Radiologist, Dr B
Radiology service

A Report by the
Health and Disability Commissioner

(Case 20HDC00356)

Health and Disability Commissioner
Te Toihau Hauora, Hauātanga

Contents

Executive summary 1
Complaint and investigation 2
Information gathered during investigation 2
Opinion: Dr B — breach 7
Opinion: Radiology service — no breach 9
Recommendations 10
Follow-up actions 11
Appendix A: Independent clinical advice to the Commissioner 12

Executive summary

1. This report discusses the care provided to a woman (aged in her fifties at the time of events) prior to her diagnosis of liver cancer in 2019 and, in particular, errors that occurred during a CT scan of her abdomen and pelvis.

Findings

2. The Commissioner considered that the radiologist should have reported that the liver lesions identified on the woman's CT scan were difficult to characterise, and therefore he should have offered a differential diagnosis and recommended further imaging. His failure to do so contributed to unacceptable delays in the diagnosis of the woman's liver cancer. Accordingly, the Commissioner found that the radiologist failed to provide services to the woman with reasonable care and skill, and breached Right 4(1) of the Code. The Commissioner noted that when the nature of the tumours was confirmed, it was too late to offer the first line of treatment, which would have been surgical removal.

Recommendations

3. The Commissioner recommended that the radiology service:

a) Provide evidence to HDC of the peer review assessment and the case study at the radiology service's Clinical Day.

b) Share HDC's anonymised report, including the expert advisor's advice, with all its radiology staff across the radiology service branches in New Zealand.

c) In addition to strongly encouraging radiologists to undertake a double reading of complex or difficult cases, consider whether any processes and/or guidelines could be developed to ensure that this occurs with consistency.

d) Review its processes to determine what steps it could put in place to prevent or minimise interruptions for radiologists who are undertaking complex analyses.

4. The radiology service has advised and provided evidence to HDC regarding the above, and therefore the Commissioner considered that recommendations a), c), and d) have been met.

Complaint and investigation

5. The Health and Disability Commissioner (HDC) received a complaint from Mr A about the care provided to his wife, Mrs A, by radiologist Dr B and the radiology service. The following issues were identified for investigation:

- *Whether Dr B provided Mrs A with an appropriate standard of care in Month4.*[1]
- *Whether the radiology service provided Mrs A with an appropriate standard of care in Month4.*

6. The parties directly involved in the investigation were:

Mr A	Complainant/consumer's husband
Radiology service	Provider
Dr B	Provider/radiologist

7. Also mentioned in this report:

Dr C	General practitioner

8. Further information was received from:

ACC
Medical Centre
District Health Board

9. Independent expert advice was obtained from a radiologist, Dr Gabriel Lau (Appendix A).

10. Sadly, Mrs A died in 2019. I extend my condolences to her family.

Information gathered during investigation

Introduction

11. This report discusses the care provided to Mrs A (aged in her fifties at the time of events) prior to her diagnosis of liver cancer in 2019 and, in particular, errors that occurred in the reporting of a CT scan of her abdomen and pelvis in Month4.

12. In 2017, Mrs A noticed that she was beginning to put on weight. In addition, she had thin hair and skin, a moon face, and prominent veins in her feet, and she bruised easily.

13. On 25 Month2 2018, Mrs A presented to her general practitioner (GP), Dr C. She had experienced ankle swelling and general weight gain and tiredness since increasing her

[1] Relevant months are referred to as Months 1–11 to protect privacy.

blood-pressure medication in Month1. Dr C decreased the medication and ordered blood tests. The results showed moderately elevated liver enzymes.[2] Repeat blood tests were scheduled for six weeks' time.

14. On 31 Month3, Mrs A's repeat blood tests again showed abnormal liver enzyme levels. Dr C referred Mrs A for an ultrasound, and indicated on the referral that it was for "[d]eranged liver function tests, recent increased weight and ?fatty liver/other".

Ultrasound scan

15. An abdominal ultrasound scan was performed on 7 Month4. The report identified a potential lesion on the right-hand side of the liver measuring 31x52x31mm with a possible cyst nearby measuring 24x24x22mm. However, the report concluded that there was "poor visualisation" of the potential lesion, which was "incompletely characterised". The report suggested further investigation with a CT scan.[3]

CT scan on 27 Month4

16. A request form for a CT scan was completed by Dr C on 12 Month4. The referral information was the same as that on the referral for the ultrasound: "Deranged liver function tests, recent increased weight and ?fatty liver/other." A copy of the ultrasound report was provided as part of the referral. A CT scan of the abdomen and pelvis was performed on 27 Month4.

17. The report of the CT scan, prepared by radiologist Dr B, stated:

> "I. There are 2 adjacent focal lesions within the medial aspect of hepatic segment 7 that exhibit imaging characteristics of benign cavernous haemangiomas.[4]
>
> II. Prominent, extensive and non-uniform hepatic steatosis[5]
>
> III. Mild, uncomplicated colonic diverticular disease[6]
>
> IV. Focal left paracentral disc protrusion[7] at the L5–S1 that impinges upon the proximal left S1 nerve."

18. The report did not provide a differential diagnosis including the possibility of liver malignancy. No further imaging was recommended.

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[2] The elevated liver enzymes were GGT (gamma glutamyl transferase) and ALT (alanine amino transferase). The pathologist commented: "High GGT is often due to medication, ethanol and fatty infiltration of the liver."
[3] A computerised tomography (CT) scan combines a series of X-ray images taken from different angles around the body, and uses computer processing to create cross-sectional images (slices) of the bones, blood vessels, and soft tissues.
[4] A cavernous liver haemangioma or hepatic haemangioma is a benign tumour of the liver composed of hepatic endothelial cells. It is the most common benign liver tumour, and is usually asymptomatic and diagnosed incidentally on radiological imaging.
[5] Fatty liver disease (FLD) is also known as hepatic steatosis.
[6] A condition in which small, bulging pouches develop in the digestive tract.
[7] The disc extrudes between the spinal cord and the foramen (the space through which the nerves exit the spinal canal).

Further reviews

19. Between Month5 and Month8, Mrs A presented to her GP, Dr C, on several occasions. Dr C referred Mrs A to a rheumatologist, who queried whether she could have Cushing's syndrome[8] and referred her to an endocrinologist.

20. Mrs A saw the endocrinologist on 4 Month9. Additional testing on 9 and 10 Month9 confirmed a diagnosis of Cushing's syndrome and indicated that the likely cause was an overgrowth or a tumour within one or both of the adrenal glands (these glands are located immediately above each kidney). Therefore, the endocrinologist referred Mrs A for a CT scan.

CT scan and cancer diagnosis

21. A CT scan performed on 23 Month9 showed significant growth of the previously identified liver lesions. Growth of the lesions was determined by direct correlation of the CT scan performed in Month9 with the CT scan performed in Month4. The comparison determined malignancy to be likely, and an MRI scan was ordered to obtain better imaging.

22. An MRI scan performed on 29 Month9 showed a large lesion measuring 12cm on the right-hand side of the liver. The CT scan performed on 27 Month4 had shown this as two adjacent lesions with a maximum dimension of approximately 9cm. The MRI scan confirmed that the lesion extended across the vena cava (the blood vessel that carries blood to the heart). Although this finding was described in the report of the Month4 CT scan, the protrusion beyond the liver was significantly more pronounced in the MRI scan of Month9. Two other small lesions were also identified.

23. On 1 Month10, tissue from the liver lesions was extracted, and the lesions were confirmed to be cancerous. A provisional diagnosis of a neuroendocrine tumour[9] or an adrenal cortical carcinoma[10] was made, and Mrs A was referred to a surgeon and a medical oncologist.

Subsequent events

24. Following further assessments and investigations, the surgeon and medical oncologist determined that the extent and position of the tumour precluded surgical removal.

25. Mrs A commenced chemotherapy on 12 Month11. The first cycle went well, but her condition deteriorated and, sadly, she died a short time later.

Radiology service review

26. On 20 Month10, the surgeon wrote to the radiology service noting that Mrs A and her family had raised questions about the results of her CT scan of the abdomen and pelvis on 27 Month4, and asking for a review.

[8] Cushing's syndrome is caused by excess levels of the hormone cortisol. It can be caused by taking certain medications, or the body itself may overproduce cortisol.
[9] An umbrella term for a group of unusual, often slow-growing cancers.
[10] A rare disease in which malignant (cancer) cells form in the outer layer of the adrenal gland.

27. The radiology service undertook a review and prepared a report dated 12 Month11. The images and reports were reviewed by Dr B, and also by a specialist radiologist with interest in abdominal imaging, and by senior radiologist members.

28. The specialist radiologist considered that the CT examination was good, and that there were no issues with the quality of the scan. With regard to whether the lesion was characteristic of a benign liver tumour (a cavernous haemangioma), the specialist radiologist considered that the pattern was not entirely typical of a benign liver tumour, and that further imaging was required. He reported:

> "My assessment of these hepatic lesions in this CT scan is that they are indeterminate and require further work-up. This would consist of MRI, and subsequently image guided biopsy depending on the MRI findings."

29. The report of the review concluded that Dr B had made an error in the interpretation of the findings of the liver lesion, and that he should have included an alternative diagnosis in the interpretation/conclusion section in his report. The review concluded that the best "next investigation" after the ultrasound scan should have been an MRI examination in light of the significant build-up of fat in the liver.

30. On 24 Month11, Dr B wrote to Mrs A apologising for his diagnostic error in the CT report. He stated: "I deeply regret the implications of this error, including any subsequent delay in reaching a definitive diagnosis as a result."

Further information — Dr B

31. Dr B told HDC that he has been a radiologist for many years, and has not previously made an error or received a complaint of this nature. He stated:

> "I have reflected at great length on [Mrs A's] case and I am devastated that my error contributed to a delay in her diagnosis. I have never sought to make any excuse for the shortcomings in my report and do not wish to do so now."

32. Whilst not attempting to excuse the error, Dr B noted that experienced and competent radiologists may miss abnormalities, and that errors are inevitable in diagnostic radiology. Dr B said that there were no wider concerns regarding his practice, and this was a one-off human error.

33. Dr B agrees that his interpretation of the CT scan represents a departure from accepted standards. He stated that his failure to describe the focal liver abnormality as indeterminate in nature, and to recommend follow-up, is an error he has acknowledged multiple times with deep regret.

34. Dr B accepts that his report on Mrs A's CT scan does not accord with his usual practice in that it did not:

- Specify the indeterminate nature of the focal pathology;
- Provide a differential diagnosis that included the possibility of liver malignancy; and
- Recommend follow-up investigation by MRI scan.

35. Although Dr B has accepted the above, he told HDC:

> "I maintain that my description of the enhancement pattern of the lesions — as well as my description of the radiologic findings within the abdomen and pelvis — was accurate and included all relevant observations."

36. Dr B stated that he is unable to account for his error beyond it possibly being a singular instance of cognitive error. He noted that reporting an abdominal scan, including the review of clinical information and prior studies, involves the study of an excess of 1,000 separate images, and it requires sustained intellectual concentration, typically for up to 30 minutes. He commented that interruptions occurred frequently. He said that he can only speculate that while he was completing his interpretation and report, he was called away to perform a hands-on medical intervention, and that this may have diverted his attention from the final remarks that were necessary for the accurate completion of his report.

37. Dr B also noted that he had limited clinical information about Mrs A's presentation, in particular, other than weight gain and abnormal liver function tests,[11] the information did not include other clinical information such as her thin hair and skin, moon face, prominent veins in her feet, easy bruising, ankle swelling, fatigue, and hypertension/hypotension.

38. Dr B further noted that even if he had not erred in his report, he could not have diagnosed Mrs A with adrenal cortical carcinoma from the CT scan in Month4, and that the diagnosis of adrenal cancer was, and could only be, determined by invasive biopsy. This occurred in Month10.

Further information — the radiology service

39. The radiology service told HDC that it is accredited with International Accreditation New Zealand (IANZ). It stated that it conducts regular performance reviews, peer reviews, and scope of practice reviews of its radiologists.

40. The radiology service said that since this incident it has strongly encouraged its radiologists to undertake a double reading of complex or difficult cases. It is undertaking a peer review of its radiologists' reports to ensure that the quality of imaging and the standards of reporting are high. The radiology service stated that in May 2020 alone, over 400 studies were peer reviewed. The radiology service also has ongoing quality assurance, with internal audits, peer reviews, assessments by IANZ, revision of examination protocols and processes, and regular equipment checks and maintenance undertaken by external health physicists.

41. The radiology service stated that it does not accept that there was a departure from accepted standards in Dr B's reporting of the radiological findings. Adopting the conclusions

[11] The clinical information included with the ultrasound report of 7 Month4.

of the review, it considers that Dr B's examination protocol, technique, and images in completing the CT scan of Mrs A were fit for purpose and of high quality. However, it does accept that there were some shortcomings in the interpretation of the described radiological findings in Dr B's report.

42. The radiology service said that Mrs A's liver lesions had complex features, and the interpretation of them was made more difficult by the superimposed patchy fatty changes throughout her liver. The radiology service stated that the differential diagnosis for the liver lesions included benign liver tumours, but the diagnosis was indeterminate and alternative diagnoses should have been offered.

Further information — ACC

43. Mrs A's ACC claim was approved for the progression and spread of cancer obstructing a main blood vessel (the vena cava) as a result of a failure to diagnose the cancer earlier.

44. ACC external clinical advice noted that the form of cancer Mrs A had was a rare malignancy, usually with an aggressive course, and it is not known to be chemo-sensitive. Consequently, it is treated with aggressive surgical resection when possible. ACC noted that based on the available imaging, if the cancer had been diagnosed in Month4, it would likely have been operable,[12] but by the time diagnosis was made in Month9, the tumour had become inoperable.

Responses to provisional opinion

45. Mr A was given an opportunity to respond to the "information gathered" section of the provisional opinion. He confirmed that he had read the report and had no further comment.

46. Dr B was given an opportunity to respond to the relevant parts of the provisional opinion. Where relevant, his response has been incorporated into the report.

47. The radiology service was given an opportunity to respond to the provisional opinion. It advised that it respects the proposed recommendations and will act on them. It again wished to offer its sincere sympathy to the family of Mrs A.

Opinion: Dr B — breach

48. I accept the sequence of events as set out above, in particular that Dr B reported Mrs A's CT scan (undertaken on 27 Month4) as indicating two liver lesions, which he interpreted as having characteristics of a benign liver tumour. The report did not offer an alternative diagnosis or recommend further imaging.

[12] In response to the provisional opinion, Dr B noted that the potential operability of the dominant tumour in Month4 does not mean that a complete cure by surgery alone would have been a likely outcome.

49. As a result of questions being raised about the results of the 27 Month4 CT scan, the radiology service requested a review of the imaging and report by the specialist radiologist, who concluded that the identified lesions were not entirely typical of benign liver tumours. Being somewhat indeterminate, the lesions required further work-up by way of an MRI scan. The radiology service's review further concluded that Dr B had made an interpretation error regarding the lesions, and that he should have included a differential diagnosis in his report.

50. Dr B has accepted that he made an error, and stated that he is devastated that this contributed to a delay in Mrs A's diagnosis. He said that his report on Mrs A's abdominal scan does not accord with his usual practice, in that it did not:

- Specify the indeterminate nature of the focal pathology;
- Provide a differential diagnosis that included the possibility of liver malignancy; and
- Recommend follow-up investigation by MRI scan.

51. I acknowledge the submission that Dr B had limited clinical information about Mrs A's presentation. I sought advice on this issue from my in-house clinical advisor, vocationally registered general practitioner Dr David Maplesden. Dr Maplesden reviewed the information provided with the CT request, and considered that it was of an adequate standard, and that his peers would agree.

52. In response to my provisional decision, Dr B commented: "I respectfully suggest that the adequacy of the clinical information provided in a radiology request is a matter for a radiologist rather than a general practitioner." As a peer of the requester of the CT scan, I accept Dr Maplesden's advice. I do, however, acknowledge that this investigation may serve as a reminder of the importance of cooperation and collaboration among providers as to what constitutes adequate information for the purpose of radiological investigations. This is potentially an issue that could be considered between the two professional colleges.[13] For the sake of completeness, I note that in the event that clinical information is perceived to be inadequate for the purpose of an investigation, additional information should be sought.

53. I also sought expert advice from a consultant radiologist, Dr Gabriel Lau. Dr Lau completed a blind review of the CT scan on 27 Month4. He found:

> "Two liver lesions, one of which would correspond to the lesion seen on the US. Both lesions are not characterised by CT, and further evaluation with a MRI scan with liver specific contrast is recommended."

54. Dr Lau considers that Dr B's report and his interpretation of the liver lesions departed from accepted standards of care. Dr Lau considers that the *reporting* of the liver lesions (that is, their description) was a moderate departure from accepted standards, and that the *interpretation* regarding the liver lesions was a marked departure from accepted standards. Dr Lau commented that the liver lesions "do not have a typical appearance of benign

[13] Royal Australian and New Zealand College of Radiologists and Royal New Zealand College of General Practitioners.

cavernous haemangiomas".[14] In addition, he noted that in this context, the liver lesions would be difficult to characterise on the CT scan alone, and an MRI should have been recommended.

55. I accept Dr Lau's advice and the conclusions of the radiology service's review. The pattern of the lesions was not entirely consistent with benign haemangiomas. Dr B should have reported that the liver lesions were difficult to characterise, offered an alternative diagnosis, and recommended further imaging. His failure to do so contributed to unacceptable delays in the diagnosis of Mrs A's liver cancer. Accordingly, I find that Dr B failed to 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).[15]

56. I note that when the nature of the tumours was confirmed, it was too late to offer the first line of treatment, which would have been surgical removal. However, it is not possible to determine with any degree of certainty whether such surgical removal would have been curative.

57. I acknowledge that Dr B apologised to Mrs A, and note his deep regret and devastation that his error contributed to a delay in her diagnosis.

Opinion: Radiology service — no breach

58. As a healthcare provider, the radiology service is responsible for providing services in accordance with the Code. The radiology service is accredited with IANZ. The radiology service conducts regular performance reviews, peer reviews, and scope of practice reviews of its radiologists.

59. In this case, I consider that Dr B's error did not indicate broader systems or organisational issues at the radiology service. I consider that the radiology service did not breach the Code directly.

60. In addition to any direct liability for a breach of the Code, under section 72(2) of the Health and Disability Commissioner Act 1994 (the Act), an employing authority is vicariously liable for any acts or omissions of its employees. A defence is available to the employing authority of an employee under section 72(5) of the Act if it can prove that it took such steps as were reasonably practicable to prevent the acts or omissions.

61. The radiology service is an employing authority for the purposes of the Act, and Dr B was an employee of the radiology service. As set out above, I have found that Dr B breached Right

[14] In response to my provisional opinion, Dr B noted that the focal pathology in Mrs A's liver can be characterised as large, and that large haemangiomas usually demonstrate imaging features that are termed atypical (including the presence of mass effect with or without capsular bulge).
[15] Right 4(1) states: "Every consumer has the right to have services provided with reasonable care and skill."

4(1) of the Code for failing to provide services to Mrs A with reasonable care and skill. I have noted that Dr B raised the possibility that he may have been interrupted while he was reviewing Mrs A's images. This was particularly important in this case, as Mrs A's liver lesions had complex features, and interpretation was made more difficult by the superimposed patchy fatty changes throughout her liver. Distraction and/or interruption can affect the working environment of a radiologist and contribute to errors occurring. As such, I have recommended that the radiology service consider what processes it could put in place to minimise the interruptions experienced by radiologists.

62. The radiology service has ongoing quality assurance, with staff performance reviews, internal audits, peer reviews, assessments by IANZ, revision of examination protocols and processes, and regular equipment checks and maintenance undertaken by external health physicists. I accept that the radiology service had taken reasonable steps to ensure the quality control of its imaging, and that the error, in this case, was human error by Dr B. Therefore, I find that the radiology service had taken reasonably practicable steps to prevent Dr B's omissions, and I do not find the radiology service vicariously liable for Dr B's breach of the Code.

63. I note that since this incident, the radiology service has strongly encouraged its radiologists to undertake a double reading of complex or difficult cases, and it is undertaking a peer review of its radiologists' reports to ensure that the quality of imaging and standards of reporting are high.

Recommendations

64. Following Dr B's error, the radiology service completed its own investigation into the matter. As part of the investigation, a peer review of 20 similar CT scans of the abdomen and pelvis performed by Dr B was carried out. In addition:

a) A copy of Dr B's report and reflection was sent to Mrs A's family.

b) The radiology service presented this case (de-identified) at a Clinical Day, which most of its radiologists attended.

65. I recommend that the radiology service:

a) Provide evidence to HDC of the peer review assessment and the case study at the Clinical Day, within three weeks of the date of this report.

b) Share HDC's anonymised report, including my expert advisor's advice, with all its radiology staff in New Zealand, within three weeks of the date of the anonymised report being placed on the HDC website.

c) In addition to strongly encouraging radiologists to undertake a double reading of complex or difficult cases, consider whether any processes and/or guidelines could be developed to ensure that this occurs with consistency. The radiology service should

advise HDC of the outcome of its consideration within three months of the date of this report.

d) Review its processes to determine what steps it could put in place to prevent or minimise interruptions for radiologists who are undertaking complex analyses. The radiology service should advise HDC of the outcome of the review within three months of the date of this report.

66. In response to the provisional opinion, the radiology service advised and provided evidence that it had completed recommendations a), c), and d) above, and I consider that these have been met.

Follow-up actions

67. 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, and it will be advised of Dr B's name.

68. A copy of this report with details identifying the parties removed, except the expert who advised on this case, will be sent to the Royal Australian and New Zealand College of Radiologists, the Royal New Zealand College of General Practitioners, and the Health Quality & Safety Commission, and placed on the Health and Disability Commissioner website, www.hdc.org.nz, for educational purposes.

Appendix A: Independent clinical advice to the Commissioner

The following expert advice was obtained from radiologist Dr Gabriel Lau:

"Report on the care provided by Radiologist, [Dr B] to [Mrs A] on 27 Month4.

Dr Gabriel Lau MB ChB, FRANZCR, EBIR
Director of Interventional Radiology,
Dunedin Hospital,
Dunedin

TERMS OF REFERENCE
I have been asked to review the radiology care provided to [Mrs A] by [Dr B]. I have been asked to review [Dr B's] interpretation and reporting of the CT, and provide advice on the standard of it. If there were any departures from accepted standards, please could I advise if it would be considered to be mild, moderate or severe.

INFORMATION PROVIDED
In order to do this I have been provided with the following information to assist with the review:
1) Ultrasound Abdomen referral dated 2 [Month4].
2) Ultrasound Abdomen performed on 7 [Month4].
3) Ultrasound Abdomen report dated 7 [Month4].
4) CT Abdomen referral dated 12 [Month4].
5) CT Abdomen performed 27 [Month4].
6) CT Abdomen report 27 [Month4].
7) CT Abdomen report 23 [Month9].
8) MRI Abdomen report 29 [Month9].

WHO AM I
I am Gabriel Buong Hung LAU, MB ChB, FRANZCR, EBIR. I am employed as a Consultant Radiologist at Dunedin Hospital and Pacific Radiology Otago Southland. I work at Dunedin Public Hospital as a diagnostic and interventional radiologist, where I am the Director of Interventional Radiology. I also work in private practice as a diagnostic and interventional radiologist at Pacific Radiology Otago Southland.

I trained in Diagnostic and Interventional Radiology in Dunedin, New Zealand, and following completion of my training I worked as a Diagnostic and Interventional Radiologist at the National University Hospital in Singapore for just over 4 years, before returning to Dunedin, to work in the capacity as described above, in 2006. I have a Radiology Fellowship from the Royal Australian and New Zealand College of Radiology (FRANZCR) and also have attained the European Board of Interventional Radiology (EBIR). As well as this I am a member of the Interventional Radiological Society of Australasia (IRSA), a corresponding member of the Cardiovascular and Interventional Society of Europe (CIRSE), a corresponding member of Society of Interventional Radiology (SIR) and a founding member of the Society of Interventional Oncology (SIO).

I am a corresponding member of the European Society of Radiology (ESR), the European Society of Gastrointestinal and Abdominal Radiology (ESGAR), the Radiological Society of North America (RSNA) and I am on the ARGANZ (Abdominal Radiology Group Australia and New Zealand) Executive.

I am a past Chief Censor of the RANZCR. I am currently the Deputy Editor of Diagnostic and Interventional Radiology for the Journal of Medical Imaging and Oncology. I am the co-lead examiner for the Abdominal component of the Part 2 RANZCR examinations and an examiner/Australia & New Zealand Liaison for the European Board of Interventional Radiology. I currently have a position on the Board of the New Zealand branch of RANZCR, and am the Chairman of the New Zealand branch of RANZCR.

RESPONSE
In response to the terms of reference as outlined above.

I have been asked to review [Dr B's] interpretation and reporting of the CT, and provide advice on the standard of it.

In the report the description of the enhancement pattern on the post contrast of the liver lesions, were of heterogeneous and predominantly peripheral enhancement on the arterial phase, partial filling in on the late portal venous phase and further progressive filling in on the delayed phase.

When measuring the Hounsfield units of the lesion post contrast, the enhancement pattern of the liver lesions, were of peripheral enhancement on the arterial phase and no enhancement of the central component when compared with the rest of the liver, persistent peripheral hyperdensity on the portal venous phase with similar density of the central component of lesions with the rest of the liver, and on the delayed phase, there is persistent peripheral hyperdensity with an increase in density on the central component, more than the rest of the liver, and less than the peripheral hyperdensity.

In the report the description of the slightly larger more anterosuperior lesion was of mass effect, deforming the inferior vena cava.

On review of the imaging, both lesions have mass effect, with the slightly larger more anterosuperior lesion not only deforming the inferior vena cava, but also bulges the surface the liver. The slight small lesion, also bulges the surface of the liver.

The reporting of the liver lesions on the CT scan performed 27 [Month4], would be a moderate departure from accepted standards. Measurements of the Hounsfield units would have provided a different description of the enhancement pattern of the lesions.

In the setting of background changes of diffuse fatty disease of the liver, on the CT scan, the interpretation of the enhancement pattern, can be difficult. Based on the

Hounsfield units on the enhancement pattern and the mass effect of both lesions, the liver lesions do not have a typical appearance for benign cavernous haemangiomas.

The interpretation of the liver lesion on the CT scan performed 27 [Month4], would be a marked departure from accepted standards, with the background changes of fatty disease in the liver, the enhancement pattern of the lesions would be difficult to interpret, however the mass effect is a worrisome feature. Given the combination of these findings it would be difficult to characterise the liver lesions on the CT scan alone and a MRI scan with Liver specific contrast should have been recommended.

COMMENT Standard of the report is a moderate departure. Standard of the interpretation is a marked departure.

Dr G.B.H. Lau"

The following further expert advice was obtained from Dr Lau:

"Response to the response on the care provided by Radiologist, [Dr B] and [the radiology service] to [Mrs A] on 27 [Month4].

Dr Gabriel Lau MB ChB, FRANZCR, EBIR
Director of Interventional Radiology,
Dunedin Hospital,
Dunedin

TERMS OF REFERENCE
I have been asked to review the response on the radiology care provided to [Mrs A] by [Dr B] and by [the radiology service].

I have been asked to review if any information submitted would cause me to change the two departures from accepted practice that I had identified.

INFORMATION PROVIDED
In order to do this I have been provided with the following information to assist with the review:
1) Response by [Dr B] dated 18 September 2020.
2) Response by [the radiology service] dated 8 October 2020.

RESPONSE
In response to the terms of reference as outlined above.

Standard of the report is a moderate departure.

a) [Dr B] admitted that there was a departure from accepted practice and has mentioned that he routinely measures the Hounsfield units, however there is no record of this on the images or report provided.

b) [The radiology service] responded that there was no departure from accepted practice, but opined that there were shortcomings.

The written description of the enhancement pattern would be in keeping with a cavernous haemangioma, however when measured, the Hounsfield units changes when compared with the rest of the liver, are not in keeping with the description in the report and would not be in keeping with a cavernous haemangioma. Therefore the standard of the report remains a moderate departure.

Standard of the interpretation is a marked departure.

a) [Dr B] admitted that there was a departure from accepted practice, and has cited a paper that showed two cases of cavernous haemangiomata that had mass effect.
b) [The radiology service] responded that there was departure from accepted practice, but did not feel that it was a marked departure, also citing the same paper.

The majority of cavernous haemangiomata do not have significant mass effect, citing a paper with two cases of a rare feature of cavernous haemangiomata, would support that the standard of the interpretation is a marked departure.

Dr G.B.H. Lau"