Opinion: Dr D's company — no breach

108. Dr D is the sole director of his company. He provides his services through this company. On 17 May 2017, he provided private surgical services as an employee of this company.

109. Dr Geddes advised:

> "I don't believe that there are any major systemic issues at [Dr D's] company … that led to the catastrophic outcome with regards to [Mrs A's] spinal surgery."

110. I accept Dr Geddes' advice. I consider that the errors that occurred did not indicate broader systems or organisational issues at Dr D's company. Therefore, I consider that Dr D's company did not breach the Code.

Opinion: DHB — adverse comment

111. As a healthcare provider, the DHB is responsible for providing services in accordance with the Code.

112. Mrs A was admitted to the public hospital from 1 June 2017 until 8 August 2017. She underwent three further surgeries performed by Dr D at the public hospital, and received care from the DHB. Dr D was an employee of the DHB at the time of these surgeries.

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

113. As noted above, Dr Geddes advised that the operation on 7 June 2017 and the final operation on 19 July 2017 were appropriate. However, he was mildly critical of the third operation by Dr D on 20 June 2017, as decompression was performed without further protection.

114. Dr Geddes advised: "I don't believe that there are any major systemic issues at … [the DHB] that led to the catastrophic outcome with regards to [Mrs A's] spinal surgery."

115. I accept that the errors that occurred did not indicate broader systems or organisational issues at the DHB. Therefore, I consider that the DHB did not breach the Code.

APS review following Mrs A's admission — adverse comment

116. The DHB 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.

117. On 2 June 2017, following Mrs A's admission, Dr F reviewed Mrs A and noted that input from the APS team should be sought about her pain. The nurse on the following shift noted Dr F's instruction that an APS referral should be sought, but a referral to APS was not made. APS review did not occur until 14 June 2017 after Mrs A's surgery on 7 June 2017. The DHB told HDC that nursing staff cannot request APS input, and it is the responsibility of the medical staff.

118. Dr Geddes advised:

> "[Mrs A] was re-admitted to [the public hospital] on the 1st June after not coping due to ongoing pain issues. At that stage there was no significant new neurological deterioration in her legs and appropriate pain management and investigations were performed …"

119. I remind the DHB of the importance of ensuring that clinical staff are aware of the referral process to different teams. In this case, I accept Dr Geddes' advice that there was appropriate management of Mrs A's pain, but in my opinion earlier input from APS may have been helpful. I note that the DHB has advised HDC that it will ensure that registrars and house officers are aware that it is the responsibility of medical staff to contact APS for a review of a patient's pain.

Recommendations

120. I note that Dr D has advised that he now confines his practice to more straightforward spinal procedures, and the DHB has also confirmed that Dr D reduced his scope of practice following these events. In addition to this change, I recommend that Dr D:

a) Provide a written apology to Mrs A and her 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) Report back to HDC on the change he made to conduct an initial discussion with his orthopaedic colleague(s) about any spinal surgery he plans to undertake (as stated in paragraph 84 above), and how this has changed and/or improved his practice. This information is to be provided to HDC within three months of the date of this report.

121. I recommend that the Medical Council of New Zealand consider whether a review of Dr D's competence is warranted.

122. I recommend that the DHB report back to HDC on its plan to ensure that registrars and house officers are aware that it is the responsibility of medical staff to contact APS for a review of a patient's pain (as stated at paragraph 85), within three months of the date of this report.

Follow-up actions

123. A copy of this report with details identifying the parties removed, except the expert who advised on this case, will be sent to the Medical Council of New Zealand, the Royal Australasian College of Surgeons, and the New Zealand Orthopaedic Association, and they will be advised of Dr D's name.

124. A copy of this report with details identifying the parties removed, except the expert who advised on this case, 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 Tom Geddes, an orthopaedic surgeon:

"I am providing an opinion on the case of [Mrs A] who had her surgery performed by [Dr D] at [the public hospital], [the DHB].

I work at Middlemore Hospital as a practicing spine surgeon and have experience in the surgery performed by [Dr D] and I have no personal or professional conflict of interest in this case. I will comment on the items as requested in the letter from HDC.

1. Whether the appropriate assessments were undertaken to ensure [Mrs A] was fit for spinal fusion surgery of 17 May 2017.

The orthopaedic/spinal workup for [Mrs A] was extensive and appropriate. She had a preoperative CT scan in order to assess anatomy and provide for intraoperative image guidance. She had had a SPECT scan to look for areas of increased metabolic activity suggesting that they may be the causes for her ongoing back pain and this led, I think, to the appropriate decision to extend the fusion into the lower thoracic spine rather than doing a shorter construct given that surgery was to be undertaken.

She also had standing full length x-rays to assess her overall spinal alignment which has become more frequently undertaken as it has become evident that obtaining good alignment of the spine particularly in the sagittal plane is a predictor for success or failure of surgery. The parameters obtained from this x-ray in [Mrs A's] case would suggest that there was a slight mismatch in her lumbar lordosis to pelvic incidence and that her sagittal balance was a little positive suggesting that she had a tendency to stoop forward.

On reading through the notes it would appear that the decision to operate was not taken lightly and multiple attempts including epidural steroid injections were made to try and avoid further surgical intervention.

[Dr D] had obviously known [Mrs A] over a significant period of time and indeed had operated on her previously which would indicate that he had a good understanding of associated health issues. She would however fall into a relatively high risk category given that she was known to have a significant number of comorbidities including diabetes, increased BMI, previous pain issues including some neurological irritation following her previous surgeries as well as a history of using immunosuppressive therapy for her arthritis.

It is not well documented whether or not any further specific medical assessments were made for her surgery in conjunction with other specialties such as medicine/cardiology. However given that she had come through her previous surgery satisfactorily this may not have been felt necessary by [Dr D] or his anaesthetist.

2. Whether the spinal fusion surgery was performed to an acceptable standard.

In my opinion the spinal fusion surgery performed on the 17th May 2017 on a number of criteria was well done except for the very significant problem of the medially mis-placed pedicle screws in the thoracic spine. One of the major technical issues in performing extended surgery from the pelvis up into the thoracic spine is the restoration of alignment. Preoperatively there was a mismatch in some of the pelvic parameters and the lumbar lordosis as well as a positive sagittal balance which means that there is a tendency for [Mrs A's] spine to be bent forward. Restoration and a more normal alignment were very well obtained at the time of surgery with an improvement in the lumbar lordosis such that it was within the ideal range. This would be considered to be at or above the normal standard.

Despite this, the proximal end of the construct is probably a little under-contoured which may have induced some increased stress at the junction of the construct and the normal spine. This may have been exacerbated by the use of very strong but stiff chrome cobalt rods. This would have been considered to be a relatively minor technical issue depending on how easily the rods were able to be dropped into the heads of the screws at the time of surgery.

With regards to the medially placed screws, this can result in a catastrophic neurological injury when the screws are misplaced at the level of the spinal cord, as in this case. Very small medial breaches of the pedicle are common and in general relatively well tolerated. It is however considered a very serious technical flaw to place screws into the canal by the amount that the screws, particularly at the T9 and T10 levels on the left hand side. The lateral misplacement of the left L2 pedicle screw, while technically an error of placement, the screw is much less likely to cause any significant harm when the screw is placed in this position as compared with the screws that had gone medially into the spinal canal.

Having said this, in [Mrs A's] case the misplaced screws do not appear to have caused any serious neurological injury at the time of insertion and were probably not responsible for her post-operative pain which was predominantly on the contralateral side to that of the misplaced screws. In this case it does appear that appropriate pre-op planning and the ordering of an image guidance system to aid with the placement of screws was performed.

3. Whether the appropriate steps were taken when technical issues were encountered during the procedure on 17th May 2017.

In the lead up to the surgery it was most appropriate a pre-operative CT scan was obtained and an image guidance system was used in order to try and place the screws as safely as possible.

There is a move internationally towards using image guidance systems more to try and ensure that thoracic screws, in particular, are placed safely with the use of computer assistance and image guidance technologies. This is considered to be an advance of

what is still probably the most widespread technique used in New Zealand which is a trained surgeon uses anatomical landmarks on the exposed spine and in conjunction with intra-operative x-rays or Image Intensifier and correlates this with the pre-operative CT scan while placing pedicle screws.

In general the computer assisted navigation systems have been shown to be more accurate than the traditional methods which are still largely used. There are however some recognised problems with image guidance. In this case the system relies on a preoperative CT scan which is taken with the patient supine (on their back) prior to surgery and then using recognised landmarks intraoperatively the computer is able to generate images and trajectories for screws based on that initial image. The patient however in surgery is placed prone and usually supported with their abdomen free which can result in a slight change in the relative positions of the vertebral bodies, depending on the flexibility of the spine. There is a registration process performed that allows the computer to recognise where the spine is in space and if there is a miss registration the computer can give instructions that are wildly inaccurate and cause the risk of very significant misplacement of metalware. The risk of this can be mitigated intra-operatively by checking the registration with visible landmarks frequently throughout the procedure.

I am not clear as to what the computer issues were during [Mrs A's] case but once it is recognised that the computer guidance is either not working or giving inappropriate instructions, it is certainly much safer to abandon the computer navigation and return to the more traditional methods. As stated previously this involves the use of Image Intensifier or x-ray and the reckoning of the surgeon based on the pre-operative imaging. This can be very difficult in some cases particularly if patients are somewhat larger or have low bone density. In these cases obtaining images that demonstrate the position of the pedicles, particularly in the A–P projection of the x-rays can be very difficult. This is the projection that is required to ensure safe medial or lateral placement of the screws. There is no comment on any technical difficulties with regards to screw placement after the abandonment of the computer navigation; however given [Mrs A's] body habitus, gender and age, it is likely that it was difficult to view very clearly the pedicles on the AP projection.

Overall I feel that the appropriate steps were taken after there was failure of the computer navigation but despite this, a significant technical error was performed particularly with regards to the medial placement of the T9 and 10 pedicle screws.

4. Whether follow up care met accepted standards.

[Mrs A's] initial operation was performed on the 17th May 2017 and she was not discharged from the private hospital until the 28th May which would have been appropriate after such a large operation but is probably slightly longer than average. She was readmitted to [the public hospital] on the 1st June after not coping due to ongoing pain issues. At that stage there was no significant new neurological

deterioration in her legs and appropriate pain management and investigations were performed as new symptoms and problems arose.

Management of patients with severe post-operative pain that are not improving as anticipated can be extremely difficult and it is certainly understandable that frustrations and concerns would have arisen from [Mrs A] and her family during this period.

It is difficult to reconcile the nursing and medical notes with the concerns of the family and it is certainly appropriate that they would have had concerns during this period and it should be ensured that there is adequate provision for these concerns to be raised and addressed by medical and nursing staff.

5. Whether management of [Mrs A's] condition by [Dr D] during her admission at [the public hospital] was appropriate.

As [Mrs A's] condition evolved during her stay at [the public hospital], in general appropriate tests, investigations and treatment were carried out once it became evident that screws had been misplaced in the initial surgery and I think it was appropriate that particularly the thoracic screws that were placed inside the canal were repositioned. This appears to have been done appropriately and appropriate intra-operative checks for infection were also performed. Once it became apparent that there was some neurological deterioration in [Mrs A's] legs, it was appropriate that further imaging be obtained in the way of an MR scan though it is not surprising that there is significant metal artefact in the scan.

6. Whether the further surgeries at [the public hospital] were performed to an acceptable standard.

There were three operations. The first of which was the repositioning of screws and sampling for potential infection, I think surgery was appropriate and performed to an acceptable standard. The second operation where removal of screws and decompression was performed, I would question whether this was the most appropriate treatment. Given the long stiff construct below the level of where the screws were removed in conjunction with further destabilisation of this region by a decompression and the knowledge that there was damage to the supporting rib structures also, would raise concern of the significant chance of developing a proximal junctional failure. I believe that the decompression was a sensible and appropriate part of the procedure but that this level should probably have been further protected by potentially extending the fusion more proximally. The final operation, after it was recognised that there was a significant dissociation of the spine causing compression of the spinal cord at the proximal margin of the previous surgeries was well performed and most appropriate. Unfortunately by that time significant cord damage had occurred.

It should be noted that this significant instability may not have been the sole result of mechanical problems related to previous surgeries but the addition of infection which

probably seeded from [Mrs A's] lungs, and is likely to have had a significant adverse effect on the long-term outcome.

7. Any other matters you consider amount to a departure from accepted standards.

With regards to matters that I would consider to be a departure from accepted standards, the initial decision to perform this degree of surgery on [Mrs A] would be considered borderline given her list of comorbidities including diabetes, increased BMI, previous pain issues and problems with surgery and a history of immunosuppressive therapy for arthritis.

With regards to the second surgery performed at [the public hospital], I would question the decision-making that was done here and I believe a decompression was appropriate, leaving this unprotected, I think would be considered a departure from ideal care though I would accept that in any given group of spinal surgeons, that there would be a considerable range in what the surgeons would feel ideal treatment would be given the situation.

With regards to things that may help avoid these problems going forward, I think the appropriate use of more technologically advanced navigation systems has been appropriate in patients where it may be difficult to use more traditional methods if the navigation fails. The ability to have neural monitoring, particularly when screws are placed at the thoracic level or any significant deformity correction is anticipated may help reduce the risks of screw misplacement.

In order to reduce the risks of surgery that has potentially caused significant problems at the proximal end of the construct, the ability to discuss these cases in a forum with other spine surgeons and indeed perform the surgery with another spine surgeon, as was done in the final operation at [the public hospital], should be greatly encouraged. These problems can be technically very demanding and the decision-making also difficult and I believe we operate at a significant advantage in the larger hospitals where we have a number of spine colleagues and meetings set up on a regular basis to discuss these cases in a timely manner."

Addendum to Dr Geddes' advice:

"**Under point 2:**

In consideration of the misplaced pedicle screws at the T9 and T10 levels, this would be considered below an acceptable standard of care given the degree of medial penetration. However this would be mitigated by the fact that every attempt was made to place these screws correctly including the use of a navigation system so this would be considered only a moderate departure from an expected standard.

With regards to the lateral misplacement of the left pedicle screw, once again this would be considered a departure from an ideal or acceptable standard but only at a mild level as there is a tendency to deliberately err towards a safer position for the screw.

Under point 7:

With regards to the second surgery at [the public hospital], it is my opinion that a consensus opinion of spine surgeons is likely belief that protection of this decompressed area is ideal and while this might be considered a departure from acceptable standards leaving it unprotected, again this would be considered mild as there is really no ideal or gold standard set out for this situation."

The following further advice was obtained from Dr Geddes:

"This is a report in addition to my initial report and I hope will clarify some issues. I have no conflict of interest, either personal or professional, in this case.

I have reviewed my initial report plus the documents previously provided being:

1. A letter of complaint dated …
2. [Dr D's] response to HDC dated 6th November 2018.
3. [Dr D's] response to ACC dated 30th August 2017.
4. [The] DHB's response dated 6th November 2018.
5. Clinical records from [Dr D] covering the period 23rd March 2017 to 19th July 2017.
6. Clinical reports from [the DHB] covering the period 1st June 2017 to 8th August 2017.
7. Further information was sent to me on the 27th May 2019.
8. [The DHB's] response dated 26th February 2020 and its attachments including relative policies.
9. [Dr D's] response dated 15th February 2020.
10. [Dr D's] company's response dated 16th April 2020.

You have asked me to comment in particular on:

1. Any further comment regarding [Dr D's] care.
2. Whether the error identified in the initial report was due or partly due to any systemic issues at [the DHB] or whether it was more attributable to an individual. If there are systemic issues please elaborate on these with reference to how other hospitals operate in these conditions in these respects.
3. The appropriateness of lack of written policies or procedures and whether the error identified by you was due (or partly due) to any systemic issues at [Dr D's] company.
4. Any other matters in the case that you might consider warrant comment.

With regards to these requests, No. 2 and 3, I don't believe that there are any major systemic issues at either [Dr D's] company or at [the DHB] that led to the catastrophic outcome with regards to [Mrs A's] spinal surgery.

I would add for clarity that while I felt that there was a significant technical error in the misplacement of thoracic pedicle screws within the spinal canal, I think it is important to note:

1. That these did not cause any significant neurological damage or appear to contribute to the final catastrophic outcome, and
2. That [Dr D] had taken all reasonable steps to ensure, as much as he could, the safe placement of these screws. He had organised a navigation system which, unfortunately, had failed and then he had resorted to a more traditional method of inserting the screws with the use of an Image Intensifier and anatomical landmarks. I believe that this would have been the path that virtually all currently practicing orthopaedic spine surgeons in New Zealand would have adopted. The alternative would have been to abandon the surgery and return to it on another date when an intraoperative guidance system would have been available. I believe that the risks associated with that option would be regarded as unreasonable by most spinal surgeons.

With regards to the catastrophic failure of the spinal column at the proximal junction of the previously operated on levels that led to the subsequent neurological injury to [Mrs A]. This has occurred due to multiple factors, some of which are still not fully understood by spinal surgeons. There is a recognised significant risk of this type of failure at the junction between areas of the spine that have been operated on and normal areas of the back and while the decision to decompress the spine in this region without fusing it may have contributed to the failure, it is not something that would have been viewed as a significant departure from normal practice.

[Mrs A's] comorbidities, the development of an infection at this level and her underlying bone quality would all have contributed to this failure to varying degrees.

With regard to avoiding these types of serious complications in the future, I would just reiterate the final two paragraphs in my initial report.

I hope this has been of some benefit in clarifying issues for you. I would be very happy to clarify things further if you had any more specific requests."

Addendum to Dr Geddes' advice:

"… I believe that [Mrs A] was always a high risk patient. [Dr D] had done appropriate investigations and had tried to help with non surgical treatment before embarking on surgical treatment.

I would agree with his statement 'I would state in response that this is very much a clinical decision-making matter, and was done in conjunction with my anaesthetist at the time.'

Most if not all spine surgeons would operate on such patients from time to time after exhausting non operative management, they would just try not to. There are times when there are no good options and an attempt at surgical treatment becomes the lesser of the available evils. As such I don't believe that the decision to operate should be considered a significant departure from expected standard of care. My initial

comment was made to convey the fact that this case was not a 'routine' procedure and that a higher than normal complication rate might be expected.

I hope this clarifies the situation. I am happy to comment further if required.

…

When I used the term 'protection' [i]t was in the context of when further surgery is performed at the end of a long construct or fusion of the spine there is increased stress between the normal spine and the stiffened section of the spine that has previously been operated on and this is an area of potential failure. There are many factors that affect the likelihood of failure at this junction including but not limited to the length of the fusion, overall alignment and balance of the spine, quality of the bone, size of patient, extent of the additional surgery and presence of infection. In some instances when considering all these factors a surgeon may 'protect' this area from failing by extending the instrumentation and fusion past the area where additional surgery is performed stopping in a more normal area of the spine."