Radiologist, Dr B

Private Radiology Service

MidCentral District Health Board

A Report by the

Health and Disability Commissioner

(Case 15HDC00464)

Health and Disability Commissioner
Te Toihau Hauora, Hauātanga

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Executive summary

1. At 31 weeks' gestation, Ms A had an ultrasound performed by sonographer Ms C at a private radiology service. Dr B was the reporting radiologist, working from a location remote from where the scan was performed.

2. During the scan, Ms C noticed that the fetal kidneys appeared dilated, and that the fetal bladder was full and not seen to empty. She recorded on the sonographer's worksheet "Kidneys appear dilated ? rescan once born." She sent the images and worksheet to Dr B, but did not discuss this case with him.

3. Dr B wrote in the ultrasound report: "[B]ilateral fetal renal dilation (5mm). Fetal bladder appears somewhat overfilled. Bladder was not seen to empty during the study. … postnatal assessment is suggested." The actual findings of the scan were fluctuating renal pelvis measurements of 4.1mm to 9.5mm on the right and 5.1mm to 14mm on the left.

4. On 28 Month1[1], Baby A was born at the public hospital, at 32 weeks' gestation, and was admitted to the Neonatal Unit. It was verbally reported to paediatric staff that an antenatal ultrasound had shown bilateral fetal renal dilation of 5mm, but a copy of the radiology report was not transferred from Ms A's clinical records to Baby A's records. A copy of the report was obtained from the private radiology service by the public hospital, but not disseminated to paediatric staff, and paediatric staff did not request a copy.

5. Baby A subsequently developed oedema and had episodes of high blood pressure. Nursing staff were told that medical staff had no concerns and that they needed to give consistent feedback to Ms A about this. On 4 Month2, a renal ultrasound was performed and a diagnosis of posterior urethral valves (PUV)[2] was made. Subsequently Baby A was catheterised and transferred to the public hospital in a main centre (Hospital 2), where he underwent posterior urethral valve ablation.[3]

6. At the time of these events, MidCentral District Health Board (MCDHB) was testing a new electronic health record, and staff were not documenting the thinking behind diagnoses or alternative diagnoses being considered. There was also a lack of clinical workstations, and it was difficult to enter data cot-side.

Findings

7. MCDHB responded appropriately to the reported antenatal ultrasound findings of bilateral fetal renal dilation of 5mm, and the care provided to Baby A on the first four days of his life was appropriate. However, MCDHB paediatric medical staff did not investigate Baby A's worsening oedema and high blood pressure from day five of his life. Accordingly, MCDHB did not provide care to Baby A with reasonable care and

[1] Relevant months are referred to as Months 1-3 to protect privacy.
[2] Posterior urethral valves is a condition where obstructing membranes in the posterior male urethra prevent normal urine flow from the bladder.
[3] Posterior valve ablation is surgery to remove the valve through the urethra.

skill and, therefore, breached Right 4(1) of the Code of Health and Disability Services Consumers' Rights (the Code).[4]

8. By not transferring a copy of the antenatal ultrasound report from Ms A's clinical records to Baby A's clinical records when he was born; not disseminating to relevant paediatric staff the copy of the report obtained from the private radiology service; and paediatric staff not requesting a copy of the report, MCDHB failed to ensure continuity of care and, therefore, breached Right 4(5) of the Code.[5]

9. There is a pattern of suboptimal documentation by multiple staff involved in Baby A's care, and the environment in which MCDHB staff were operating contributed considerably to the documentation failures in this case. MCDHB failed to provide services to Baby A that complied with relevant standards, and thereby breached Right 4(2) of the Code.[6]

10. Adverse comment is made with regard to the culture at the DHB, particularly given that nursing staff felt that they were not listened to.

11. Adverse comment is made that Dr B misreported the abnormality, as the measurements of the renal pelvic dilation stated in the report were incorrect.

12. The care Ms C provided to Ms A on 31 weeks' gestation was within the range of accepted practice.

13. The private radiology service's policies and procedures were appropriate.

Recommendations

14. It is recommended that MCDHB report back to HDC on the implementation of the recommendations arising from its Root Cause Analysis; provide refresher training to all paediatric staff on coordination of care; undertake a qualitative audit to check for appropriate use of the electronic health record in the Neonatal Unit; provide a detailed update on progress toward additional clinical workstations being situated cot-side; and provide a written apology to Ms A and Mr A.

15. It is recommended that Dr B provide a written apology to Ms A.

Complaint and investigation

16. The Commissioner received a complaint from Mr A about the care provided to his son, Baby A, by MidCentral District Health Board (MCDHB). During the course of

[4] Right 4(1) states: "Every consumer has the right to have services provided with reasonable care and skill."
[5] Right 4(5) states: "Every consumer has the right to co-operation among providers to ensure quality and continuity of services."
[6] Right 4(2) states: "Every consumer has the right to have services provided that comply with legal, professional, ethical, and other relevant standards."

the assessment of this complaint, MCDHB raised concern about the reporting of an antenatal ultrasound provided to Baby A's mother, Ms A, by the private radiology service. The following issues were identified for investigation:

- *Whether MidCentral District Health Board provided Baby A with care of an appropriate standard in Month1 and Month2.*
- *Whether Dr B provided Ms A with care of an appropriate standard on 21 Month1.*
- *Whether the private radiology service provided Ms A with care of an appropriate standard on 21 Month1.*

17. The parties directly involved in the investigation were:

Ms A	Consumer
Mr A	Complainant
Dr B	Radiologist
Private radiology service	Provider
MidCentral District Health Board	Provider

Also mentioned in this report:

Dr E	Paediatric consultant
Dr F	Paediatric registrar
Dr G	Paediatrician

18. Information was also reviewed from:

Ms C	Sonographer
RM D	Midwife

19. Independent expert advice was obtained by the Commissioner, including advice from paediatrician Dr Philip Moore which is attached as **Appendix A**.

20. A diagram of the renal system showing a normal kidney and a kidney with hydronephrosis[7] is attached as **Appendix B**.

Information gathered during investigation

Background

21. In 2014, Ms A, aged 34 years at the time of these events, became pregnant with her second child. Her lead maternity carer (LMC) was midwife RM D. At 11 weeks' gestation, Ms A experienced severe vaginal bleeding and presented to the Emergency Department at the public hospital. An ultrasound was performed. No cause for the

[7] Hydronephrosis is dilation of the kidneys.

bleeding was seen, but a low anterior fibroid[8] was reported. It was recommended in the ultrasound report that Ms A have a follow-up ultrasound at around 32 weeks' gestation, in addition to the usual anatomy ultrasound at around 20 weeks' gestation, to ensure that the fibroid would not be likely to cause any problems with delivery.

22. Ms A's 20-week ultrasound was carried out at the public hospital;[9] however, the subsequent ultrasound was carried out by the private radiology service at 31 weeks' gestation. This ultrasound reported "bilateral fetal renal dilation".[10]

23. Baby A was born at the public hospital at 32 weeks' gestation, and subsequently was diagnosed with posterior urethral valves (PUV).[11]

24. This report relates to the care provided to Ms A by sonographer Ms C,[12] radiologist Dr B,[13] and the private radiology service. The report also addresses the care provided to Baby A by MCDHB.

Fetal renal dilation

25. The function of the kidneys is to filter the blood and send the waste products (urine) to the bladder via the ureters.[14] Within each kidney is a renal pelvis[15] (which connects with the ureter) and calyces,[16] through which urine passes into the renal pelvis.

26. Fetal renal dilation is a general term meaning dilation of the fetal renal pelvis, with or without dilation of the calyces. The renal pelvis measurement is used to determine the degree of fetal renal dilation. If the calyces are also significantly dilated, the overall severity of the renal abnormality is greater. MCDHB's clinical guideline "Hydronephrosis — Neonatal Management" (2014) states that renal pelvic dilation less than 5mm is considered normal.

Ms A's antenatal ultrasound at 31 weeks' gestation (21 Month1)

27. At 31 weeks' gestation, Ms A presented to the private radiology service for a third trimester antenatal ultrasound. She had been referred by her back-up LMC. The referral stated: "Fundal height[17] less than expected."

[8] A fibroid is a benign growth of tissue in the wall of the uterus.
[9] The results of this scan were normal.
[10] Fetal renal dilation is a general term meaning dilation of the fetal renal pelvis (see footnote 15 and appendix B), with or without dilation of the calyces (see footnote 16). It means that the renal pelvis is enlarged as a result of urine being unable to drain from the kidney into the bladder. In practice, this term is used interchangeably with antenatal hydronephrosis (dilation of the kidneys, including both the renal pelvis and calyces) and renal pelvi-calyceal dilatation (dilation of both the renal pelvis and calyces).
[11] Posterior urethral valves is a condition where obstructing membranes in the posterior male urethra prevent normal urine flow from the bladder.
[12] Ms C is an employee of the private radiology service.
[13] Dr B is vocationally registered in diagnostic and interventional radiology. At the time of these events, he provided remote reporting services to the private radiology service via teleradiology.
[14] The ureter is the duct through which urine passes from the kidney to the bladder.
[15] The renal pelvis is part of the kidney next to the ureter, which collects urine from the calyces and acts as a funnel for urine flowing to the ureter. See Appendix B.
[16] The calyces are chambers of the kidney, through which urine passes into the renal pelvis.

28. The ultrasound was performed by Ms C at the private radiology service. She told HDC that there was normal amniotic fluid index, growth was within normal limits, and she was not aware of the sex of the baby. She stated:

> "During the scan I noticed that the kidneys appeared dilated and reviewed them throughout the scan to see if they remained dilated or reduced. They remained dilated and I took several images of the kidneys along with the growth measurements that are required for a growth scan. At the time of the scan I noted that the bladder was full and it was not seen to empty during the scan."

29. Ms C recorded on the sonographer's worksheet: "[Anterior] fibroid seen again 33 x 38 x 31mm (previously 55 x 35 mm) [down] in size. Good growth. Kidneys appear dilated ? rescan once born." Ms C did not document on the worksheet that the bladder was full and was not seen to empty during the scan; however, the fact that the bladder is full can be seen on the image she took of Baby A's bladder.

30. On one image of Baby A's kidneys,[18] Ms C placed cursors on the edges of the renal pelves, measuring 4.1mm on the right and 5.1mm on the left. She did not document any measurements on the sonographer's worksheet.

31. The ultrasound was reported on remotely, via teleradiology,[19] by Dr B. Ms C stated that Dr B was available for her to contact, but she did not discuss this case with him, as she felt that the sonographer's worksheet and the images adequately showed the renal abnormality.

32. Ms C told HDC that, on review, she should have extended the ultrasound further and examined the bladder in more detail with a coronal image,[20] waited to assess whether the bladder emptied during the scan, and reviewed the scan with the reporting radiologist at the time with a view to Ms A being referred to an obstetrician.

33. Dr B told HDC that it was straightforward for him to communicate with the sonographers at the private radiology service, which he often did as part of supervision,[21] but he did not do so in this case, as it was not necessary. He stated that he was satisfied with the images at the time.

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[17] The fundal height is the measurement from the top of the uterus to the pubic symphysis (pubic bone) and roughly corresponds to gestational age.
[18] Ms C took eight images of Baby A's kidneys.
[19] Teleradiology is a system where radiology images are sent from the site of acquisition to the reporting location, to be reported on remotely. In this case, Dr B was located elsewhere and was available at the time of the scan. Ms C sent the images, along with her worksheet, to Dr B electronically after Ms A had left the private radiology service. Dr B dictated a report based on this information, which he later verified.
[20] The coronal plane divides the body into front and back halves.
[21] In addition to the supervision provided to sonographers by on-site radiologists, radiologists carrying out remote reporting also provide supervision to the sonographers who have obtained the imaging they are reporting on.

34. Dr B reviewed the images obtained by Ms C, and the sonographer's worksheet, and reported:

> "**Indication:**
> Third trimester assessment. Assessment of growth.
>
> **Findings:**
> Expected gestation and previously determined [expected due date] are 31 weeks 3 days[22] and 22nd of [Month3].
>
> Placenta previously seen anterior, clear of the cervix. Fluid volume normal.
> Anatomy assessment today reveals bilateral fetal renal dilation (5mm).[23] Fetal bladder appears somewhat overfilled. Bladder was not seen to empty during the study. Sex of the fetus is uncertain to me.
>
> [Bi-parietal diameter],[24] [head circumference], [abdominal circumference], [femoral length] and [estimated fetal weight] are respectively 80mm, 288mm, 268mm, 60mm and 1704g (35th percentile).
>
> Anterior fibroid again noted, maximum diameter 33mm.
>
> **Comment:**
> Ongoing single gestation. Fetal renal dilation and postnatal assessment is suggested."

35. Dr B told HDC that the actual findings of the scan are fluctuating renal pelvis measurements of 4.1mm to 9.5mm on the right and 5.1mm to 14mm on the left. He stated that fetal renal dilation can vary markedly over short periods of time, so assessment is based on the image with the greatest renal pelvic dilation (in this case, the image showing renal pelves of 9.5mm on the right and 14mm on the left). Dr B told HDC that the 5mm figure given in the body of his report in relation to the bilateral fetal renal dilation means that the degree of dilation was not described accurately. The calyces were also significantly dilated.

36. Dr B stated that his ultrasound report indicated an abnormal renal tract, with 'bilateral fetal renal dilation' being a statement of abnormality. He considered that he interpreted the ultrasound to standard and gave the correct diagnosis (bilateral fetal renal dilation) and recommendation (postnatal assessment), but, due to a typographical error, incorrectly stated the degree of renal pelvic dilation (5mm rather than 9.5mm on the right and 14mm on the left).

37. A copy of the written ultrasound report was sent to RM D that day. RM D told HDC:

[22] Baby A was born on 28 Month1. Baby A's clinical records from MCDHB state that he was born at 32+2 weeks' gestation. However, based on the expected gestation as at 31 weeks' gestation of 31 weeks and 3 days, Baby A would have been 32+3 days when he was born.
[23] The 5mm measurement relates to the renal pelves.
[24] Bi-parietal diameter is the measurement of the fetus's head from side to side, used to assess fetal size.

> "On receipt of the scan report I noted the comment about bilateral renal dilation 5mm on each side. I … was aware that the usual follow-up … is an ultrasound scan for baby after birth at 1 week old. … Therefore there was no further action required until the birth when a follow up ultrasound would be arranged by a Paediatrician."

Public hospital (24 Month1–4 Month2)

Birth and admission to Neonatal Unit (24–29 Month1)

38. Ms A's membranes ruptured prematurely on 24 Month1 and she presented to the public hospital, where her care was transferred from RM D to the hospital's obstetric team. RM D told HDC that she provided the Obstetric Team with a copy of the antenatal ultrasound report of 31 weeks' gestation, along with other antenatal documentation.

39. Subsequently Ms A was induced, and Baby A was born at 2.59am at 32+3 weeks' gestation.[25] Baby A was admitted to the Neonatal Unit, owing to his prematurity. On admission, it was verbally reported to paediatric staff that an antenatal ultrasound had shown bilateral fetal renal dilation of 5mm. It was not documented who informed paediatric staff of this, and MCDHB told HDC that paediatric staff do not recall who did so. The antenatal screening section of the admission records state: "Bilateral renal dilatation (5mm)." "Renal pelvi-calyceal dilatation[26] (antenatal hydronephrosis[27])" was also listed amongst Baby A's admission diagnoses/problems, and this continued to be listed as a diagnosis throughout his admission. The documented management plan included requesting a postnatal renal ultrasound.

40. On 28 Month1, paediatric consultant Dr E[28] reviewed Baby A during the morning ward round. Baby A's bilateral fetal renal dilation of 5mm was noted as a current issue. The management plan included: "Needs renal [ultrasound] arranged." A paediatric registrar reviewed Baby A later that night, as Baby A had been experiencing frequent apnoea,[29] and his oxygen saturation levels had decreased during those episodes. Caffeine[30] was prescribed.

41. On 29 Month1, paediatric registrar Dr F[31] requested a postnatal renal ultrasound. The referral form stated: "Bilateral renal dilatation on ante-natal scan of 5mm. Repeat renal [ultrasound] in one week." MCDHB told HDC that the postnatal ultrasound was then booked for 4 Month2.

42. At 1.09pm on 29 Month1, the private radiology service faxed a copy of the antenatal ultrasound report of 31 weeks' gestation to the Ultrasound Department at the public

[25] The clinical notes at MCDHB incorrectly state that Baby A was born at 32+2 weeks' gestation (see footnote 22).
[26] See footnote 9.
[27] See footnote 9.
[28] Dr E is vocationally registered in paediatrics.
[29] Apnoea is cessation of breathing.
[30] A citrate salt of caffeine is sometimes used in medical treatment, including short-term treatment of apnoea of prematurity.
[31] Dr F is registered in New Zealand as a doctor with a general scope of practice.

hospital. The private radiology service told HDC that it was highly likely that someone from the Ultrasound Department had requested it around the time it was sent; however, this is not documented. The report was not forwarded to paediatric staff by the Ultrasound Department. There is no documentation regarding whether the report was requested, who requested it, or what action was taken once it was received.

Development of oedema (29–31 Month1)

43. In the late afternoon on 29 Month1, a paediatric registrar reviewed Baby A because he had an erythematous[32] umbilical area. A rash on his chest was also noted, but his observations were stable. The paediatric registrar discussed Baby A's case with Dr F, who was a more senior paediatric registrar. Dr F also examined Baby A, documenting bilateral pitting oedema[33] extending up to the thighs. Due to concern that his symptoms might be due to early sepsis,[34] blood tests were taken and intravenous (IV) antibiotics, including gentamicin,[35] were prescribed. MCDHB told HDC that, because infection was being considered, Baby A's kidney function was not checked.

44. At the morning ward round on 30 Month1, Baby A was examined and found to have a healthy umbilicus and no oedema. The management plan included "Renal [ultrasound] on Monday [2 Month2]"[36] and an instruction to nursing staff that they no longer needed to weigh Baby A's nappies. It is not documented who had initially requested that Baby A's nappies be weighed.

45. A senior house officer reviewed Baby A overnight, owing to nursing concerns of oedema on his right hand, abdominal distension, and umbilical flare. On clinical examination, he was also noted to have a slightly oedematous abdomen. The management plan included monitoring urine output.

46. During the morning ward round on 31 Month1, Baby A was noted to have a small amount of dependent oedema,[37] and the clinical impression was oedema of immaturity. Antibiotics were stopped.

47. Later that day, nursing staff documented in Baby A's progress notes:

> "For kidney [ultrasound] to be arranged by [a paediatric house officer].[38] On Monday [2 Month2].[39] … [Ms A was] a bit upset when [she arrived] in the unit as she is worried about Baby A's kidney. [Ms A] is aware of kidney [ultrasound] to be arranged on Monday [2 Month2]."

[32] Red. Erythema (redness of the skin) usually occurs with skin injury, infection, or inflammation.
[33] Bilateral pitting oedema is swelling due to the accumulation of fluid underneath the skin, where, after pressure is applied, the indentation persists after release of the pressure.
[34] Sepsis is a condition caused by the presence of harmful bacteria and their toxins in tissues, typically though infection.
[35] Gentamicin is an antibiotic that can cause renal and inner ear problems.
[36] According to MCDHB, the ultrasound was actually booked for 4 Month2, not 2 Month2 as was documented in the management plan.
[37] Dependent oedema is oedema that appears to be influenced by gravity and position.
[38] Registered as a doctor with a general scope of practice.
[39] According to MCDHB, the ultrasound was actually booked for 4 Month2, not 2 Month2 as documented in the progress notes.

48. Mr A told HDC that he and Ms A continually asked nursing staff about Baby A's oedema, but were reassured that everything was normal.

49. MCDHB told HDC that a paediatric house officer was to follow up the postnatal ultrasound referral made by Dr F.

50. On 31 Month1, evening nursing staff noted that oedema persisted on Baby A's groin, thighs, legs and right hand, and that the area of oedema tended to be related to his position.

Elevated blood pressure (1–4 Month2)

51. In the morning on 1 Month2, nursing staff documented that Baby A's oedema remained present in his extremities and lower abdomen. His blood pressure was taken at 8am and was high. At the morning ward round, his oedema was noted to have improved. However, in the afternoon, nursing staff documented that Ms A felt that Baby A's oedema had increased slightly since the previous day. It was also recorded that Baby A's blood pressure had been elevated that morning, and it was requested that it be taken again that afternoon.

52. That evening, nursing staff documented that there was oedema on Baby A's lower abdomen, thighs and lower extremities, as well as dependent oedema on his face and eyelid. His blood pressure was taken again and was within the normal range.

53. At the morning ward round on 2 Month2, it was noted that Baby A had no oedema and that the renal ultrasound was booked for 4 Month2.

54. MCDHB told HDC that, in response to the elevated blood pressure, a decision was made to try to bring forward the planned renal ultrasound from 4 Month2 to 2 Month2. MCDHB said that enquiries were made on 2 Month2 to see if the postnatal ultrasound could be performed that day, but it was unable to be brought forward, owing to the unavailability of sonography staff. MCDHB stated that the request to bring forward the ultrasound was not made urgently, and it was considered reasonable to proceed with the ultrasound booked for 4 Month2. However, there is no documentation regarding a request to bring forward the ultrasound to 2 Month2.

55. Mr A told HDC that he and Ms A requested an earlier ultrasound, but were told that there were no sonographers available.

56. In the afternoon on 2 Month2, Dr E reviewed Baby A, as Mr A and Ms A were anxious about Baby A's oedema and renal dilation, and wanted an ultrasound to be undertaken urgently. The clinical records state: "[Dr E] has explained that dilatation is minimal and unlikely to be significant. … Mild oedema proximal lower limbs. Baby is fine."

57. Later that evening, nursing staff documented that Baby A remained very oedematous and appeared worse than the previous day, with oedema present on both legs up to the thighs, and on the face and eyelid. His blood pressure was taken and was again raised.

58. A senior house officer reviewed Baby A overnight because he was still oedematous, and was vomiting and unsettled. The impression was that he was possibly slightly more oedematous than the previous night, but that it was oedema of prematurity. Nursing staff informed the senior house officer that Baby A had diminished urine output.

59. In the morning on 3 Month2, the Charge Nurse Manager of the Neonatal Unit documented:

> "Discussion with [Dr E] and [Dr G][40] about baby. They have absolutely no concerns about baby's health. Oedema [and] one raised [blood pressure][41] unconcerning. … Baby is well. The senior medical staff have asked nurses to please give consistent feedback to parents and be on the same page that nothing is wrong with the infant."

60. At the morning ward round, a paediatric registrar noted that Mr A and Ms A were very concerned about renal dilation and oedema, but had been reassured many times. The management plan stated: "Please reassure parents that kidneys and oedema are normal. Does not need multiple doctors' reviews regarding this."

61. That afternoon, nursing staff documented that Baby A remained oedematous, and they raised concerns with medical staff that he was passing only small amounts of urine. The paediatric registrar discussed this with Dr E, and they decided to weigh Baby A's nappies again to monitor his output. That night, nursing staff documented that Baby A was oedematous and that his blood pressure remained elevated.

62. MCDHB told HDC that Baby A's elevated blood pressure on 2 and 3 Month2 was not acted on by medical staff. It stated that, during this time, there was continued recording of wet nappies and no definite recording of decreased urine output. It acknowledged that the clinical thinking was not well documented, but stated that examination findings indicate that causes other than renal abnormalities were being looked for to explain the high blood pressure, raising the likelihood that the near-normal antenatal ultrasound report was influencing clinical thinking.

Diagnosis of posterior urethral valves (4 Month2)

63. Early in the morning on 4 Month2, nursing staff documented that Baby A had oedematous thighs, feet and eyes, that he had had minimal urine output overnight, and that his blood pressure remained elevated. MCDHB told HDC that blood tests were taken in response to the high blood pressure (although this reasoning is not documented), and that the tests showed increased creatinine, indicating renal impairment.

64. It was subsequently discovered that Baby A's drug chart stated that he was given 90.6mg of gentamicin on 29 Month1, rather than the 6.3mg charted. This was believed to be a transcription error, as the dose of amoxicillin[42] was 90.6mg.

[40] Dr G is vocationally registered in paediatrics.
[41] There had actually been two raised blood pressure readings at this time — on the morning of 1 Month2 and on the evening of 2 Month2.
[42] Amoxicillin is an antibiotic.

65. An incident report was completed for the medication documentation error, which stated:

> "Although there was a documentation error the nurses involved in administering and checking IV antibiotics on [29 Month1] are confident that the actual dose administered was correct. Gentamicin doses in the Neonatal Unit are typically very small and always only require only a very small amount from one ampoule.[43] In this case staff would have had to open two ampoules and this is highly unlikely and improbable."

66. The report listed the immediate actions taken in response to the possible administration error as: assessment by a doctor; diagnostic tests/imaging; and increased observations. It noted that blood tests showed a very high potassium level, and IV medications were given in an effort to reduce this. An urgent electrocardiogram was performed, which was normal. A gentamicin level was done, which was within the therapeutic range. The incident report noted that Baby A would receive a hearing screening at Hospital 2 (where subsequently he was transferred).

67. At 9.59am on 4 Month2, the private radiology service faxed a copy of the antenatal ultrasound report of 31 weeks' gestation to the Neonatal Unit at the public hospital.

68. At 10.10am, a renal ultrasound was performed at the public hospital. The report stated:

> "There is dilatation of the calyces in both kidneys consistent with moderate hydronephrosis. Both ureters are also moderately dilated measuring 0.5cm and remain dilated down into their insertion into the bladder. The bladder is not dilated with an estimated volume [of] 11ml. The bladder wall appears thickened measuring 0.6cm inferiorly. On sagittal imaging[44] the posterior urethra[45] is well visualised and is dilated. The combination of the above findings is most consistent with posterior urethral valves. Summary: Bilateral hydronephrosis, bilateral hydroureter,[46] thick walled bladder and dilatation of the posterior urethra consistent with posterior urethral valves."

69. Subsequently Baby A was catheterised and, at around 12.54pm, he was transferred to Hospital 2.

70. Another copy of the antenatal ultrasound report of 31 weeks' gestation was faxed from the private radiology service to the Neonatal Unit at the public hospital at 2.42pm.

[43] An ampoule is a small sealed vial, often containing a liquid ready for injection.
[44] The sagittal plane divides the body into right and left halves.
[45] The posterior urethra is the duct through which urine is transferred out of the body from the bladder.
[46] Hydroureter is dilation of the ureter.

Post-diagnosis of PUV

71. At Hospital 2, Baby A underwent posterior urethral valve ablation.[47] His renal function and urine output returned to normal following this, but, on 17 Month3, he was transferred back to the public hospital, because of poor feeding. Baby A was discharged home on 27 Month3. Mr A told HDC that Baby A's kidney function will need to be checked regularly until he is 15 years old.

Further information — Ms C

72. Ms C told HDC that she believes that she followed the private radiology service's procedures in regard to scanning a fetus with dilated renal pelves in the third trimester.

73. Ms C said that this scan was discussed at a peer review meeting on 23 Month3 and that, on review, the bladder was more distended than she had appreciated at the time. She stated that now she routinely takes a coronal bladder image and, if the bladder appears at all distended, she reviews it at the end of the scan. If it is still distended and has not been seen to empty, she brings this to the attention of the reporting radiologist before the consumer leaves the clinic. Ms C also told HDC that she is now more careful with the recommendations she makes regarding follow-up scans.

Further information — Dr B

74. Dr B expressed his regret and apologised for any part he had in any avoidable problem Baby A suffered, including the stress and distress this would have caused Mr A and Ms A.

75. Dr B stated that the incorrect degree of renal pelvic dilation in his report did not affect his recommendation. He told HDC that, according to MCDHB's guideline "Hydronephrosis — Neonatal Management", which he used in formulating his recommendation, the appropriate management for bilateral renal dilation of 9.5mm on the right and 14mm on the left is an ultrasound at five to seven days of life. Dr B stated that the fact that there was a correct diagnosis and recommendation demonstrates that he observed and interpreted the images correctly, but made a typographical error. Dr B said that mistakes are a reality of radiology, and that he makes fewer mistakes than the average radiologist, with auditing of his work giving results that fit within the accepted range for teleradiology.

76. Dr B noted that the local MCDHB guidelines do not require or specifically recommend extended bladder imaging. Dr B told HDC:

> "[E]xtension of the examination … is not a universal feature of protocols in New Zealand. This in part reflects the fact that antenatal ultrasound is sufficiently imprecise that (as stated in the [MCDHB] guidelines) antenatal kidney abnormalities need to be confirmed by postnatal ultrasound … Once a fetus has had renal tract dilation identified at an antenatal study and it is on a pathway to post-natal assessment, neither [the private radiology service], nor [MCDHB], nor

[47] Posterior valve ablation is surgery to remove the valve through the urethra.

[another District Health Board] would mandate a further, protocol driven antenatal study."

77. Dr B also noted that the bladder was shown full, but not post urination, the fetus was of indeterminate gender and there was no severe fetal renal dilation (>15mm), renal cortical[48] change suggesting dysplasia,[49] bladder wall hypertrophy,[50] bladder trabeculation,[51] urinoma[52] or oligohydramnios[53] to point to a diagnosis of PUV. He stated that the images provided a broad differential, and there were much more common diagnoses than PUV, which is a very rare diagnosis. Dr B stated:

> "With so many expected findings [of] PUV being absent and extended examination not being part of [the private radiology service] protocols (or even all other [New Zealand] protocols), following the local [MCDHB] protocols for the management of fetal renal dilatation was a reasonable approach."

78. Dr B disagrees with MCDHB that the incorrect reporting of the ultrasound report "influenced clinical thinking" by DHB staff. He noted that the measurement given, 5mm, may be near-normal, but is not normal. Dr B also noted that stating that there was bilateral fetal renal dilation and recommending postnatal assessment is not normal.

79. Dr B told HDC:

> "Whenever a question-mark is raised over an aspect of my clinical practice, or a report I write, I take this to heart and very seriously. My process is generally the same. I read widely around the area in question, discuss my reading with the most qualified expert I can find, go away and read further, return to the expert for further discussion and so on until I believe I am as capable as I can be in the area and have reduced the chance of an error being repeated to the minimum possible. In relation to this case, this process is well underway. … [M]y conclusion in relation to the case in hand is that the main failure on my part falls under the heading of typographical error. So, specific points which have come out of my review so far are that I will increase my vigilance when proof-reading."

Radiologist opinion obtained by Dr B

80. Dr B obtained a radiologist opinion on the care he provided from a general radiologist.

81. The radiologist stated that it is clear that there was an error in the renal pelvic dilation reported by Dr B (5mm bilaterally). The radiologist advised that scientific literature

[48] The renal cortex is the outer portion of the kidney.
[49] Dysplasia is a condition where cysts have replaced normal kidney tissue.
[50] Bladder wall hypertrophy is thickened bladder walls.
[51] Bladder trabeculation is thickened bladder walls and muscle.
[52] Urinoma is a collection of urine.
[53] Oligohydramnios is deficiency of amniotic fluid (the fluid surrounding a fetus).

gives a frequency of typographical errors ranging from 5% to 40%.[54] He stated that, with an expected error rate of 5 to 40% for these types of errors, he would consider radiology peers to regard such errors as mild.

82. In regard to extending the examination, the radiologist stated that not taking or requesting further images is consistent with how most radiologists would proceed in this situation, and is consistent with MCDHB's ultrasound protocols, which do not recommend delayed imaging or further antenatal imaging.

83. The radiologist stated that Dr B correctly recommended a postnatal scan for renal dilation. The radiologist advised that the correct management for renal dilation on a 31-week scan is to allow the gestation to proceed to term, regardless of the degree of dilation. Thus, the antenatal report did not influence management between the 31-week scan and the spontaneous labour at 32 weeks. The radiologist advised that, following delivery, using the full-term protocol for the timing of the postnatal scan would be wrong, regardless of any typographical error in the report. He stated that, for a premature baby with a known abnormality in an organ system, reimaging earlier than the full term protocol suggests would be prudent.

Further information — Private radiology service

84. The private radiology service noted that Ms C and Dr B identified bilateral hydronephrosis, with renal dilation recorded on the sonographer's worksheet and reported on by Dr B. However, it stated that more focus could have been placed on the severity of the renal dilation. The private radiology service told HDC that the dilation was intermittent, and on some images the kidneys are both a lot less dilated than on other images, but the dilation was significant.

85. The private radiology service stated that longitudinal images[55] of the bladder neck would have been helpful to demonstrate dilation of the upper urethra, which occurs in some cases of PUV. It also told HDC that the renal dilation should have been brought to the notice of the obstetricians and, subsequently, paediatricians at the time of the premature delivery.

86. The private radiology service told HDC that its policy is that, if the sonographer has any concerns about fetal anomalies, then he or she may bring this to the attention of the radiologist on site at the time. It stated:

> "There is no specific policy for remote reporting. In developing our policies and procedures it was felt that the quality of care should be identical for a radiologist reporting remotely compared to a report given on an examination by a radiologist on site. There would obviously be a difference if the radiologist examined the patient themselves, or was consulted directly by the sonographer while the patient was still in the practice. In other cases the communication between the

[54] The radiologist cited a review by the Radiological Society of North America of error rates in dictation.

[55] A longitudinal plane is any plane perpendicular to the transverse plane (which divides the body into top and bottom halves). The coronal plane (see footnote 19) and sagittal plane (see footnote 43) are longitudinal planes.

sonographer and the radiologist is predominantly from the work sheet. On this occasion the sonographer elected not to consult a radiologist directly, since the images adequately illustrated the findings."

87. The private radiology service told HDC that all sonographers have been informed of this case and have been encouraged to consult the radiologist on site with any fetal anomaly, particularly hydronephrosis, whether or not the renal pelvis is significantly dilated. It felt that its policies were worded appropriately.

88. The private radiology service stated that reports and images can be transferred to MCDHB, either electronically or by hard copy. However, the private radiology service stated that this report would not have been made available to staff at MCDHB unless a request was made specifically.

Policies — Private radiology service

89. The private radiology service's policy "Ultrasound Procedures 13. Growth Scan for a 2nd or 3rd Trimester Pregnancy" requires sonographers to check and document as much fetal anatomy as possible.

90. The private radiology service's policy "Radiologists' Procedures 16. Miscellaneous — 16.2 Foetal Anomalies" states:

> "If a significant foetal abnormality is discovered the referring midwife or doctor should be contacted immediately and the patient given an explanation as appropriate. …
>
> Protocol for some foetal anomalies (if solitary, i.e. no 2nd soft sign[56]):
>
> 1. Foetal renal dilatation — repeat scan at 30+ weeks and recommend a scan after birth."

91. the private radiology service's "Quality Manual 5.9 Reporting" states:

> "[W]herever possible the reports shall normally include this information which is required in radiology test reports when it is relevant to the validity or application of the results, or when a client's instructions so requires: …
>
> - Recommendation for further examinations based upon the images recorded and reported on."

92. The "Quality Manual 5.9 Reporting" also states: "In some cases, it is better to communicate the professional judgement by direct dialogue with the referring clinician, in addition to the presentation of the report."

[56] Soft signs include maternal age > 35, choroid plexus (the cells that produce cerebrospinal fluid in the brain) separation ≥ 3mm, echogenic (appears brighter than usual) bowel, echogenic (appears brighter than usual) focus in heart, and choroid plexus cyst.

93. In response to the provisional opinion, the private radiology service stated that the above policies have now been accompanied by national guidelines and MCDHB protocols regarding renal tract imaging.

Further information — MidCentral District Health Board

94. MCDHB apologised to Mr A and Ms A for the delay in diagnosis of Baby A's PUV. It explained that, even if PUV had been diagnosed earlier, Baby A would still have required operations and other medical procedures to be undertaken at Hospital 2. It stated that it is impossible to determine how much of Baby A's renal function impairment is due to antenatal damage and how much was contributed to by the delay in postnatal management. Nonetheless, MCDHB told HDC:

> "We have learnt [from] the quality and effectiveness of the care provided to [Baby A]. The opportunity to review our departures from expected practice, to reflect and to instigate those significant learnings, has, we believe, permanently embedded better clinical practice in our Unit."

95. Dr E has met with Mr A and Ms A to apologise for the delay in diagnosis.

96. MCDHB told HDC:

> "The cause of many of the problems in this case was the incorrect reporting of the antenatal ultrasound which was performed at the private radiology service about one week before delivery. This report was of a near-normal renal system, noting the baby had normal growth and no evidence of oligohydramnios. This near-normal report affected diagnostic thinking when subsequently the 32 week premature infant developed intermittent oedema."

97. Furthermore, MCDHB told HDC that a major issue in this case was paediatric staff's inability to access the written antenatal ultrasound report until several days after the birth. The only information available about the fetal kidneys was a verbal report of borderline problems, which did not include the information that the bladder was not seen to empty during the ultrasound. MCDHB stated that this meant that staff did not have information about the seriousness of the renal dilation and its implications. If this information had been known, there would have been a higher degree of clinical suspicion of more serious renal problems, an earlier postnatal scan would have been prompted, and there would not have been the delay in diagnosis. MCDHB told HDC that this situation exemplifies a disconnect between parts of the health system, where external providers do not advise regarding vital information and the implications for continuity of care.

98. MCDHB stated that it has looked extensively into the problem of having antenatal ultrasounds conducted externally and the transfer of that information into the pregnant woman's notes and subsequently the baby's notes. It advised that there is a process whereby, if a referrer to the private radiology service wishes for MCDHB clinicians to be advised of a report, they can order (at the time of the referral) a copy to be provided to the relevant clinician or department. The person who orders the investigation is responsible for ensuring that the report is made available and

responded to. If the referrer does not do this, but the MCDHB clinician is aware of imaging undertaken at the private radiology service for a patient under his or her care, access to the report can be arranged through the Medical Imaging Department. The Emergency Department has direct access to the private radiology service images and reports. In response to the provisional opinion, the private radiology service told HDC that MCDHB clinicians can access its reports and images by contacting the private radiology service to have these transferred into their picture archiving and communication system.

99. In regard to documentation, MCDHB explained that, at the time of these events, it was testing a new electronic health record. It stated that the documentation of clinical findings and clinical thinking in an electronic health record is quite different from writing paper notes, and staff were recording in bullet or abbreviated form the clinical decisions made, but not necessarily the thinking behind those diagnoses or alternative diagnoses being considered. MCDHB also explained that there was a lack of clinical workstations, and it was difficult to enter data cot-side. At the time of these events, there was not sufficient equipment to allow real-time information to be entered, so, in some cases, paper notes were made and then subsequently entered into the electronic record.

Root Cause Analysis — MidCentral District Health Board

100. A second radiological opinion was obtained as part of MCDHB's review of this incident. The radiologist agreed with the findings documented in Dr B's ultrasound report, but indicated that, in retrospect, this could have been improved either by doing a one-hour delayed ultrasound or a follow-up scan in a few weeks' time, to assess the bladder and renal system. The Root Cause Analysis (RCA) noted that there was no formal policy recommending these actions.

101. The RCA identified the following causal factors for the delay in diagnosis:

- Postnatal ultrasound not brought forward on day 6: it appears that an attempt was made to bring forward the scan booked for 4 Month2 (day 8) to 2 Month2 (day 6), but this was unsuccessful owing to a lack of resource/availability. It is unclear what communication was had with the Medical Imaging Department regarding the ultrasound now being urgent.

- Postnatal ultrasound completed on day 8: the clinical guideline "Hydronephrosis — Neonatal Management" indicated a follow-up ultrasound on days 5–7 of life. The scan was completed on day 8.

- Management of high blood pressure not acted on: on 1 Month2 (day 5), the blood pressure was high, but the repeated blood pressure was within a normal threshold that did not require action. However, the blood pressure was high on the next two days, but appears not to have been acted on by medical staff.

102. The RCA also noted that there was regular documentation of nursing staff raising concerns for the well-being of Baby A with medical staff, and documenting concerns from Mr A and Ms A. Medical staff documented that Baby A was fine, and nursing

staff were given direction not to contact medical staff repeatedly for the same concerns. The RCA found that some nursing staff felt that they were not listened to. It also noted that medical staff found that the change to an electronic record altered their documentation style and the information recorded. It was not easy to see the entire notes in chronological order, so the nursing section could easily be missed. Clinical notes were also written in a more abbreviated style and did not relay critical thinking.

103. The RCA stated that the following changes have been made as a result of this incident:

- The Charge Nurse attends and participates in the daily medical staff handover, so she can raise any concerns that nursing staff might have.
- Each morning the Charge Nurse has a bedside huddle with the registrar to check how everything is going and discuss any concerns.
- All Neonatal Unit staff are participating in effective communication training, and Dr E is undertaking external communication training.
- A multidisciplinary group has been redeveloped to ensure improved coordination and communication between health and social services for improving care for vulnerable pregnancies, including antenatal abnormalities.

104. The RCA recommendations included:

- A review of current best practice for fetal/renal antenatal ultrasound scanning for renal abnormalities.
- Referrers to use a specific date on ultrasound requests rather than a time period, to ensure that scans are booked according to the timeframes in guidelines.
- A process map be completed on the use of the electronic clinical records for various roles to identify areas for further improvement.
- The Child Health Service evaluate the improvements already commenced.
- The Child Health Service consider widening communication training to incorporate standardised communication tools.
- MCDHB work with LMC representatives and key stakeholders for the dissemination of the appropriate referral process, in particular to The multidisciplinary group.

Further changes made — MidCentral District Health Board

105. MCDHB told HDC that it has instigated a weekly departmental review of the ultrasounds that it is aware of, which includes an MCDHB radiologist as well as paediatric doctors.

106. MCDHB stated that it has instituted a Neonatal Unit practice of determining the 95 percentile values for systolic and diastolic blood pressure and entering these values on observation charts. If a blood pressure recording is above these values, recordings are repeated. If there are three recordings above the values, this is investigated further.

107. MCDHB told HDC that it has also undertaken education for staff about the use of the electronic health record, increased its expectations of the fullness of that documentation, and has worked with the vendors to improve the free format text abilities of the system. It stated that it has also been working to identify suitable equipment for additional clinical workstations and ergonomic solutions to site the equipment cot-side. Implementation is underway urgently to enable safe and comprehensive documentation in real time at the cot-side.

108. Further, MCDHB told HDC that it has undertaken an assessment of the functioning of the electronic record system and is working to improve the functionality and clinical suitability of the system. It stated that it was engaged with the Ministry of Health over the need for improvements, before the system is implemented nationally. MCDHB told HDC that this is an extensive continuous improvement project that will take many months.

Responses to provisional opinion

109. The parties were provided with relevant sections of the provisional opinion for their comment. Responses to the provisional opinion were received from MCDHB, the private radiology service, Dr B, and Ms C. Where appropriate, information has been incorporated above into the "information gathered" section of the report. Mr A did not comment in response to the "information gathered" section of the provisional opinion.

110. MCDHB confirmed that it accepts the provisional decision and recommendations.

111. In response to the provisional opinion, the private radiology service told HDC that it has ensured that its policy regarding obstetric ultrasound scans in second and third trimesters has been fully scrutinised by both radiology and sonography staff. The private radiology service stated that Ms C has used this unfortunate incident to educate her fellow sonographers, and that this incident has been used in an educational manner for both junior and senior sonographers at the private radiology service.

112. In response to the provisional opinion, Ms C told HDC that she has since attended two different study courses regarding fetal kidney imaging and the accepted practices, and that one course covered new national guidelines. Ms C stated that she found the courses valuable and she used this as an opportunity to better improve her skills and knowledge in relation to antenatal scanning of fetal kidneys. She noted that new guidelines have been developed to better manage antenatally detected fetal renal dilation.

113. In response to the provisional opinion, Dr B noted that the typographical error became irrelevant when Baby A was born prematurely, and that MCDHB considered that the major item of information relevant in the delay in diagnosis was the inability to access

the written antenatal ultrasound report. Dr B noted that the MCDHB internal review did not identify the reporting, the degree of abnormality, or the recorded measurement as causal factors for the delay in diagnosis for Baby A.

114. Dr B also provided HDC with a further report from a radiologist

Relevant standards

115. MCDHB's clinical guideline "Hydronephrosis Neonatal Management" (2014) states:

"**1. PURPOSE**

Antenatal hydronephrosis (dilatation of the pelvis of the fetal kidney) is the commonest fetal anomaly detected by antenatal ultrasound screening. Whilst the majority of these do not have a significant underlying cause there are a few which have life or kidney threatening diagnoses which need to be acted on in an appropriate and timely fashion.

Antenatal kidney abnormalities need to be confirmed by postnatal ultrasound.

2. CLINICAL GUIDELINE

Hydronephrosis and pyelectasis are equivalent terms and both infer dilatation of the renal pelvis …. **Normal would be considered less than 5mm.**

… The greatest dilatation on any scan … should guide further management.

2.1 For unilateral hydronephrosis < 10mm (and there is a normal kidney on the other side):

LMC management is appropriate. These infants should be examined at birth as is routine, with particular attention to any abdominal (kidney) masses. **Arrange an [ultrasound] at 1–4 weeks of age.** …

2.2 For unilateral hydronephrosis 10–15mm:

LMC should contact the paediatric registrar or paediatrician of the day to arrange management. These infants should be examined at birth as is routine, with particular attention to any abdominal (kidney) masses. **Arrange an USS on day 5–7 of life and repeat this at 6–8 weeks of life.**

2.3 For bilateral hydronephrosis with both sides 5–10mm:

Proceed as for unilateral hydronephrosis 10–15mm.

2.4 For unilateral hydronephrosis >15mm or bilateral hydronephrosis with both sides >10mm, or any suggestion of posterior urethral valves (in BOYS ONLY):

LMC should contact the paediatric team to make them aware of the impending delivery. These babies need examination including a blood pressure performed early. If possible the urinary stream should be observed. Blood sampling for creatinine should be considered on day 1–3 (although serum creatinine will not reflect the child's renal function until 48–72 hours of age).

An USS may be required on day 1."

116. Standards New Zealand Health and Disability Services (Core) Standards 2008 standard "Consumer Information Management Systems" states:

"**Standard 2.9 Consumer information is uniquely identifiable, accurately recorded, current, confidential, and accessible when required.**

Criteria The criteria required to achieve this outcome shall include the organisation ensuring:

2.9.1 Information is entered into the consumer information management system in an accurate and timely manner, appropriate to the service type and setting. …

2.9.6 Management of health information meets the requirements of appropriate legislation and relevant professional and sector Standards where these exist."

Opinion: Dr B — adverse comment

117. Ms A's pregnancy was complicated by severe vaginal bleeding at 11 weeks' gestation, following which an ultrasound identified a fibroid. It was recommended in the ultrasound report that Ms A have a follow-up ultrasound at around 32 weeks' gestation. Her back-up LMC referred her for the follow-up ultrasound, which was undertaken at 31 weeks. The indication listed was "fundal height less than expected".

118. Dr B was the radiologist who reported on Ms A's 31-week ultrasound, on 31 weeks' gestation. Dr B reported on Ms A's ultrasound remotely, via teleradiology. It would have been possible for Dr B and the sonographer, Ms C, to have discussed the ultrasound via telephone.

Reporting of renal abnormality – adverse comment

119. Dr B reported: "[B]ilateral fetal renal dilation (5mm). Fetal bladder appears somewhat overfilled. Bladder was not seen to empty during the study. Sex of the fetus is uncertain to me." The renal pelvic dilation was actually 9.5mm on the right and 14mm on the left at its greatest.

120. Dr B told HDC that the 5mm figure given in the body of his report meant that the degree of fetal renal pelvic dilation was not described accurately. He stated that this was a typographical error on his part.

121. The private radiology service told HDC that more focus in the report could have been placed on the severity of the renal dilation. It stated that the dilation was intermittent, and on some images the kidneys are both a lot less dilated than on other images, but the dilation was significant.

122. As part of its RCA, MCDHB obtained a second radiologist opinion. The radiologist agreed with the findings documented in Dr B's report.

123. My expert advisor, radiologist Dr Robert Sim, conducted a review of the ultrasound of 31 weeks' gestation and advised:

> "The pertinent recorded finding on the images is bilateral fetal hydronephrosis, with the … dimensions of the dilated collecting system in the right kidney 9.5mm and of the dilated collecting system in the left kidney 14mm."

Conclusion

124. I acknowledge that Dr B did identify and report on the renal abnormality and the overfilled bladder. However, I am concerned that he misreported the abnormality, as the measurements of the renal pelvic dilation stated in the report were incorrect. Ultimate responsibility for the reporting and supervision of Ms A's ultrasound lay with Dr B. I am concerned that Dr B failed to state the correct measurements regarding the bilateral dilation and to accurately convey the significance of the situation.

125. I acknowledge that the MCDHB internal review did not identify the reporting, the degree of abnormality, or the recorded measurement as causal factors for the delay in diagnosis for Baby A. However, I remain of the view that the correct measurements were important to inform subsequent providers involved in Baby A's care regarding the significance of the renal abnormality.

Opinion: Ms C — other comment

126. Ms A's pregnancy was complicated by severe vaginal bleeding at 11 weeks' gestation, following which an ultrasound identified a fibroid. The ultrasound report recommended a follow-up ultrasound at around 32 weeks. Her back-up LMC referred her for the follow-up ultrasound, which was undertaken at 31 weeks. The indication listed was "fundal height less than expected".

127. Ms C was the sonographer who performed Ms A's 31-week ultrasound, on 31 weeks' gestation, at the private radiology service. Ms C noted on the sonographer's worksheet, "Kidneys appear dilated ? rescan once born" and, on one image, placed

cursors on Baby A's renal pelves, measuring 4.1mm on the right and 5.1mm on the left. The renal pelvic dilation was greatest on another image, measuring 9.5mm on the right and 14mm on the left. No cursors were placed on this image. Ms C did not record any measurements for renal pelvic dilation on the sonographer's worksheet.

128. The private radiology service's policy "Ultrasound Procedures 13. Growth Scan for a 2nd or 3rd Trimester Pregnancy" required sonographers to check and document as much fetal anatomy as possible Ms C told HDC that, on review, she should have extended the ultrasound further and examined the bladder in more detail with a coronal image, waited to assess whether the bladder emptied during the scan, and reviewed the scan with the reporting radiologist at the time, with a view to referral to an obstetrician.

129. Ms C also told HDC that she now routinely takes a coronal bladder image and, if the bladder appears at all distended, she reviews it at the end of the scan. If it is still distended and has not been seen to empty, she brings this to the attention of the reporting radiologist before the consumer leaves the clinic.

130. My expert advisor, sonographer Naomi Rasmussen, advised me that the care provided by Ms C on 31 weeks' gestation was within the range of accepted practice, as the renal abnormality was documented in the images and commented on in the worksheet ("Kidneys appear dilated"). Mrs Rasmussen stated that it is difficult to assess whether the bladder should have been commented on, with it appearing on the one image recorded as within the upper limits of normal.

131. However, Mrs Rasmussen advised:

> "It is possible that a more experienced Sonographer, or one with Fetal Medicine experience might have examined the bladder in a long axis view and shown a 'keyhole bladder' seen with Posterior Uretheral Valves."

132. Further, Mrs Rasmussen stated that "the ideal standard" would have been for Ms C to have discussed the findings of the scan with Dr B, although it is accepted practice to document the findings on the sonographer's worksheet.

Conclusion

133. I acknowledge Ms C's comments that she considers that she should have extended the ultrasound further, waited to assess whether the bladder emptied, and reviewed the scan with the reporting radiologist at the time, and I note Mrs Rasmussen's advice that "the ideal standard" would have been to have discussed the findings of the scan with Dr B. However, overall, I accept Mrs Rasmussen's advice that the care Ms C provided to Ms A on 31 weeks' gestation was within the range of accepted practice.

Opinion: Private radiology service

134. The private radiology service had a responsibility for ensuring that Ms A received an appropriate standard of care. It needed to have adequate systems and procedures in place and to provide appropriate guidance to enable compliance with those systems and procedures.

135. At the time of these events, the private radiology service had relevant policies and procedures in place relating to antenatal ultrasound, although it did not have any protocols relating specifically to fetal renal dilation. My expert advisor, sonographer Naomi Rasmussen, advised me that "the relevant [sonography] policies and procedures in place at [the private radiology service] were adequate".

136. Furthermore, my expert advisor, radiologist Dr Robert Sim, advised:

> "[The private radiology service] protocols for obstetric ultrasound scans in second and third trimesters are satisfactory quality assurance documents for the purposes of the conduct of these examinations. They are typical of those held by other radiology practices accredited by International Accreditation New Zealand (IANZ). It should be noted that a protocol relating to fetal renal tract dilatation in pregnancy is currently unlikely to be held as a quality assurance document in most community based radiology practices. This information would be considered as radiologist and sonographer knowledge."

Conclusion

137. I am satisfied that the private radiology service's policies and procedures were appropriate.

Opinion: MidCentral District Health Board — breach

138. Baby A was born at the public hospital on 28 Month1, at 32 weeks' gestation. He was admitted to the Neonatal Unit, owing to his prematurity, and subsequently was diagnosed with PUV.

139. This case has highlighted particular hospital system issues that contributed to Baby A receiving suboptimal care — in the areas of clinical care, co-ordination of care, documentation, and culture.

Clinical care — breach

140. Under Right 4(1) of the Code, Baby A had the right to have services provided with reasonable care and skill.

141. On admission to the Neonatal Unit, it was verbally reported to paediatric staff that an antenatal ultrasound had reported bilateral fetal renal dilation of 5mm. This finding was then documented in the clinical records. Paediatric staff were not informed that

the bladder appeared somewhat overfilled and was not seen to empty during the ultrasound (as stated in the ultrasound report). The following day, a postnatal ultrasound was requested for one week's time (4 Month2, day eight of life).

142. My expert advisor, paediatrician Dr Phillip Moore, advised:

> "Given the report findings of bilateral mild hydronephrosis (5mm bilaterally, normal <5mm), with normal liquor volume, the accepted standard of care … is for a repeat renal ultrasound on day seven of life. Earlier ultrasound can be misleadingly reassuring. … In my opinion [the public hospital] did respond appropriately to the reported antenatal ultrasound report findings. There is no departure from standard of care."

143. On 29 Month1, Baby A developed oedema. Blood tests were taken and IV antibiotics were prescribed; however, MCDHB told HDC that, because infection was being looked for, Baby A's kidney function was not checked. Baby A's oedema continued, and his urine output was monitored. MCDHB told HDC that the near-normal antenatal ultrasound report affected diagnostic thinking.

144. On 31 Month1, nursing staff documented in Baby A's progress notes that Ms A was worried about Baby A's kidney. Mr A told HDC that, during Baby A's admission, he and Ms A continually asked nursing staff about Baby A's oedema, but were reassured that everything was normal.

145. Dr Moore advised:

> "Oedema usually represents a normal finding in otherwise well babies. Further, the literature suggests that oedema is an unusual sign in the context of posterior urethral valves. … During these first four days all other vital signs were normal and urine output was being monitored appropriately. In my opinion, many Paediatricians would have checked serum electrolytes, albumin and renal function in an oedematous baby. However, there is no clear accepted standard of practice in this regard and as baby was off IV fluids by 24 hours no clear imperative to do so. Blood pressure was normal at admission. It was not rechecked over the first four days of life. Given otherwise reassuring progress that is not unreasonable. **In my opinion the presumption that the oedema was normal oedema of prematurity was reasonable, and represents an appropriate standard of care for the first four days of life.**"[57]

146. On the morning of 1 Month2, Baby A's blood pressure was elevated, but was within the normal range when repeated that evening. In the afternoon on 1 Month2, nursing staff documented that Ms A felt that Baby A's oedema had increased slightly since the previous day. On 2 Month2, paediatric staff attempted to bring forward the postnatal renal ultrasound booked for 4 Month2, in response to Baby A's elevated blood pressure the previous day. MCDHB told HDC that it was unable to be brought forward, owing to the unavailability of sonography staff. However, the request was

[57] Emphasis as per original.

not made urgently, and it was considered reasonable to proceed with the booking for 4 Month2. Baby A remained oedematous, his blood pressure was elevated on 2 and 3 Month2, and his urine output was diminished.

147. MCDHB told HDC that causes other than renal abnormalities were being looked for to explain the high blood pressure, as the near-normal antenatal ultrasound report was "likely influencing clinical thinking". In this respect, the clinical records for the afternoon of 2 Month2 state: "[Dr E] has explained that dilatation is minimal and unlikely to be significant. … Mild oedema proximal lower limbs. Baby is fine."

148. In the afternoon on 2 Month2, Dr E reviewed Baby A, as Mr A and Ms A were anxious about Baby A's oedema and fetal renal dilation, and wanted an ultrasound to be undertaken urgently.

149. In the morning on 3 Month2, the Charge Nurse Manager of the Neonatal Unit documented:

> "Discussion with [Dr E] and [Dr G] about baby. They have absolutely no concerns about baby's health. Oedema [and] one raised [blood pressure] unconcerning. … Baby is well."

150. At the morning ward round, a paediatric registrar noted that Mr A and Ms A were very concerned about renal dilation and oedema, but had been reassured many times.

151. The RCA found that the casual factors in this case were the postnatal ultrasound not being brought forward on 2 Month2 when an attempt was made to do so, the postnatal ultrasound taking place on day 8, rather than day 5–7, and Baby A's high blood pressure not being acted on. The RCA also noted that medical staff found that the change to an electronic record altered their documentation style and the information recorded. It was not easy to see the entire notes in chronological order, so the nursing section could easily be missed.

152. Dr Moore advised:

> "After day five it is clear that the oedema was worsening. This is also the stage at which blood pressures were rising into the hypertensive range … In my opinion this combination of worsening oedema and hypertension should have led to earlier investigation with blood tests and the planned renal ultrasound scan. … **I view this failure to act earlier to investigate the oedema and hypertension with blood tests and an ultrasound scan as a departure from accepted practice. I would consider this departure to be of moderate significance.**"[58]

153. Dr Moore also advised:

> "It follows from the above that in my opinion the diagnosis of posterior urethral valves and renal failure **could** have been made somewhere between 48 and 72 hours earlier than it was. If a blood test to look at renal function had been

[58] Emphasis as per original.

> performed on day five when hypertension was first noted, and the scan expedited, the diagnosis would have been made earlier. I do not believe an earlier diagnosis would have made any difference to the subsequent care or progress that [Baby A] made. … **Nevertheless, in my opinion, the delay in diagnosis of renal failure should be considered a departure from accepted practice. I would view this departure as of mild significance.**"[59]

Conclusion — clinical care

154. I accept Dr Moore's advice that MCDHB responded appropriately to the reported antenatal ultrasound findings of bilateral fetal renal dilation of 5mm. I also accept his advice that the care provided to Baby A on the first four days of his life was appropriate.

155. However, based on Dr Moore's advice, I am critical that MCDHB paediatric medical staff did not investigate Baby A's worsening oedema and high blood pressure earlier, from day five of life. I note that an attempt was made to bring forward the postnatal ultrasound, but that this was not requested urgently. I am particularly concerned about these delays in investigation, given that Mr A and Ms A repeatedly raised their concerns and requested earlier investigations. I consider that this represents a lack of responsiveness and clinical judgement on the part of paediatric medical staff.

156. Overall, I consider that MCDHB did not provide care to Baby A with reasonable care and skill and, therefore, breached Right 4(1) of the Code.

Coordination of care — breach

157. Under Right 4(5) of the Code, Baby A had the right to co-operation among providers to ensure quality and continuity of services.

158. RM D told HDC that she provided the Obstetric Team at the public hospital with a copy of the antenatal ultrasound report of 31 weeks' gestation, when Ms A's care was transferred to them on 24 Month1. Subsequently, paediatric staff recall being verbally informed, when Baby A was admitted to the Neonatal Unit on 28 Month1, that an antenatal ultrasound had reported bilateral fetal renal dilation of 5mm. The antenatal screening section of Baby A's admission records states: "Bilateral renal dilatation (5mm)." "Renal pelvi-calyceal dilatation (antenatal hydronephrosis)" was also listed amongst Baby A's admission diagnoses/problems, and this continued to be listed as a diagnosis throughout his admission. The documented management plan included requesting a postnatal renal ultrasound. However, obstetric staff did not provide paediatric staff with a copy of the antenatal ultrasound report, and a copy of the report was not placed in Baby A's clinical records.

159. The private radiology service faxed a copy of the antenatal ultrasound report to the Ultrasound Department at the public hospital on 29 Month1. However, again, the report was not provided to paediatric staff and a copy was not placed in Baby A's clinical records.

[59] Emphasis as per original.

160. MCDHB told HDC that paediatric staff were unaware that the antenatal ultrasound report stated that Baby A's bladder appeared overfilled and was not seen to empty, and that, had they known this, they would have been more suspicious of a renal abnormality. MCDHB stated that a major issue in this case was the paediatric staff's inability to access the antenatal ultrasound report, which exemplifies a disconnect between parts of the health system where external providers do not advise of vital information.[60] However, MCDHB also stated that its policy is that, where an MCDHB clinician is aware of imaging undertaken at the private radiology service for a patient under his or her care, access to the report can be arranged through the Medical Imaging Department.

Conclusion — coordination of care

161. I am concerned that the Obstetric Team did not pass on all relevant information to paediatric staff and that a copy of the antenatal ultrasound report was not transferred from Ms A's clinical records to Baby A's clinical records when he was born. I am also critical that the Ultrasound Department received a copy of the antenatal ultrasound report from the private radiology service on 29 Month1, but did not disseminate it to relevant paediatric staff. This is suboptimal coordination of care.

162. Furthermore, I consider that paediatric staff should have requested a copy of the antenatal ultrasound report, either from the Obstetric Team or from the private radiology service, when verbally informed of the fetal renal dilation.

163. Overall, I consider that MCDHB failed to ensure continuity of care and, therefore, breached Right 4(5) of the Code. This failure had an adverse impact on the quality of care provided to Baby A.

Documentation — breach

164. Under Right 4(2) of the Code, Baby A had the right to have services provided that complied with legal, professional, ethical, and other relevant standards. Standards New Zealand Health and Disability Services (Core) Standards require organisations to ensure that information is entered into the consumer information management system in an accurate and timely manner, appropriate to the service type and setting, and that the management of health information meets the requirements of appropriate legislation and relevant professional and sector standards where these exist.

165. As I have stated previously, "It is essential to a patient's seamless continuity of care that all clinical reviews and decisions are fully documented. The omission to do so creates potential risk, particularly in the hospital setting where multiple staff are involved in a patient's care."[61]

166. It is not documented who provided the verbal report of fetal renal dilation to paediatric staff; who requested a copy of the antenatal ultrasound report on 29

[60] Ms D provided a copy of the antenatal ultrasound report to obstetric staff on 24 Month1, and the private radiology service faxed a copy of the antenatal ultrasound report to the public hospital's ultrasound department when requested on 29 Month1.
[61] See 13HDC00482 (18 Month3) and 10HDC01344 (20 June 2013), available at www.hdc.org.nz.

Month1; why the report was requested and what occurred once the request was received; who first requested that Baby A's nappies be weighed; or any detail of the attempt to bring forward the postnatal ultrasound to 2 Month2, including the reasoning and urgency. In addition, there is little documentation about the clinical thinking in regard to the management of Baby A's oedema and elevated blood pressure. Furthermore, on Baby A's medication chart, it was inaccurately stated that he was administered 90.6mg of gentamicin rather than 6.3mg.

167. MCDHB told HDC that, at the time of these events, it was testing a new electronic health record, and staff were recording in bullet or abbreviated form the clinical decisions made, but not necessarily the thinking behind those diagnoses or alternative diagnoses being considered. It explained that there was also a lack of clinical workstations, and it was difficult to enter data cot-side so, in some cases, paper notes were made and then subsequently entered into the electronic record.

168. My expert advisor, Dr Moore, advised:

> "It is clear that [public hospital] staff were becoming used to a new electronic records system. I am not familiar with this system and as an independent assessor I found the medical notes in particular hard to follow. It is difficult to get a sequence of events and it appears that some of the note-taking is incomplete. The [public hospital] team might like to review their use of this electronic system and ensure that improvements are made."

Conclusion — documentation

169. There is a pattern of suboptimal documentation by multiple staff involved in Baby A's care. In my view, the environment in which MCDHB staff were operating (with a new electronic system being tested, but insufficient equipment provided to use it properly) contributed considerably to the documentation failures in this case. Accordingly, I consider that MCDHB failed to provide services to Baby A that complied with relevant standards, and thereby breached Right 4(2) of the Code.

Culture — adverse comment

170. In the morning on 3 Month2, the Charge Nurse Manager of the Neonatal Unit documented:

> "Discussion with [Dr E] and [Dr G] about baby. They have absolutely no concerns about baby's health. Oedema [and] one raised [blood pressure][62] unconcerning. … Baby is well. The senior medical staff have asked nurses to please give consistent feedback to parents and be on the same page that nothing is wrong with the infant."

171. At the morning ward round, a paediatric registrar noted that Mr A and Ms A were very concerned about renal dilation and oedema, but had been reassured many times.

[62] There had actually been two raised blood pressure readings at this time — on the morning of 1 Month2 and on the evening of 2 Month2.

The management plan stated: "Please reassure parents that kidneys and oedema are normal. Does not need multiple doctors' reviews regarding this."

172. The RCA found that some nursing staff felt that they were not listened to.

Conclusion — culture

173. I am concerned that nursing staff were instructed to reassure Mr A and Ms A that Baby A was fine, and were told that Baby A did not require multiple medical reviews in relation to his oedema, particularly in light of the fact that the RCA found that some nursing staff felt that they were not listened to. It is important that medical staff work in partnership with nursing staff and take their views into consideration.

174. Previously I have emphasised the importance of any provider who has concerns about a patient:

> "… doing everything possible to voice his or her concerns and advocate for the patient in accordance with professional and ethical duties. The DHB should encourage a culture where it is acceptable to voice concerns and ask questions to and from any point in the hierarchy."[63]

Recommendations

175. I recommend that MCDHB:

a) Report back to HDC on the implementation of the recommendations arising from the RCA, including a review of current best practice for fetal/renal antenatal ultrasound scanning for renal abnormalities, within six months of the date of this report.

b) Provide refresher training to all paediatric staff on the procedure for obtaining copies of external ultrasound reports, and remind all maternity staff of the importance of transferring relevant information from the mother's clinical records into the baby's clinical records, and report back to HDC on this within six months of the date of this report.

c) Undertake a qualitative audit to check for appropriate use of the electronic health record in the Neonatal Unit, obtain feedback from staff regarding any user issues, implement a mechanism for ensuring ongoing staff communication of issues, and report back to HDC within six months of the date of this report.

d) Provide a detailed update to HDC on progress toward additional clinical workstations being situated cot-side, within six months of the date of this report.

e) Provide a written apology to Ms A and Mr A. The apology should be sent to HDC within three weeks of the date of this report, for forwarding to Ms A and Mr A.

[63] See 12HDC00846.

176. I recommend that Dr B provide a written apology to Ms A. The apology should be sent to HDC within four weeks of the date of this report for forwarding to Ms A.

Follow-up actions

177. A partially anonymised copy of this report, with details identifying the parties removed except the experts who advised on this case and MidCentral District Health Board, will be sent to the Medical Council of New Zealand, HealthCERT (Ministry of Health), and the New Zealand Maternal Fetal Medicine Network, and placed on the Health and Disability Commissioner website, www.hdc.org.nz, for educational purposes.

Appendix A: Independent paediatric advice to the Commissioner

The following expert advice was obtained from paediatrician Dr Philip Moore:

"I have been asked to provide expert advice to the Health & Disability Commissioner on Case no. C15HDC00464. I have read and agreed to follow the Commissioner's Guidelines for Independent Advisors.

My name is Philip Peter Charles Moore. I am a Fellow of the Royal Australasian College of Physicians (1993) and have worked as a General Consultant Paediatrician at Hawke's Bay Hospital for 22 years. My experience includes provision of neonatal intensive care in a Level 2A Special Care Baby Unit.

In providing this opinion I have reviewed the original complaint, the response from the MidCentral District Health Board, the MidCentral and Capital Coast District Health Board health records, and all relevant laboratory and x-ray reports. I have also reviewed literature relating to the presentation, diagnosis and management of antenatal hydronephrosis, neonatal hypertension and posterior urethral valves.

I provided an opinion on 5th October 2015. I have now been provided with further nursing observation records from MidCentral District Health Board which cause me to revise my initial opinion.

The Commissioner has asked me to provide an opinion on the following issues.

1. Whether [public hospital] staff responded appropriately to the renal dilation noted on the antenatal ultrasound report.

2. Whether [Baby A's] oedema and blood pressure were adequately investigated.

3. Whether the diagnosis of renal failure should have been made earlier.

4. Any other comments on the care provided.

Background of case (as provided by Senior Complaints Assessor)

'[Baby A] was born at [the public hospital] on 28th [Month1] at 32 weeks gestation. He subsequently developed intermittent oedema and high blood pressure. On 4th [Month2] blood tests were taken which showed increased creatinine, indicating renal impairment. An ultrasound of the kidneys showed posterior urethral valves and moderate nephrosis. [Baby A] was transferred later that day to [Hospital 2] due to renal failure and now has permanent kidney damage.

MidCentral District Health Board acknowledges that there was a delay in diagnosis, but claims this was partly caused by the incorrect reporting of an antenatal ultrasound undertaken on 21st [Month1]. It states that the report was of a

near-normal renal system noting that the baby had normal growth and no evidence of oligohydramnios. MidCentral District Health Board advises that this report influenced clinical thinking as causes other than renal abnormalities were being looked for. This office subsequently obtained a copy of the report which notes a 5 mm bilateral foetal renal dilation and suggests postnatal assessment.'

Timeline of case (from my review of the medical and nursing records)

[Ms A] was a 34 year old woman in her first pregnancy. The pregnancy was complicated by gestational diabetes, treated mostly with diet, and threatened preterm labour at 27 weeks gestation.

On 21st [Month1] an antenatal ultrasound scan was performed to assess growth of the foetus. This scan revealed normal growth. It also revealed bilateral foetal renal pelvis dilatation of 5 mm. The foetal bladder was described as 'somewhat overfilled' and the bladder did not empty during the study. Amniotic fluid volume was described as normal (no oligohydramnios). The sex of the baby was not determined and there was no comment, or measurement of the thickness of the bladder wall. The radiologist commented that 'postnatal assessment is suggested'.

Spontaneous pre-labour rupture of membranes occurred 71 hours before eventual delivery, steroids were given for lung development. Because of variable maternal blood sugars an insulin infusion was given. Because of the early rupture of membranes intravenous penicillin was given. Labour was induced and proceeded to a normal cephalic vaginal delivery.

[Baby A] was born at [the public hospital] at 0259 hours on 28th [Month1] (Day one) at 32 weeks and two days gestation. Birth weight was 1812 grams (50th percentile). Apgars were 91 and 105 and no resuscitation was required after he cried at birth. He was transferred to the Neonatal Unit for ongoing management.

On admission to the Neonatal Unit his temperature was 36.5°C, a low initial blood sugar of 1.1mmol/L was documented. He was warmed in an incubator and intravenous dextrose was commenced. Initial full blood count was normal. Initial CRP was <1. Admission blood pressure is documented as 72/35 (mean of 51) which is normal. Caffeine was commenced at 20 hours of age because of some episodes of apnoea and desaturation.

The antenatal renal ultrasound findings are mentioned in the admission note and it was recognised that a follow-up renal ultrasound scan should be requested.

By day two of life baby had a normal body temperature and the incubator temperature was reducing. Blood sugars were all satisfactory after the initial low sugar. Oral feeds were tolerated and intravenous fluids were able to be discontinued at 24 hours of age. Urine was first passed at 23 hours of age following which 'good amounts' of urine were noted.

Later on day two of life, at 38 hours of age, some redness was noted around the umbilicus. Repeat full blood count and CRP were again normal. Electrolytes and

renal function were not checked. Intravenous antibiotics (Gentamicin and Amoxicillin) were commenced for a possible periumbilical infection.

At 42 hours of age, also on day two of life, the first mention of some pitting oedema of the right leg was documented. Various degrees of oedema were then noticed by various members of staff over the next week of life. The notes suggest oedema of moderate degree in dependent areas, moving with positioning of the baby. Other vital signs (respiratory rate, pulse rate, temperature), and feeding behaviour and activity, remained normal.

Standard monitoring of urine output was continued over the first few days of life. This was done by counting distinct episodes of micturition (passage of urine) with some estimation of volumes and times. The number of discrete episodes of passage of urine varied between 4–5 in every 24 hour period and, when measured, the measured amounts were normal. Evidence suggests [Baby A] had normal urine output for the first six days of life. No description or observation of urinary stream was made but that is not unusual in care of preterm babies.

[Baby A] had blood pressure measured very soon after birth which is normal practice. The blood pressure recorded was 72/35 (mean of 51) which is normal. Blood pressure was then not measured again until day five of life, when on 1st [Month2] at 0800 hours it is recorded as 86/54 (mean 64) in the left arm, 88/64 (mean 74) in the right arm, 83/53 (mean 63) in left leg and 95/66 (mean 76) in right leg. These blood pressures are raised according to accepted normal values.

A further blood pressure check on 1st [Month2] at 1935 hours is recorded as 73/48 (mean of 57) in the left arm and 70/42 (mean of 52) in the right arm. These blood pressures are normal according to the accepted values.

On day six of life, 2nd [Month2], the blood pressure is recorded as 83/57 (mean of 66) which is raised between the 95th and 99th percentile of the accepted normal range. That day four urine outputs are recorded (two small, one moderate and one ‘very wet’) and urine output was not causing concern. A request for the planned renal ultrasound scan was sent that day.

By day seven of life, 3rd [Month2], the nursing and medical records are indicating more significant oedema, e.g. notes including ‘very oedematous, worse, oedema present on both legs, up the thigh, face and eyelids that he lies on’. On this day the blood pressure is recorded as 95/60 (mean of 73) which is now clearly above the 99th centile of the quoted normal range and is indicative of significant hypertension. The medical and nursing records hint that there were concerns about decreasing urine output e.g notes including ‘Baby’s nappies can be weighed to monitor urine output if **ongoing concerns of low output**.’ (my emphasis).

Because of these combined concerns, and the repeated expressions of concern from the baby’s parents, blood tests were performed and the planned ultrasound scan was performed on day eight of life, Wednesday 4th [Month2]. The correct diagnosis of posterior urethral valves with renal failure was then made.

The second renal ultrasound scan showed bilateral hydronephrosis, bilateral hydroureter, a thick walled bladder and dilatation of the posterior urethra — all findings consistent with posterior urethral valves. By this stage serum creatinine was 401 µmol/L, serum potassium was 7.7 mmol/L, serum sodium 126 mmol/L.

Management then proceeded along standard lines with stabilisation, drainage of the obstructed system via urinary catheter, management of subsequent post obstructive diuresis and electrolyte abnormalities, and transfer to the tertiary neonatal unit. The neonatal course following that was rather stormy with a large post-obstructive diuresis, electrolyte abnormalities and a seizure, but baby eventually proceeded to successful surgical ablation of the valves via cystoscopy at around five weeks of age.

Baby returned to [the public hospital] for a further nine day stay with eventual discharge on 27th [Month3]. At the time of discharge renal function had returned to normal, blood pressure had returned to normal on no treatment and although long-term prognosis remains guarded, there is a reasonable likelihood that normal renal function will be maintained.

Issues

1. *Whether [public hospital] staff responded appropriately to the renal dilation noted on the antenatal ultrasound report.*

   The [the public hospital] staff could only act on the information provided. Given the report findings of bilateral mild hydronephrosis (5 mm bilaterally, normal <5mm), with normal liquor volume, the accepted standard of care (Starship Clinical Guidelines) is for a repeat renal ultrasound on day seven of life. Earlier ultrasound can be misleadingly reassuring.

   In my opinion this initial ultrasound scan report is incomplete. In particular, comment or measurement of bladder wall thickness could have been helpful.

   In my opinion the [the public hospital] staff did respond appropriately to the reported antenatal ultrasound report findings. There is no departure from standard care.

2. *Whether baby's oedema and blood pressure were adequately investigated.*

   First four days:
   Oedema is very common in preterm babies. It is also more common in infants of diabetic mothers. Oedema usually represents a normal finding in otherwise well babies. Further, the literature suggests that oedema is an unusual sign in the context of posterior urethral valves. In the section of UpToDate (2015) concerning the clinical presentation and diagnosis of posterior urethral valves, most infants after birth present with failure to thrive, poor urine stream, urosepsis or respiratory distress. No mention is made of oedema.

Having said that, oedema was first noticed in the right leg on day two of life. Oedema is then noted every day following, varying in severity and involving different parts of the body. It is clear from the records that baby's parents were very concerned about this oedema and were reassured repeatedly and by various staff that this was nothing to be concerned about. Staff assessment was that this was oedema of prematurity, a common and benign finding in many premature babies.

During these first four days all other vital signs were normal and urine output was being monitored appropriately. In my opinion, many Paediatricians would have checked serum electrolytes, albumin and renal function in an oedematous baby. However, there is no clear accepted standard of practice in this regard and as baby was off IV fluids by 24 hours no clear imperative to do so.

Blood pressure was normal at admission. It was not rechecked over the first four days of life. Given otherwise reassuring progress that is not unreasonable.

In my opinion the presumption that the oedema was normal oedema of prematurity was reasonable, and represents an appropriate standard of care for the first four days of life Therefore, I do not believe management of the oedema or blood pressure to day four of life represents a departure from accepted practice.

Day 5 onwards:
After day five it is clear that the oedema was worsening. This is also the stage at which blood pressures were rising into the hypertensive range (see above). Blood pressures at 0800 hours on 1st [Month2] (into the fifth day of life) were abnormal. When repeated 12 hours later they were normal. It is unclear from the notes that the abnormal pressures were recognised.

The normal values for blood pressure at 32 weeks gestation vary from study to study. An acceptable standard of care in the New Zealand setting would be the values given in the Starship Hospital guidelines for hypertension. These guidelines would suggest that the 95th centile for blood pressure would be 83/55 (mean of 62) and the 99th centile would be 88/60 (mean of 69). It is these values I have used in providing this opinion.

Alternative values are given in the National Women's Newborn Services Clinical Guidelines, which suggest a systolic BP of 67 mmHg (97%ile) on Day 1, rising to a systolic BP of 94 mmHg by Day 10.

As detailed above, by Day 5 of life (0800 hrs, 1st [Month2]) the blood pressure was between the 95% and 99%ile. By Day 7 of life (1600 hrs, 3rd [Month2]) the blood pressure is above the 99%ile.

In my opinion this combination of worsening oedema and hypertension should have led to earlier investigation with blood tests and the planned renal ultrasound scan. Mention is made at a couple of points in the record to 'bringing the renal ultrasound scan forward' but this did not occur. It appears the scan was ordered on Monday 2nd [Month2], Day six, which is appropriate, but then not performed until Wednesday 3rd [Month2], Day eight.

I view this failure to act earlier to investigate the oedema and hypertension with blood tests and an ultrasound scan as a departure from accepted practice. I would consider this departure to be of moderate significance.

3. *Whether the diagnosis of renal failure should have been made earlier*

It follows from the above that in my opinion the diagnosis of posterior urethral valves and renal failure **could** have been made somewhere between 48 and 72 hours earlier than it was. If a blood test to look at renal function had been performed on day five when hypertension was first noted, and the scan expedited, the diagnosis would have been made earlier.

I do not believe an earlier diagnosis would have made any difference to the subsequent care or progress that [Baby A] made. Management would still have involved relief of obstruction, correction of fluid and electrolyte abnormalities, and transfer to a tertiary unit. Management would still have included surgery at the same stage. I do not believe the long-term outcome would be any different, nor would the prognosis or need for follow-up be any different. An expert view of this would need to come from a Paediatric Renal Specialist.

Nevertheless, in my opinion, the delay in diagnosis of renal failure should be considered a departure from accepted practice. I would view this departure as of mild significance.

4. *Any other comment on the care provided*

Other aspects of care of a 32 week gestation infant were performed to a good standard and followed accepted practice. The nursing observations in particular are detailed and well documented and easy to follow.

It is clear that the [public hospital] staff were becoming used to a new electronic records system. I am not familiar with this system and as an independent assessor I found the medical notes in particular hard to follow. It is difficult to get a sequence of events and it appears that some of the note-taking is incomplete. The [public hospital] team might like to review their use of this electronic system and ensure that improvements are made.

It is clear from the notes that this baby's parents had significant concerns about the antenatal ultrasound scan, the subsequent oedema and the baby's

general well-being from birth. They repeatedly expressed these concerns to various staff members. They received repeated reassurances and their requests to bring forward the planned ultrasound scan were not actioned.

For example, at 0952 hours on 3rd [Month2] (day seven) the following progress note is made. 'Discussion with doctors about baby. They have absolutely no concerns about baby's health. Oedema one raised blood pressure unconcerning (sic). [Doctor] available to talk to parents at 2pm but they are not able to be here. Parents will try and see him tomorrow but I confirmed to them his view is unchanged. Baby is well. The senior medical staff have asked nurses to please give consistency feedback to parents and be on the same page that nothing is wrong with the infant.'

By this stage [Baby A] had significant oedema, blood pressures over the 95%ile for gestation (and later that day over the 99%ile) and there was a level of concern about his urine output. It is therefore understandable that when the diagnosis was confirmed shortly after the parents were very upset. I would comment that I am sure the [public hospital] team [has] reflected on the general communication aspects of this case.

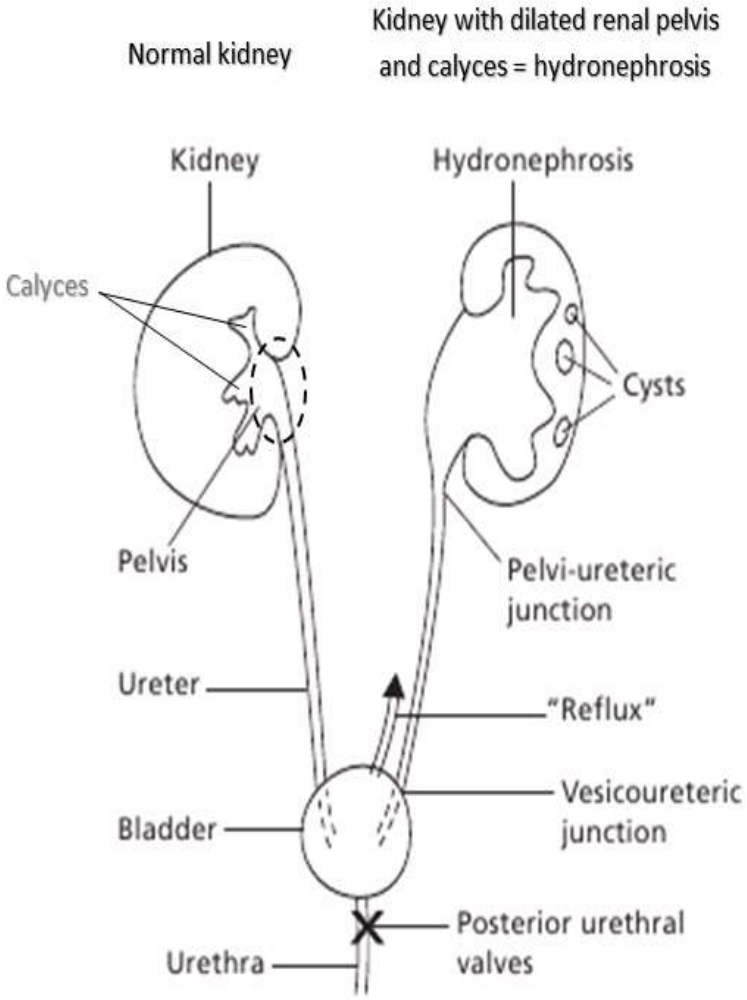
Detecting hypertension in the neonatal unit, particularly in preterm babies, is challenging. This is partly because we more commonly deal with babies with hypotension. In my unit we review the normal values (see above) and indicate on the observation chart the 95%ile for systolic and diastolic pressure. Nursing staff then report higher levels. Also, although there is no clear accepted standard of practice, every preterm baby in my unit who receives any intravenous fluid, has renal function and electrolytes measured at about 24 hours.

It is clear from the MidCentral Health response to the original complaint that they do acknowledge some shortcomings. The response indicates they have met with the parents and 'apologised for errors and delay in diagnosis and managing the kidney problems'. Their response outlines a number of useful initiatives to try to 'minimise the chances of this sort of error and delay occurring in the future'.

In summary, in my opinion I believe staff acted appropriately to the renal ultrasound scan report received and did not depart from accepted standard of care in this regard. I believe that up until the end of day four of life management of oedema and blood pressure were appropriate and did not depart from standard of care.

In my opinion, probably from day five, and certainly from day six of life, further steps should have been made to investigate the worsening oedema and hypertension. This would have led to a somewhat earlier diagnosis of the renal problem, and earlier transfer to tertiary care, but is not likely to have affected the short, medium or long-term outcome."

Appendix B: Diagram of the renal system showing hydronephrosis



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