HEALTH & DISABILITY COMMISSIONER
TE TOIHAU HAUORA, HAUĀTANGA

A Decision by the Deputy Health and Disability Commissioner

(Case 22HDC03118)

Contents

Introduction

1. This report is the opinion of Dr Vanessa Caldwell, Deputy Health and Disability Commissioner, and is made in accordance with the power delegated to her by the Commissioner.

2. The report discusses the care provided to Mr A by Health New Zealand|Te Whatu Ora (Health NZ) Southern.

3. Mr A was referred to Southland Hospital in 2017 for ongoing chest pain. Between 2017 and 2022, he had several chest X-rays and CT[1] scans. Following an MRI[2] scan completed on 18 October 2022, Mr A was diagnosed with Stage 4[3] right upper lobe cancer (lung cancer), with a secondary diagnosis of spinal metastasis.[4] Mr A's sister raised concerns that the abnormalities in chest imaging were not identified in 2017 and that follow-up scans between

[1] Computed tomography (a procedure used to take images of areas of the body).
[2] Magnetic resonance imaging (a procedure used to take images of areas of the body — an MRI scan produces more detailed images than a CT scan and can show abnormal tissue).
[3] An advanced stage of cancer that occurs when cancer cells spread to other areas of the body from where the cancer started. In many cases, stage four cancer is not curable.
[4] Spread of cancer to the spine.

Names (except Health NZ Southern, Southland Hospital, and the advisor) have been removed to protect privacy. Identifying letters are assigned in alphabetical order and bear no relationship to the person's actual name.

2019 and 2022 revealed evolutionary changes that were not followed up adequately, leading to a delay in diagnosis of Stage 4 cancer.

4. The following issue was identified for investigation:

- *Whether [Health NZ]|Te Whatu Ora Southern provided Mr A with an appropriate standard of care between January 2017 and December 2022.*

5. The parties directly involved in the investigation were:

Mr A	Consumer
Mr A's sister	Complainant
Southland Hospital	Group provider/hospital

6. Further information was received from Dr B, Dr C, and Dr D, Southland Hospital radiologists; Dr E, an advisor for ACC; and Dr F, a medical officer at Southland Hospital, and a private radiology provider.

7. Independent clinical advice was received from radiologist Dr Andrew Kingzett Taylor.

Summary of events

12 May 2017

8. On 12 May 2017, Mr A underwent a CT scan of his chest, abdomen, and pelvis. The clinical details on the radiology report state:

> '1 month history of intermittent abdominal pain. Obstructive jaundice [5] with steatorrhea.[6] No gallstones[7] on [abdominal ultrasound on 11 May 2017]. [Common bile duct] dilated. Lipase[8] more than 3000 but low CRP[9].'

9. The report was read and interpreted by Dr B. The imaging found several liver cysts of the left and right lobe, but no obvious pancreatic tumour and no dilation of the pancreatic duct. Three small cysts in the left kidney were also found, and the upper pole of the right kidney showed an 'enhancing lesion' that was noted to be suspicious for a tumour. The lungs were reported to show no abnormality, aside from a mild plate-like atelectasis[10] in the upper lobe of the left lung. The report concluded:

[5] A blockage in the normal drainage of bile from the liver to the small intestine.
[6] Excessive amounts of fat in the stool.
[7] Hardened deposits of bile that can form in the gallbladder.
[8] An enzyme present in pancreatic secretions.
[9] C-reactive protein (a protein made by the liver). A CRP test is used to detect inflammation in the body.
[10] Collapse of a lung or part of a lung.

> 'No definitive cause for the bile duct obstruction is seen. A distal gallstone or small tumour near the ampulla[11] is possible … further assessment. Additional finding of an upper pole tumour of the right kidney suspicious for a renal cell carcinoma (cancer).'

10. The report does not mention any findings in the upper lobe of the right lung (where eventually Mr A's cancer was found).

11. Dr B told HDC that he did not see any sign of metastasis in the lungs but failed to see a small area of opacity in the upper lobe of the right lung. He said that if he had seen this at the time, there would have been a recommendation for a follow-up CT scan according to relevant guidelines. Dr B said that he may have been distracted by the fact that the main clinical concern at that time was a possible pancreatic lesion, and by the unexpected additional finding of the right renal tumour.

12. Health NZ acknowledged that in retrospect, 'when reviewing the film for this document, there is an 18 mm [irregularly] marginated nodule in the right upper lobe'.

16 August 2017

13. On 16 August 2017 Mr A underwent a repeat CT scan of the abdomen and pelvis for further investigation of the renal mass found on 12 May 2017. The clinical details on the radiology report state: 'Incidental 3cm right upper pole mass on CT, had MRI and US, repeat imaging for dedicated renal mass.' The report was compared to the CT scan of the abdomen and pelvis taken on 12 May 2017, and magnetic resonance cholangiopancreatography (MRCP)[12] was undertaken on 16 May 2017. The scan was read and interpreted by Dr C. The findings state:

> 'The 35mm ill-defined moderately enhancing right kidney upper pole lesion is again noted and has been stable compared to previously. The renal vein is patent[13] and the collecting systems are unobstructed. No significant change is seen for the multiple hepatic cysts and bilateral renal cysts. No other significant abnormalities are seen … Unchanged ill-defined right kidney upper pole mass of unknown significance.'

14. Dr C said that the scan was performed for the abdomen and pelvis, and so only the lower/basal aspects of the lungs were included and, for that reason, the lesion in question (the lung lesion) was not visualised on the scans reported on. Dr C said that as this imaging was dedicated renal imaging, the lesion on the previous scan (as described by Health NZ in paragraph 12 above) was not picked up in May 2017 when the scan was being used for comparison.

15. In response to the provisional opinion, Mr A told HDC that the lesion 'was clearly visible but "missed" in 2017 (retrospectively noted to be 18 mm or 1.8 cm)'.

[11] A sac-like enlargement of a duct.
[12] A type of MRI scan.
[13] Open and unobstructed.

27 July 2018

16. On 27 July 2018, Mr A presented to the Emergency Department (ED) at Southland Hospital with non-specific chest pain. An X-ray was undertaken that day and was read and reported by a private radiology provider. The clinical history states: 'Chest pain and dyspnoea,[14] one week history.' In relation to the lungs, the report states: 'The lungs are clear apart from linear parenchymal[15] change. No focal bone lesion.'

17. Southland Hospital ED specialist Dr D reviewed the X-ray at the time. He told HDC that he thought there were possible ineffective changes in Mr A's left lower lobe, but the wording used in the X-ray report implied a minor, nonspecific change that would not prompt any further action.

18. In response to the provisional opinion, Mr A said that the significance of the lesion was 'missed' again in 2018 when it measured 3cm.

November 2019

19. On 19 November, Mr A underwent a further X-ray for chest pain, which was read and reported on by the radiology provider. The report noted: '[Outline of the heart] and pulmonary parenchymal appearances are widely stable when compared with the prior study from 27/7/2018.'

20. On 30 November 2019, Mr A presented to the ED again with chest pain. The ED assessment included a chest X-ray, which was read and reported on by the provider. The clinical history on the radiology report stated that Mr A had been experiencing chest pain. The findings reported:

> 'The lungs are well expanded. An ill-defined 1 cm focus of opacity through the anterior tip of the right second rib is a little more conspicuous today. No pleural mass,[16] or collection. No focal bone lesion'.

21. The report concluded that the right upper lobe opacity was 'indeterminate' and stated:

> 'Discussion with a respiratory physician is suggested. Depending on the clinical situation, a followup chest x-ray in 6–8 weeks to check for resolution, or CT sooner for improved characterisation could be considered. Notification [has been] arranged.'

22. Mr A was referred to the Southland Hospital respiratory clinic on 3 December 2019 and Dr F referred Mr A for a CT scan of the thorax (chest).

27 December 2019

23. On 27 December 2019, Mr A underwent a chest CT scan for further investigation of the abnormality noted on the 30 November chest X-ray. The clinical history states: 'Focal change

[14] Shortness of breath.
[15] The portion of the lung involved in gas transfer (the alveoli).
[16] Tumour in the lung.

in right upper lobe on chest x-ray.' The report was read and reported by a private radiology provider. The findings showed:

> 'In the right upper lobe there is a vaguely linear area of opacity with ill defined groundglass margins. This is difficult to measure but the main component is 27 x 11 mm. No other potential lung nodule or mass. No other significant alveolar or interstitial pathology.'

24. The report concluded: 'Roughly stable appearance of the right upper lobe changes presumably post inflammatory/scarring.' Dr F wrote a letter to Mr A (copied to Mr A's general practitioner (GP)) on 6 January 2020, which stated:

> 'There hasn't been a change compared to your scan from 2 year and 8 months ago which is good news. You do have signs of a previous lung reaction although this could go back quite a long time. I don't think this has got anything to do with developing chest pains. I have written to [Mr A's GP] and it would be good if you could touch base with him in due course to discuss whether or not any other steps are needed.'

25. Dr F also wrote directly to Mr A's GP. The letter stated:

> 'I have not met [Mr A] face to face. We got a referral from the ED on 03.12.19. I wrote on 04.12.19 alerting [Mr A] to the CT scan I had requested. He did now have a CT thorax on 27.12.19. I am pleased to report that this looks pretty much the same as in 2017 on 12th May … There is poorly defined opacity in the right upper lobe, also lymph nodes in the mediastinum with calcification all of which would be in keeping with previous granulomatous disease. I trust there is no obvious history as such. At this point I consider this to be very reassuring and I don't believe that further routine radiographic or CT surveillance is necessary. If he were to develop respiratory symptoms he obviously should have a repeat chest x-ray in the first instance. I gather that the ED team advised him to discuss the issue of chest pain with yourself. I hope this is no longer a problem. **As stated I have not seen him face to face, at this point he is not going to be booked for a review in the respiratory clinic** [Dr F's emphasis].'

26. There is no record in the GP notes that suggests that Mr A met with his GP to discuss the findings of the CT scan or the ongoing chest pain, as suggested by Dr F in his letter to Mr A.

27. Dr F told HDC:

> 'I did not see [Mr A] face-to-face. I did not perceive "red flags" and I did note the fact that [Mr A] had been a non-smoker. There is no question that, as a minimum, further surveillance should have followed or additional investigations including a bronchoscopy and biopsy in January 2020. Neither step was taken, and a lung cancer was diagnosed only much later with unacceptable delay and with now a poor outcome. All of this is more regrettable and I am deeply sorry.'

28. Dr F said that the 27 December 2019 CT images were not reviewed at the weekly respiratory radiology meeting, as the images were taken between Christmas and New Year.

29. In response to the provisional opinion, Mr A told HDC:

> 'In 2019 the clinicians reported "*roughly stable appearance of the right upper lobe changes presumably post inflammatory/scarring".* Again we note that the significance of the lesion was missed, as was the significant growth in the dimensions of it, noting that by the end of 2019 the lesion measured 27mm x 1 mm.'

16 September 2020

30. Mr A again presented to the ED with chest pain on 16 September 2020. An X-ray read and reported by the private radiology provider noted the opacity in the right upper lobe of the lung and recorded that the changes were similar to those noted on previous scans since November 2019. No follow-up chest imaging was advised.

27 September 2022

31. On 27 September 2022, Mr A underwent a further chest X-ray, which had been ordered by his GP. The X-ray was read and reported by another Southland Hospital radiologist. The X-ray was compared with the previous scan of 16 September 2020 and reported a 5.3 x 4.4cm opacity 'superior to the right hilum[17] with no calcification or air fluid level. Wedge-shaped opacity peripheral to this is likely atelectasis.' The findings were noted to be suspicious of a mass, and further evaluation by way of CT was recommended.

32. In response to the provisional opinion, Mr A told HDC that towards the end of September 2022, the lesion 'had grown significantly again, measuring 5.3 x 4.4 cm … That is almost double in size to the lesion when it was first overlooked in 2017.'

10 October 2022

33. On 10 October 2022, Mr A underwent a CT scan of the chest, abdomen, and pelvis, as recommended on 27 September 2022. The CT report stated: '6.8 cm right upper lobe mass is very likely … a primary bronchogenic carcinoma[18]… Likely left adrenal metastasis.' The report recommended a PET scan for further staging.

Subsequent events

34. Sadly, Mr A was diagnosed with Stage 4 right upper lobe (lung) cancer and a secondary diagnosis of spinal metastasis. He was advised that he had a life expectancy of six months to one year.

Further information

Health NZ

35. Health NZ advised:

> '[T]he background to this has to be taken into account that over a series of investigations from 11 May 2017 to 16 September 2020 the lesion in the right upper lobe was either not seen (as it is difficult to see on the [chest X-rays]), or deemed to be

[17] A wedge-shaped area on the central portion of the lung.
[18] Lung cancer.

stable and benign (on the CT scan of 27 December 2019), and the respiratory physician dealing with the referral was acting on the reports and made a decision not to pursue any further follow up imaging.'

Adverse event review

36. Health NZ conducted an adverse event review, which was completed in July 2024. The event was categorised with a Severity Assessment Code (SAC) rating of 2.[19] The review included a blind review of the May 2017 scan, and identified the following:

'• On the CT scan of 12 May 2017, there was an unexpected 20 mm nodule in the right upper lobe suspicious of malignancy, not followed up at this point or at future interactions until 2022.'

37. Contributory factors were noted as follows:

'• Specialist radiologist staffing has impacted on workload, with staff who are working in an environment often with a greater number of hours and with distraction.

- There is no radiology registrar on the Southland site to support the radiologist workload — the SMO supervising the modality will be reporting, acting as registrar (taking acute calls) and protocolling examinations all at the same time.
- Multiple reports are reviewed in an environment which is noisy where distractions cannot be avoided.
- The opportunity for peer review is challenging with lack of resourcing.
- The complexity of the reporting process, with factors such as "satisfaction of search" bias, the need to have an appropriate environment and time to complete reports, and expertise in reviewing imaging all being critical to reducing missed/incidental findings.
- Radiologists are generalists rather than subspecialists.'

ACC

38. Mr A submitted a claim to ACC for a treatment injury. As part of its assessment of Mr A's claim, ACC obtained independent advice from radiologist Dr E for the purpose of assessing whether an earlier diagnosis of lung cancer could have been made. Dr E assessed the imaging of 12 May 2017 and 27 December 2019.

39. Regarding the imaging of 12 May 2017, Dr E advised:

[19] Major: Permanent major or temporary severe loss of function not related to the natural course of the illness; differs from the immediate expected outcome of the care management; can be sensory, motor, physiological, psychological, or intellectual.

> 'There is a 15mm part solid, part non-solid nodule in the posterior segment of the right upper lobe … The right upper lobe lesion is most likely a primary lung cancer and a respiratory opinion is advised.'

40. Dr E asked two other radiologists to review the imaging, and they were provided with the same history as was available at the time of the scan. Both radiologists identified the abnormality in the right upper lobe and recommended respiratory referral. Dr E advised:

> 'There are several findings present on the CT examination of 12/5/2017 which require further investigation. These include a probable small lung cancer in the right upper lobe … All of these are significant findings and require resolution … The right upper lobe cancer was not observed or reported on the CT examination of 12/5/2017. This is an error of observation on behalf of the reporting radiologist [Dr B].'

41. Regarding the CT imaging of 27 December 2019, Dr E advised:

> 'I have reviewed this scan and the part solid, part non-solid nodule in the right upper lobe is slightly larger than on the imaging 19 months prior. The scan of 27/12/2019 was reported by another radiologist as indicating the nodule was "roughly stable" and "presumably post inflammatory". This is an error of both observation and interpretation as the lesion is slightly larger and does not have typical appearances of a post inflammatory scar. Respiratory services at [Southern DHB] advised no follow up of the lung lesion due to the reported stability and failure to recognise that this lesion was a mixed solid and non solid lesion which requires follow up for longer than the 2 years recommended for pure solid lesion according to international guidelines (BTS, Fleischner). Errors of observation and interpretation are common in clinical radiology and should not give rise to concerns regarding competence if isolated.'

Relevant standards

42. The Fleischner guideline was published in 2017. It replaced the recommendations for solid and sub-solid pulmonary nodules. Pulmonary nodules can be divided into solid lesions and sub-solid lesions, which can be further subdivided into part-solid and pure groundglass nodules. A sub-solid nodule is a pulmonary nodule with at least partial groundglass appearance. Groundglass is opacification with a higher density than the surrounding tissues, not obscuring underlying bronchovascular structures.

43. The guidelines stipulate the following for subsolid nodules:

> 'Single nodules
>
> **Single ground glass nodule <6 mm (<100mm[3])**
> - No routine follow up required
>
> **Single ground glass nodule >6 mm (>100 mm[3])**
> - CT at 6–12 months, then if persistent, CT every 2 years until 5 years

Single part-solid nodule >6 mm (>100 mm[3])

- CT at 3–6 months, then if persistent and solid component remains <6 mm, annual CT until 5 years'

Standards of practice for clinical radiology

44. Health NZ Southern provided HDC with a copy of its 'Standards of Practice for clinical radiology'. Clause 5.6 'Image Review' states:

> 'The practice develops and implements a fit for purpose and radiologist-led peer review process to regularly monitor the interpretation of imaging studies. Some modalities have specific image review requirements that are described in the modality-specific requirements.'

Responses to provisional opinion

Mr A

45. Mr A was given the opportunity to respond to the 'summary of events' section of the provisional report. Where relevant, his responses have been incorporated into this report. His lawyer noted that no meaningful, 'but definitely clinically indicated (by their own admission)', follow-up occurred by Health NZ. In addition, the response detailed the impact that these events have had on Mr A. It stated:

> 'We note within the provisional report some of the excuses offered by [Health NZ Southern] in respect of the environment, work pressure, working conditions etc that the radiologists had to work in. With respect, that is not the patients fault … We note that multiple parties from different working environments, all of whom are deemed to be professional clinicians, failed [Mr A] significantly and repeatedly … [Mr A] and his family and friends are left wondering what his prognosis and outcome of treatment would have been, had the radiologists involved in this case been competent and had seen the clearly visible lesion in 2017 and ensured that the doctor/s looking after him actually followed up and that his case was made a priority … [Mr A] is now dealing with multiple metastases, liver and venous compromise, brain bleeds and lesions now becoming evident in his spine and other bones.'

Health NZ

46. Health NZ accepted the recommendations in the provisional opinion.

Private radiology provider

47. The private radiology provider agreed to action the proposed recommendations and said that it has advised the teleradiologists concerned[20] of the report and clinical advice.

48. In relation to the scan of 27 December 2019, it told HDC:

[20] One teleradiologist has since left the provider and has not seen the report or advice.

> '[B]ased on its knowledge of the subject radiologist's teleradiology reporting history, [the provider] submits that the alleged concerns identified by [Dr E] … represent an isolated incident.'

49. The teleradiologist at the radiology provider also told HDC: 'Thank you for this feedback and time taken in review. Key learnings from this HDC investigation are acknowledged and have been adapted into my standard tele-radiology reporting practices.'

50. The provider also told HDC (in relation to the 27 December 2019 scan) that it agrees with Dr Kingzett Taylor's report (Appendix A), which identified that the images in the study were 3mm in thickness, which is thicker than the normal slice thickness used for the assessment of pulmonary nodules. It confirmed that the teleradiologist who reported on this study was provided with images of the same thickness and did not have access to thinner slices at the time. It said:

> 'It is submitted that the greater than normal thickness of the images provided by [the hospital] to [the private radiology provider] in relation to the 27.12.19 CT may have been a source of further difficulty for the radiologist when assessing the growth of the subject lesion.'

51. In relation to the scan of 16 September 2020, the provider again referenced Dr Kingzett Taylor's report (Appendix A) and said that it agrees that the changes in the subject lesion that Dr Kingzett Taylor identified could have 'reasonably been attributed to technical factors'. It told HDC:

> 'It is submitted that the challenges faced by the radiologists when reporting the above [27 December 2019 and 16 September 2020] two studies were unique and distinct. Based on [the organisation's] knowledge of both radiologist's reporting histories, these cases represent isolated incidents and are not indicative of a pattern of concern with respect to the identification of growth and/or changes in lesions across studies.'

52. In conclusion, it told HDC that as an external radiology provider (contracted by Southland Hospital), the teleradiologists were not intimately involved in the care of Mr A and did not have the benefit of access to the complete series of images and were not privy to Mr A's evolving condition over time.

Opinion: Health NZ Southern — breach

Introduction

53. It is important to note that my role is to determine whether the care provided to Mr A at the time of the events, with the information available at that time, was appropriate. Notwithstanding the sad outcome for Mr A, my opinion must minimise hindsight bias as far as possible. Accordingly, as part of my assessment of this complaint, I sought a blind reading of the key X-ray and CT scans from 2017 to 2022 from radiologist Dr Andrew Kingzett Taylor. Following receipt of Dr Kingzett Taylor's blind reading report, I obtained a full advice report.

54. At the outset, I wish to highlight the below comments from Dr Kingzett Taylor:

> 'It is acknowledged that perceptual error is a common part of radiology practice and some errors are "inevitable". Experienced, conscientious and competent radiologists can and do make random perceptual errors. Radiologist errors may occur for many reasons, both human- and system-derived. In forming an opinion as to whether a perceptual error is a departure from the standard of care, I consider the clinical context and my assessment of the "difficulty" of the interpretation for a general radiologist (this includes for example the location, morphology, and conspicuity of the lesion, the number of images demonstrating the abnormality and any other confounders).'

12 May 2017

55. On 12 May 2017, Mr A underwent a CT scan of his chest, abdomen, and pelvis following a one-month history of intermittent abdominal pain.

56. The report (read and interpreted by Southland Hospital radiologist Dr B) showed no abnormality of the lungs, aside from a mild plate-like atelectasis (collapse of a lung or lobe of a lung) in the left upper lobe of the lung. The imaging also showed a right renal tumour. Dr B told HDC that he did not see any sign of metastasis in the lungs but failed to see a small layer of opacity in the right upper lobe of the lung. He said that he may have been distracted by the fact that the main clinical concern at that time was a possible pancreatic lesion and by the unexpected additional finding of a right renal tumour.

57. Health NZ acknowledged that in retrospect, 'when reviewing the film for this document, there is an 18 mm irregularity marginated nodule in the right upper lobe'.

58. The blind reading conducted by Dr Kingzett Taylor concluded:

> 'No CT evidence of pancreatitis. No intrahepatic ductal dilation.
>
> UNEXPECTED FINDING: Hypodense lesion upper pole right kidney. Differential for this appearance includes focal infection and malignancy. Recommend MRI and urologic referral.
>
> UNEXPECTED FINDING: 6 x 9 mm subsolid nodule right upper lobe. Recommend 3–6 month follow-up.'

59. Dr Kingzett Taylor noted that the imaging was ordered for the investigation of abdominal pain (rather than chest pain) and therefore, Dr B would have been focusing on the abdomen, pelvis, and lung bases rather than the upper lobes. Dr Kingzett Taylor also noted that an unexpected renal mass was found and there was scarring in the left upper lobe, which may have diverted Dr B's attention. Dr Kingzett Taylor advised that considering the above, it 'had the potential to monopolise the radiologist's attention and distract from further review'. Dr Kingzett Taylor advised:

> 'This has been described as the "satisfaction of search" error and occurs when the reporting radiologist fails to continue to search for subsequent abnormalities after identifying an initial one.'

60. Dr Kingzett Taylor considered that in light of the above factors, the failure to identify the abnormality represented a mild departure from acceptable practice and most likely was a perceptual error. I accept this advice.

61. I have also considered the advice provided to ACC by radiologist Dr E, who advised:

> 'There is a 15mm part solid, part non-solid nodule in the posterior segment of the right upper lobe … The right upper lobe lesion is most likely a primary lung cancer and a respiratory opinion is advised.'

62. Dr E also advised that two other radiologists reviewed the 12 May imaging (with access to only the clinical history) and both identified the abnormality in the right upper lobe and recommended respiratory referral. Dr E stated:

> 'There are several findings present on the CT examination of 12/5/2017 which require further investigation. These include a probable small lung cancer in the right upper lobe … All of these are significant findings and require resolution … The right upper lobe cancer was not observed or reported on the CT examination of 12/5/2017. This is an error of observation on behalf of the reporting radiologist [Dr B].'

63. Dr Kingzett Taylor's blind reading also recommended follow-up within 3–6 months. I note that as the abnormality was not identified on the imaging, this did not occur.

30 November 2019

64. On 30 November 2019, Mr A presented to ED with chest pain and underwent a further chest X-ray. The findings reported: 'The lungs are well expanded. An ill-defined 1 cm focus of opacity through the anterior tip of the right second rib is a little more conspicuous today. No pleural mass, or collection.' Mr A was referred to the respiratory clinic on 3 December 2019 and respiratory SMO Dr F referred Mr A for a CT of the thorax (a chest CT scan).

27 December 2019

65. Mr A underwent the chest CT scan on 27 December 2019 for further investigation of the abnormality identified in November. The imaging showed a 'vaguely linear area of opacity [in the right upper lobe of the lung] with ill defined groundglass margins. This is difficult to measure but the main component is 27 x 11 mm.' The report concluded that the lesion was 'roughly stable' and 'presumably post inflammatory/scarring'. No recommendation was made for follow-up or further investigation of the lesion. The report was read and reported by the private radiology provider.

66. Dr Kingzett Taylor advised that the teleradiologist failed to detect interval growth in the lesion during reading of this scan but said that the growth between the May 2017 scan and this scan was 'reasonably subtle'.

67. Following the scan, Dr F wrote a letter to Mr A (on 6 January 2020) advising that there had been no change compared with the scan from 12 May 2017 and that Mr A had signs of a previous lung infection, but this was not thought to have anything to do with Mr A's ongoing

chest pains. Mr A was advised to meet with his GP to discuss whether any further investigations were required.

68. A separate letter was sent to Mr A's GP. The letter stated that Dr F had not met with Mr A in person but that he was 'pleased to report that [the mass] looks pretty much the same as in 2017 on the 12th May'. Dr F wrote that there was poorly defined opacity in the right upper lobe and lymph nodes with calcification in the mediastinum, 'all of which would be keeping with previous granulomatous disease'. He wrote:

> 'I trust there is obvious history as such. At this point I consider this to be very reassuring and I don't believe that further routine radiographic or CT surveillance is necessary … I gather that the ED team advised him to discuss the issue of chest pain with yourself … [A]t this point he is not going to be booked for a review in the respiratory clinic.'

69. Mr A did not see his GP to discuss the scan. The letter sent to Mr A by Dr F suggested that Mr A meet with his GP to discuss whether further follow-up was required. Conversely, the letter to Mr A's GP said that Dr F was 'very reassured' by the findings, and he did not consider that any further follow-up or surveillance imaging was required. Dr F also noted in the letter that he assumed that ED clinicians had advised Mr A to follow up with Mr A's GP for the ongoing chest pain. In my view, the wording of these letters conveyed to the GP that no follow-up was required, and, as such, none occurred.

70. Dr F told HDC that he did not meet with Mr A in person, but he did not perceive any 'red flags' for malignancy. However, he acknowledged that further surveillance or additional investigation 'including a bronchoscopy and biopsy in January 2020' should have occurred.

71. Dr Kingzett Taylor advised that although the reporting teleradiologist at the private radiology provider stated that the appearance was 'presumably post inflammatory/ scarring', this does not mean that the teleradiologist is advising that ongoing follow-up was not necessary. Dr Kingzett Taylor stated:

> 'The report is addressed to the respiratory physicians who will integrate the radiology report with their own clinical assessment, patient risk factors and professional judgment. Radiologists will hesitate to be prescriptive when their report is addressed to a specialist in their field.'

72. I have also considered the advice provided to ACC by Dr E, who advised that the lesion was slightly larger than on the imaging from May 2017. He said that the radiologist's finding that the nodule was 'roughly stable' and 'presumably post inflammatory' was an error of both observation and interpretation. Dr E said that the lesion was slightly larger and did not have features of a post-inflammatory scar.

73. Dr E advised:

> 'Respiratory services at [Southern DHB] advised … no follow up of the lung lesion due to the reported stability and failure to recognise that this lesion was a mixed solid and non solid lesion which requires follow up for longer than the 2 years recommended for

> pure solid lesion according to international guidelines (BTS, Fleischner). Errors of observation and interpretation are common in clinical radiology and should not give rise to concerns regarding competence if isolated.'

74. I have also considered the relevant guidelines in relation to the lack of follow-up after the 27 December 2019 scan. The Fleischner 2017 guidelines state that for single sub-solid nodules measuring over 6mm x 100mm, CT scanning is recommended at 3–6 months and then if the solid component remains, every year for five years. This did not occur.

75. I also acknowledge Dr Kingzett Taylor's comments that the reporting by the teleradiologist was made with the knowledge that it would be read by the respiratory specialist, who would act accordingly. This mirrors Dr E's advice that the respiratory service failed to advise that the lesion required follow-up in line with international guidelines (the Fleischner guidelines). Accordingly, I am concerned that Southland Hospital respiratory services failed to identify the growth of the lesion (irrespective of the reporting by the teleradiologist) and did not comply with international guidelines for such lesions by recommending follow-up CT scanning in line with the Fleischner guidelines.

16 September 2020

76. Mr A again presented to ED with chest pain on 16 September 2020 and underwent a chest X-ray. The imaging showed the opacity in the right upper lobe, and the changes were reported to be similar to those noted on previous scans since November 2019. The X-ray was read and reported by the private radiology provider, and no follow-up was advised or occurred.

77. Irrespective of the reporting by the private radiology provider, I am concerned that at this stage, Mr A had presented to ED several times for unresolved chest pain and had undergone a series of imaging that failed to detect the evolution of the lung lesion. In addition, I note that again the Fleischner 2017 guidelines were not followed. As outlined above, the guidelines state that for single sub-solid nodules measuring over 6mm x 100mm, CT scanning is recommended at 3–6 months, and then if the solid component remains, every year for five years. This did not occur. In my view, there were several missed opportunities for follow-up, as evidenced by Dr Kingzett Taylor's blind read report.

78. I note the following advice from Dr Kingzett Taylor:

> 'I am very sorry to read of the unfortunate outcome in this case. Several factors appeared to have conspired together including the inherent characteristics of the lesion itself (initially a subsolid pulmonary nodule) … The lesion is at first difficult to appreciate and then very difficult to monitor on chest [X-rays] which are far less accurate for assessing such a lesion. The lesion was a subsolid pulmonary nodule. It was difficult to measure due to indistinct margins and consequently the growth of the lesion was not appreciated on the 2019 CT … Several studies have analysed the natural course of subsolid nodules and reported the relatively indolent (slow growing) clinical course of malignant subsolid nodules … With respect to the follow-up of the lesion. Decisions …

about the management and follow-up of the nodules, especially larger nodules usually follow multidisciplinary team discussion.'

79. I note that there is no evidence that multidisciplinary discussion occurred following any of Mr A's scans.

Conclusion

80. Health NZ had a responsibility to provide Mr A with an appropriate standard of care between 2017 and 2022. In my view, there were several missed opportunities by staff at Southland Hospital to identify Mr A's malignancy and escalate his care appropriately. Guided by Dr Kingzett Taylor's advice and taking into account the advice of ACC advisor Dr E, I consider that cumulatively, these failures amount to a breach of the Code of Health and Disability Services Consumers' Rights (the Code). In reaching this finding I have taken into account that several different clinicians involved in Mr A's care failed to identify the abnormality and its evolution adequately and conduct further investigations or surveillance in line with relevant standards, which are designed to mitigate potential errors of perception (Fleischner 2017 guidelines). In particular, I note:

- The failure by Dr B to identify the lesion in 2017.
- The failure by the Southland Hospital respiratory service both to identify the evolution of the lesion in 2019 and to recommend appropriate follow-up in line with the Fleischner 2017 guidelines.
- The failure by the respiratory service to communicate appropriately with Mr A's GP in 2019 about the need for further follow-up.
- The failure following the September 2020 scan to follow up on what, at that point, was a series of presentations to ED and subsequent imaging that had failed to identify a cause for Mr A's ongoing chest pain.

81. In addition to the failure to identify the mass on the May 2017 scan, several opportunities were missed by the respiratory service to recommend follow-up of Mr A in line with the Fleischner 2017 guidelines from when it was first identified on 30 November 2019 — despite Mr A experiencing ongoing and unresolved chest pain. Accordingly, I find that Health NZ Southern failed to provide services to Mr A with reasonable care and skill and breached Right 4(1) of the Code.

Private radiology provider — other comment

82. The private radiology provider read and reported on several scans between 2017 and 2022. As identified by my independent clinical advisor, radiologist Dr Kingzett Taylor, there were two missed opportunities to identify growth of the lung lesion. I will discuss these below.

27 July 2018

83. Mr A underwent an X-ray on 27 July 2018 following a presentation to the ED with non-specific chest pain. Dr Kingzett Taylor's blind reading of this scan did not identify the lesion. He advised that there was no departure from the appropriate standard of care in relation to

this scan, as the lesion of the right upper lobe of the lung was not seen clearly on the imaging. I accept this advice.

19 November 2019

84. Mr A underwent a chest X-ray on 19 November 2019 due to ongoing chest pain. The X-ray was read and reported by the private radiology provider and did not identify the abnormality in the upper lobe. No recommendation for follow-up imaging or investigations was made because the abnormality had not been identified.

85. The blind reading conducted by Dr Kingzett Taylor stated: 'Vague/equivocal sellate distortion/nodular density medial right upper lobe. CT recommended.' In his full advice report, Dr Kingzett Taylor noted that the right upper lobe lesion 'can be appreciated in retrospect on November 19 2019 chest radiograph but it is a subtle inconspicuous lesion at a difficult location between the first and second ribs'. Dr Kingzett Taylor advised that he showed three radiologists this imaging (blinded to clinical details and unaware of previous imaging) and only one of the three radiologists suggested further imaging of the right upper lobe mass based on this radiograph in isolation. Taking into account the above, Dr Kingzett Taylor advised that he did not consider there to a be a departure from an accepted standard of care in relation to the reading and reporting of the scan. I accept this advice.

30 November 2019

86. On 30 November 2019, Mr A presented to ED with chest pain and underwent a further chest X-ray. The findings were reported as: 'The lungs are well expanded. An ill-defined 1 cm focus of opacity through the anterior tip of the right second rib is a little more conspicuous today. No pleural mass, or collection.'

87. Dr Kingzett Taylor advised:

> 'The nodule was first detected on a follow-up chest radiograph a short interval afterwards on November 30, 2019. The lesion appears rather more conspicuous on the later radiograph, likely due to technical factors but I still consider this pick up on November 30th to have been an astute one. In my opinion, not all radiologists would have detected the lesion on the November 30, 2019 radiograph.'

88. I accept this advice.

27 December 2019

89. Mr A underwent a chest CT scan on 27 December 2019 for further investigation of an abnormality picked up on the chest X-ray of 30 November 2019. The reporting teleradiologist reported a 'vaguely linear area of opacity [in the right upper lobe of the lung] with ill defined groundglass margins. This is difficult to measure but the main component is 27 x 11mm.' The report concluded that the lesion was 'roughly stable' and 'presumably post inflammatory/scarring'.

90. Dr Kingzett Taylor advised that during reading of this scan, the teleradiologist failed to detect interval growth in the lesion, although Dr Kingzett Taylor noted that the growth between

the May 2017 scan and this scan was 'reasonably subtle'. He also advised that several factors may have contributed to the misinterpretation, including the following:

'• The interval growth of the right upper lobe lesion between 2017 and 2019 is not particularly evident on initial visual inspection of the horizontal cross-sectional ("axial") sequence. These are the images typically first viewed by the radiologist and measurements of lung nodules are typically obtained in this plane. Due to the shape of the nodule, the change is far more apparent on the coronal images (vertical front to back view).

- On the axial (horizontal) sequence the lesion had an elongated linear shape which appeared similar to the prior 2017 CT, this shape can be seen with scarring. Elsewhere in the chest, there are small, calcified nodes and minor scarring within the left lung. These additional observations may have been interpreted as supporting a diagnosis of prior inflammation/infection and scarring.

- It is agreed with the reporting radiologist that this lesion is difficult to measure. This lesion is subsolid and transversed by pulmonary vessels, several converging blood vessels contribute to the appearance. Measuring subsolid lesions is known to be subject to variation and measurement error due to indistinct margins. There is associated linear scarring.'

91. In response to the provisional opinion, the private radiology provider told HDC that it agrees with Dr Kingzett Taylor's report (Appendix A), which identified that the images in the study were 3mm in thickness, which is thicker than the normal slice thickness used for the assessment of pulmonary nodules. It confirmed that the teleradiologist who reported on this study was provided with images of the same thickness and did not have access to thinner slices at the time. It told HDC:

> 'It is submitted that the greater than normal thickness of the images provided by [the hospital] to [the private radiology provider] in relation to the 27.12.19 CT may have been a source of further difficulty for the radiologist when assessing the growth of the subject lesion.'

92. Dr Kingzett Taylor advised that the failure to identify the interval growth in the lesion represented a mild departure from accepted standards. I agree. I have also considered the advice provided to ACC by radiologist Dr E, which concurs that there had been interval growth of the lesion and that there was a failure in both observation and interpretation of the 27 December 2019 scan. However, he also noted: 'Errors of observation and interpretation are common in clinical radiology and should not give rise to concerns regarding competence if isolated.' I agree, and I encourage the private radiology provider to reflect on these findings and provide feedback to the teleradiologist concerned.

16 September 2020

93. Mr A underwent a chest X ray on 16 September 2020 for ongoing chest pain. The radiology report identified the opacity in the right upper lobe, but the changes were reported to be similar to those noted on previous scans since November 2019.

94. Dr Kingzett Taylor's blind reading of the imaging reported the following:

> 'The ill-defined nodular lesion right upper lobe between the first and second ribs has increased in density and possibly in size when compared to the prior radiograph in 2019 … COMMENT: The ill-defined lesion right upper lobe appears more conspicuous than in 2019. Advise repeat CT.'

95. Dr Kingzett Taylor advised that there was no departure from the accepted standard of care in the reading and reporting of the scan, despite it not detecting the changes in the mass. He advised:

> 'The report [was] compared with the prior 2019 chest radiograph and found that appearances were "similar" noting also [that] stability had been reported on the 2019 CT. In my opinion the upper right lesion is rather more conspicuous than in 2019 (it is denser) but the size appears similar. The improved conspicuity/density of the lesion could have reasonably been attributed to technical factors.'

96. I accept this advice.

97. I also acknowledge the provider's comments in response to the provisional opinion, in particular that as an external radiology provider (contracted by Southland Hospital), the teleradiologists were not intimately involved in the care of Mr A and did not have the benefit of access to the complete series of images and would not have been privy to Mr A's evolving condition over time. In addition, I note their further comments that the challenges faced by the teleradiologists (discussed above) when reporting on the two studies were 'unique and distinct' and that the errors represent 'isolated incidents'.

98. While acknowledging that there were two scans reported by the provider where growth of the lesion was not appreciated, I have taken into account that they are a private contracted radiology provider and not involved in the care of Mr A directly. As such, they could not have been expected to have a view of the overall picture of Mr A's evolving chest pain and series of imaging from 2017 to 2020. I note with approval that the findings in Dr Kingzett Taylor's report have been brought to the attention of the teleradiologists concerned.

Changes made since events

99. Health NZ Southern said that it will 'review the peer review requirements as documented in the Standards of Practice for clinical radiology, clause 5.6, and discuss if this should be performed more frequently than annually'.

100. The adverse event review completed in July 2024 noted that work is occurring to provide support to staff to ensure a reasonable work-life balance to reduce stress and fatigue.

101. The adverse event review also included the following recommendations:

- Consider establishing a business case for a radiology registrar in Southland Hospital.

- Review alternative options for managing the day-to-day radiology processes to reduce distraction, including developing an advanced practice role for a medical imaging technologist or registered nurse who could take acute calls and support the triage process, allowing development and enforcement of 'protected time' to undertake reviews.
- Reconfigure the working environment to allow the SMO undertaking the reading of images to have quiet protected time.
- Peer review/audit to include consideration of 'satisfaction of search' bias and whether there are specific trends relating to this. Peer review should be implemented, including a regular planned audit.
- Regular teaching sessions for Southland SMOs with a topic like 'early-stage appearances of lung cancer' and teaching on general/follow-up recommendations for unusual lung lesions, conducted by a chest speciality radiologist.

Recommendations

102. I recommend that Health NZ Southern:

a) Provide a written apology to Mr A for the failings identified in this report. The apology is to be sent to HDC, for forwarding to Mr A, within three weeks of the date of this report.

b) Provide HDC with an update on the implementation of the recommendations made in the adverse event review, within six months of the date of this report.

c) Consider implementing more frequent peer review (as documented in the Standards of Practice for clinical radiology, clause 5.6) rather than annual review, and advise HDC on the outcome of its consideration within three weeks of the date of this report.

d) Use an anonymised version of this report to conduct a training session for the radiology and respiratory departments, with specific focus on the importance of the Fleischner guidelines, and report back to HDC within six months of the date of this report.

Follow-up action

103. A copy of this report with details identifying the parties removed, except Health NZ Southern, Southland Hospital, and the advisors on this case, will be placed on the Health and Disability Commissioner website, www.hdc.org.nz, for educational purposes.

Appendix A: Independent clinical advice to Commissioner

The following blind reading was obtained from radiologist Dr Andrew Kingzett Taylor:

'To Whom It May Concern:

Regarding

Complaint: 22HDC03118

MY QUALIFICATIONS

I am a diagnostic radiologist working for the Pacific Radiology Group. I became a fellow of the Royal Australian and New Zealand College of Radiologists in 1996.

I am registered as a diagnostic radiologist in both Australia and New Zealand.

I am a member of the
- Royal Australian and New Zealand College of Radiologists
- American Roentgen Ray Society
- Radiologic Society of North America
- Australasian Musculoskeletal Imaging Group
- European Society of Radiology (corresponding member)
- European Society of Skeletal Radiology.

I participate fully in the RANZCR CPD programme.

I am local representative on peer review committee and arrange/present periodic peer review meetings.

CONFLICTS:

I have no conflicts of interest to declare.

I have reviewed the following items:

- Letter from HDC dated 7 March 2024
- CT study performed May 12 2017
- Chest radiograph July 27 2018
- Chest radiograph November 19 2019
- CT study performed December 27 2019
- CT study performed September 16 2020

REPORT CT MAY 12 2017

INDICATION: One month history of intermittent abdominal pain; obstructive jaundice with steatorrhea; no gallstones on ultrasound [ultrasound completed on 11 May 2017 showed mild dilation of the common bile duct]; CBD dilated; and lipase more than 3000 but low CRP.

FINDINGS: Post contrast MDCT

CHEST
Small subsolid nodule right upper lobe about 6 mm diameter Minor atelectasis/scarring lingula. Multiple calcified mediastinal nodes No pericardial thickening or pericardial fluid

ABDOMEN AND PELVIS

LIVER: Multiple well-circumscribed hypodense hepatic lesions, the largest within the right lobe is 43 mm. Several lesions are too small to characterise

GALL BLADDER & BILIARY TREE: No gallstones seen. No gallbladder wall thickening. No biliary duct dilatation CT cannot detect all gallstones

SPLEEN: Normal.

ADRENALS: Normal.

PANCREAS: Normal limits. No mass lesion. No ductal dilatation. No peripancreatic oedema.

RIGHT KIDNEY AND URETER: Hypodense lesion upper pole right kidney 31 mm. No calcification. Parapelvic cyst. No calculus or dilatation

LEFT KIDNEY AND URETER: Vague hypodense lesion medial cortex lower pole left kidney in addition to several well marginated cysts No calculus or dilatation

AORTA/PARA-AORTIC REGION: Aorta normal calibre. No retroperitoneal or lymphadenopathy. No collection seen within the psoas muscles.

MESENTERY: No abnormality GI TRACT: Mild diverticulosis. No mural thickening. No pericolonic stranding. CT cannot exclude colonic neoplasm

PELVIC VISCERA: No bladder wall thickening. Mild prostatomegaly.

ABDOMINAL WALL: Normal

MISCELLANEOUS: No free fluid. No free air

SKELETON: Scoliosis with multilevel spondylosis. No vertebral body fracture

CONCLUSION: No CT evidence of pancreatitis. No intrahepatic ductal dilatation

UNEXPECTED FINDING: Hypodense lesion upper pole right kidney. Differential for this appearance includes focal infection and malignancy. Recommend MRI and urologic referral UNEXPECTED FINDING: 6 x 9 mm subsolid nodule right upper lobe. Recommend 3–6 month follow-up

RADIOGRAPH JULY 27 2018

CLINICAL DETAILS
One week chest pain

COMPARISON: CT 2017

FINDINGS:

No pneumothorax
No definite mass lesion or consolidation
No pleural fluid.
Heart size normal.
Tortuous aorta.
Thoracic scoliosis

COMMENT: No consolidation or mass lesion seen

RADIOGRAPH NOVEMBER 19, 2019

CLINICAL DETAILS

Chest pain

FINDINGS:

Vague/equivocal stellate distortion right upper lobe between the first and second ribs No consolidation or mass lesion seen elsewhere. No pleural fluid Heart size and contour normal. Tortuous aorta

COMMENT:

Vague/equivocal stellate distortion/nodular density medial right upper lobe CT recommended

CT 27 December 2019

INDICATION:

Focal change right upper lobe on chest radiograph. Atypical/non-cardiac chest pain, not fully explained. Previous nephrectomy for oncocytoma rather than renal cell carcinoma

FINDINGS: AIRWAYS: Normal calibre. No endobronchial or endotracheal lesion. No compression

PULMONARY PARENCHYMA: A right upper lobe subsolid nodule has increased slightly in size/complexity compared to 2017, linear parenchymal bands and groundglass opacity radiating peripherally, the greatest diameter of the lesion is about 14 mm

PLEURA: No mass seen. No pleural fluid

LYMPH NODES: Multiple calcified mediastinal/hilar nodes

HEART, PERICARDIUM AND AORTA No pericardial thickening or pericardial fluid. Main pulmonary artery normal calibre. No features of right heart strain. Tortuous aorta retaining normal calibre.

THORACIC CAGE/CHEST WALL: No vertebral fracture. No rib lesion.

MISCELLANEOUS: Multiple hypodense liver lesions compatible with cysts, similar to preceding exam. Right nephrectomy

OPINION: The subsolid nodule right upper lobe has increased in size compared to 2017, arguably better appreciated on the coronal images. A respiratory referral is advised.

CHEST RADIOGRAPH SEPTEMBER 16, 2020

INDICATION: Chest pain

FINDINGS: The ill-defined nodular lesion right upper lobe between the first and second ribs has increased in density and possibly in size when compared to the prior radiograph in 2019 Heart size normal. Tortuous aorta No thoracic vertebral body wedging > 20%

COMMENT: The ill-defined lesion right upper lobe appears more conspicuous than in 2019. Advise repeat CT.

Andrew Kingzett Taylor'

The following further advice was received from Dr Kingzett Taylor:

'To Whom It May Concern:

Regarding

Complaint: 22HDC03118

MY QUALIFICATIONS

I am a diagnostic radiologist working for the Pacific Radiology Group. I became a fellow of the Royal Australian and New Zealand College of Radiologists in 1996. I am registered as a diagnostic radiologist in both Australia and New Zealand.

I am a member of the
- Royal Australian and New Zealand College of Radiologists
- American Roentgen Ray Society
- Radiologic Society of North America
- Australasian Musculoskeletal Imaging Group
- European Society of Radiology (corresponding member)
- European Society of Skeletal Radiology.

I participate fully in the RANZCR CPD programme. I am the local representative on the Pacific Radiology peer review committee and arrange and present periodic peer review

meetings. I regularly report chest radiographs, CT chest exams and advanced oncologic imaging including PET but I do not consider myself, nor am I considered, a subspecialty chest radiologist.

CONFLICTS: I have no conflicts of interest to declare.

INFORMATION REVIEWED I have reviewed the following items:

- Relevant imaging
- Letter from HDC dated 7 March 2024
- CT study performed May 12 2017
- Chest radiograph July 27 2018
- Chest radiograph November 19 2019
- CT study performed December 27 2019
- CT study performed September 16 2020
- Copy of complaint
- Te Whatu Ora response
- Clinical records
- Te Whatu Ora further response

SUMMARY OF CLINICAL EVENTS

[Mr A] was diagnosed with advanced stage 4 lung malignancy in 2022.

The complainant states that he was first referred for investigation of chest pain in 2017 and had several CT examinations and chest radiographs between 2017 and 2022.

He has been advised that an opacity is evident on retrospective review of the 2017 CT examination but that it was not reported contemporaneously. An opacity was first identified on radiographs in 2019. CT performed subsequently in 2019 reported the lesion as stable compared to a retrospective review of the 2017 examination.

A chest radiograph performed in 2020 reported a persisting opacity. There was no further imaging until 2022 when a large pulmonary mass was diagnosed as advanced stage 4 lung cancer.

The key issues for the complainant are the failure to diagnose the pulmonary lesion in 2017 and the failure to adequately follow-up the evolution of the lesion thereafter.

CT MAY 12 2017

MILD DEPARTURE FROM STANDARD OF CARE

The reporting radiologist failed to detect the right upper lobe pulmonary lesion. This is a perceptual error. It is acknowledged that perceptual error is a common part of radiology practice and some errors are “inevitable”. Experienced, conscientious and competent radiologists can and do make random perceptual errors.

Radiologist errors may occur for many reasons, both human- and system-derived. In forming an opinion as to whether a perceptual error is a departure from the standard of care, I consider the clinical context and my assessment of the "difficulty" of the interpretation for a general radiologist (this includes for example the location, morphology and conspicuity of the lesion, the number of images demonstrating the abnormality and any other confounders).

Clinical context

This study was ordered for the investigation of *abdominal pain and obstructive jaundice* rather than for chest pain.

The primary attention of the reporting radiologist would have been the abdomen and pelvis together with the lung bases, rather than the upper lobes.

Furthermore a solid renal mass (possibly but it transpired not, a renal malignancy) was discovered on the CT. This had the potential to monopolise the radiologist's attention and distract from further review. This has been described as the "satisfaction of search" error and occurs when the reporting radiologist fails to continue to search for subsequent abnormalities after identifying an initial one. ("Satisfaction of search error| Radiology Reference Article …")

Difficulty of interpretation

There is scarring within the LEFT upper lobe which may have diverted attention. The appearance on axial images is non-specific.

RADIOGRAPH JULY 27, 2018

NO DEPARTURE FROM THE STANDARD OF CARE

The right upper lobe lesion is not clearly seen on the July 2018 radiograph.

RADIOGRAPH NOVEMBER 19, 2019

NO DEPARTURE FROM THE STANDARD OF CARE

The right upper lobe lesion can be appreciated in retrospect on November 19, 2019, chest radiograph but it is a subtle inconspicuous lesion at a difficult location between the first and second ribs.

I have shown three radiologists this case (blinded to clinical details, unaware of previous imaging) and only one of three suggested further imaging of the right upper lobe mass based on this radiograph in isolation.

The nodule was first detected on a follow-up chest radiograph a short interval afterwards on November 30, 2019. The lesion appears rather more conspicuous on the later radiograph, likely due to technical factors but I still consider this pick-up on November 30th to have been an astute one.

In my opinion, not all radiologists would have detected the lesion on the November 30, 2019, radiograph.

CT 27 December 2019

MILD DEPARTURE FROM STANDARD OF CARE

The radiologist failed to detect interval growth in the lesion.

The interval growth between the two exams is reasonably subtle, there are several mitigating factors as below.

It is noteworthy that the radiologist refers to ground glass opacity in his report. Ground glass opacity is a feature of *subsolid nodules.*

There is a background discussion on subsolid pulmonary nodules on the next page.

The CT reported that the lesion was "roughly" stable over two years although on retrospective review there was in fact a subtle increase in size.

Several confounding factors may have contributed to this misinterpretation.

The interval growth of the right upper lobe lesion between 2017 and 2019 is not particularly evident on initial visual inspection of the horizontal cross-sectional ("axial") sequence. These are the images typically first viewed by the radiologist and measurements of lung nodules are typically obtained in this plane. Due to the shape of the nodule, the change is far more apparent on the coronal images (vertical front-to-back view).

On the axial (horizontal) sequence the lesion had an elongated linear shape which appeared similar to the prior 2017 CT, this shape can be seen with scarring. Elsewhere in the chest, there are small, calcified nodes and minor scarring within the left lung. These additional observations may have been interpreted as supporting a diagnosis of prior inflammation/infection and scarring.

It is agreed with the reporting radiologist that this lesion is difficult to measure.

This lesion is subsolid and traversed by pulmonary vessels, several converging blood vessels contribute to the appearance.

Measuring subsolid lesions is known to be subject to variation and measurement error due to indistinct margins.

There is associated linear scarring.

Although the radiologist states that the appearance is "presumably post inflammatory/scarring", this does not mean in my opinion that the radiologist is advising that ongoing follow-up is unnecessary. The report is addressed to the respiratory physicians who will integrate the radiology report with their own clinical

assessment, patient risk factors and professional judgment. Radiologists will hesitate to be proscriptive when their report is addressed to a specialist in their field.

Technical note: The images presented to me for review of this case are 3mm thickness which is rather thicker than the normal slice thickness employed for assessment of pulmonary nodules (usually 1mm or similar). I am not sure whether the reporting radiologist had access to thinner slices contemporaneously.

Background on subsolid pulmonary nodules

"Not every pulmonary nodule is the same, some are solid, some are nonsolid (ground glass) and some are both solid and nonsolid (part-solid). Nonsolid and part-solid nodules are together termed subsolid pulmonary nodules "(Pompe et al 'Unravelling complexities of the subsolid pulmonary nodule — detection, characterization, natural history, monitoring and (future) patient management')".

In contrast to a "solid" pulmonary nodule, a pulmonary lesion is called "subsolid" when it includes a hazy component ("ground glass opacity") which does not obscure the underlying vessels and airways.

Subsolid pulmonary lesions are common and detected in about 9% of asymptomatic screening chest CT examinations. Causes include inflammation/infection, fibrosis (scarring) and malignancy.

Inflammatory subsolid nodules may resolve on follow-up imaging.

Malignant subsolid nodules typically have slow growth and may appear stable for years before growing. In some cases, a more aggressive malignancy may develop years after initial detection of a subsolid nodule. ("Subsolid pulmonary nodules: Controversy and perspective — PMC") It remains unclear how frequently and for how long subsolid nodules should be surveilled. This is an area of very active ongoing research and debate, seeking a balance between detecting those with a risk of developing invasive malignancy on the one hand and avoiding excessive scanning and overtreatment on the other.

Fleischner guidelines currently recommend annual follow-up for 5 years duration for subsolid nodules (compared to only two years for stable solid nodules). However these guidelines are not universally followed by respiratory physicians (Iacarrino et al).

Measurement of subsolid nodules

"In comparison to solid nodules, subsolid nodules are even more difficult to evaluate because they tend to grow slowly, the border can be less clear defined and also delineating the solid component can be challenging" ("Unravelling complexities of the subsolid pulmonary nodule — detection, characterization, natural history, monitoring and (future) patient management").

CHEST RADIOGRAPH SEPTEMBER 16, 2020

NO DEPARTURE FROM THE STANDARD OF CARE

This examination was performed for assessment of chest pain rather than for surveillance of the pulmonary nodule.

The report compared with the prior 2019 chest radiograph and found that appearances were "similar" noting also stability had been reported on the 2019 CT.

In my opinion the right upper lobe lesion is rather more conspicuous than in 2019 (it is denser) but the size appears similar. The improved conspicuity/density of the lesion could have reasonably been attributed to technical factors.

SUMMARY

I am very sorry to read of the unfortunate outcome in this case.

Several factors appear to have conspired together including the inherent characteristics of the lesion itself (initially a subsolid pulmonary nodule).

This lesion was initially overlooked on a 2017 CT examination performed for another clinical indication with "satisfaction of search" (the detection of a renal mass) likely contributing to the perceptual error.

The lesion was at first difficult to appreciate and then very difficult to monitor on chest radiographs which are far less accurate for assessing such a lesion.

The lesion was a subsolid pulmonary nodule.

It was difficult to measure due to indistinct margins and consequently the growth of the lesion was not appreciated on the 2019 CT.

Due to increased detection on CT, awareness of the different characteristics and behaviour of subsolid pulmonary nodules has increased greatly over the past decade. Several studies have analysed the natural course of subsolid nodules and reported the relatively indolent (slow growing) clinical course of malignant subsolid nodules. Based on these results, the 2017 Fleischner guidelines recommended longer follow-up periods for subsolid nodules of 5 years.

"Because subsolid nodules typically have very indolent growth, they may appear stable for years before growing. In some cases, a more aggressive malignancy may develop years after initial detection of a subsolid nodule. For these reasons, it remains unclear how frequently and for how long subsolid nodules should be surveilled. ("Subsolid pulmonary nodules: Controversy and perspective — PMC") (Hamner et al 2020).

With respect to the follow-up of the lesion. Decisions regarding the management and follow-up of nodules, especially larger nodules usually follow multidisciplinary team discussion.

RECOMMENDATIONS

It is important that cases such as this are reviewed at "peer learning" sessions.

In this way, radiologists calibrate and recalibrate their search patterns and reporting throughout their careers.

As stated in the report, it will not be possible to eliminate perceptual error in radiology as long as there is a human element but, in my experience, each case such as this presented at a peer review meeting will reduce the likelihood of a similar case occurring for those in attendance.

It unfortunately will not assist in this case, but I consider that there is far greater awareness of subsolid pulmonary nodules and their differing behavior patterns amongst radiologists than even 5–7 years ago when these examinations were performed. It has been a topic widely covered at radiology conferences and even the peer review meeting I conducted in the last few years. It is clear from the literature that research and debate is ongoing, and that management of these lesions can be challenging.

It is recognized by many that measurement of these lesions during follow-up can be imprecise, and it is likely that in the future there will be more computer assistance to achieve better accuracy (automated measurement of volume and density rather than manual measurement and visual inspection by the radiologist).

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