

Failure to conduct required pH testing for nasal gastric tube placement

Executive summary

1. This investigation reviewed the care provided to five-week-old Baby B after her admission to Health NZ – Hauora a Toi Bay of Plenty – Whakatāne Hospital (Health NZ) on 21 July 2022 with a severe case of bronchiolitis.¹ As part of her admission, on 21 July 2022 Baby B was fitted with a nasogastric tube (NGT) to assist with feeding, nutrition, and medication administration. On 23 July 2022, it was identified that the NGT was not in the correct position and had folded in on itself in her oesophagus (instead of her stomach).
2. From the outset, I wish to acknowledge the difficult and unexpected circumstances faced by Baby B and her whānau during her severe illness and the distress they experienced.
3. Under right 4(2) of the Code of Health and Disability Services Consumers' Rights (the Code), Health NZ had a responsibility to ensure that services provided at Whakatāne Hospital complied with legal, professional, ethical, and other relevant standards. Having reviewed all information, I find Health NZ in breach of Right 4(2) for failing to confirm correct placement of the NGT via a pH test at the point of insertion and at multiple points between 21 and 23 July 2022, as required by the relevant standard.
4. Baby B's mother was provided the opportunity to comment on the 'facts gathered' section of my provisional report and had no comment.
5. Health NZ was provided with a copy of my provisional report and given an opportunity to comment. Health NZ advised that it accepts my decision and recommendations.

Recommendations

6. Further to the actions already undertaken by Health NZ (outlined in paragraph 42), I recommend that Health NZ:
 - a) provide a written apology to Baby B's whānau for the failings identified in this report, which is to be sent to the Health and Disability Commissioner (HDC) for forwarding within three weeks of the date of the final report.
 - b) Undertake an audit of 30 paediatric NGT care records and fluid balance charts to identify/determine the degree of compliance with the Starship NGT protocol for confirming and monitoring placement of NGTs. The summary of findings with any corrective actions to be implemented is to be provided to HDC within 3 months of the date of the final report.

Background

7. On 21 July 2022, Baby B's parents presented her to the Whakatāne Hospital Emergency Department with a stuffy nose, fatigue, reduced feeding, and trouble breathing. Upon

¹ Inflammation of the bronchioles.

admission to the children's ward, Baby B was diagnosed with bronchiolitis and a viral upper respiratory tract infection. She was placed on oxygen and had an NGT inserted to facilitate her feeds. Nursing notes on 21 July reported that Baby B's observations appeared to deteriorate around the time of feeds via the NGT.

8. In the evening of 22 July 2022, Baby B's condition worsened, including increased work of breathing (the physical work required to inhale and exhale) and recorded Paediatric Early Warning Scores (PEWS) above 8 (requiring clinical review and consideration for admission to the Intensive Care Unit (ICU)). After a suspected episode of mucous plugging,² continued deterioration, and subsequent escalation and consultation with the on-call paediatrician, Baby B was transferred to the Acute Care Unit (ACU). The on-call paediatrician met and assessed Baby B on arrival in the ACU.
9. Baby B was placed on bubble CPAP³ to help her breathe. The CPAP initially had no effect, and Baby B began to desaturate rapidly.⁴ The on-call paediatrician was recalled to the room and ordered the mask be removed and bag valve mask oxygen be administered, resulting in increased oxygen saturation. It was then identified that the 'oxygen analyser' on the bubble CPAP was not switched on, which resulted in a lower oxygen delivery of a minimum of 21%. I have addressed this issue in separate correspondence. The mistake was quickly identified and corrected, Baby B was placed back in the bubble, and her oxygen saturation improved. Baby B developed a fever overnight and continued to record high PEWS, and a plan was made for her to start on antibiotics, to have a chest X-ray the following day, and to have the NGT changed to an orogastric⁵ tube to reduce pressure on her nostrils.
10. On 23 July 2022, Baby B's chest X-ray showed that the NGT had folded in on itself and that placement was in the oesophagus (instead of the stomach). The NGT was removed at 11.20am and replaced with an orogastric tube.
11. On 24 July 2022, a paediatrician apologised to the family for this error and encouraged the family to make a complaint. Later in the day on 24 July 2022, Baby B had another desaturation episode and the right upper lobe of her lung collapsed.
12. On 25 July 2022, Baby B's diagnosis was updated to severe bronchiolitis and suspected aspiration/superimposed pneumonia.⁶ Although clinicians were unable to establish whether the NGT had caused Baby B to experience an aspiration event, Baby B's treatment plan included this as a working diagnosis, and relevant actions were taken (including antibiotics).

² When thick mucus blocks the airways, potentially causing lung collapse and breathing difficulties.

³ Bubble continuous positive airway pressure (CPAP) provides warmed humidified air via a mask covering the nose and mouth to assist with inhalation and exhalation.

⁴ Desaturation is when the amount of oxygen in the blood drops below normal.

⁵ Feeding tube through the mouth (versus the nose for nasogastric).

⁶ Aspiration pneumonia is a lung infection caused by inhaling food, liquids, saliva, or stomach contents into the lungs, leading to inflammation and bacterial infection. Superimposed pneumonia is when pneumonia develops on top of another condition.

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13. Baby B experienced a long and challenging recovery, moving between the ACU and the paediatric ward, but her condition gradually improved and she was discharged on 5 August 2022.
14. Baby B's parents raised a variety of concerns about the care provided to Baby B by Health NZ, some of which have been addressed in separate correspondence. The focus of this report is on the insertion and monitoring of Baby B's NGT placement.

Health NZ Policy and process in place at the time

NGT protocol

15. At the time of Baby B's admission, the process for inserting and monitoring paediatric NGTs was the Lippincott NGT insertion protocol. This document outlines that, at the point of insertion, the tube must be checked for correct placement by aspirating a sample of the stomach contents onto a pH indicator strip to determine whether gastric contents are present. A pH >5 can indicate respiratory, oesophageal, or intestinal placement.
16. The Lippincott protocol also outlined that the NGT position and function must be evaluated using the pH indicator strip before the tube is used.

NGT care record

17. Health NZ had an NGT care record document that was designed to capture information about the insertion process (including a tick box for placement confirmation via X-ray) and recording of four-hourly NGT checks, including any changes in tube length; whether the tip has moved into the oral cavity; pressure area checks and water flush; and positioning of patient's head to prevent aspiration. This form did not include any check for pH levels. The NGT care record states that the Lippincott protocol should be referred to and provides a hyperlink to protocols for adult and paediatric patients.

Health NZ response to HDC and internal review

Health NZ response to HDC

18. Health NZ acknowledged that Baby B experienced severe illness that was complicated by a mispositioned NGT.
19. Health NZ told HDC that an NGT can be mispositioned at the time of insertion and may also become displaced by dragging, pulling, or coughing. Health NZ told HDC that, in recognition of this risk, recommended practice is to check the position of the NGT via a pH test before administering any substance (eg, fluid, medication, or enteral feeding) via the tube and that this should be routinely recorded on the paediatric fluid balance chart, which has a specific section for pH test recording.
20. Health NZ told HDC that a chest X-ray to check the NGT position in paediatric patients is not routinely completed.
21. Health NZ has acknowledged that, in Baby B's case, no pH test was conducted at the time of insertion (6.45am on 21 July) to confirm NGT placement. The clinical records indicate that pH tests were done at 11am and 1pm on 21 July, both of which recorded a pH of 4, but no

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further pH tests were conducted to check NGT placement until 23 July, when the misplacement was identified via X-ray. From that point forward, the pH was routinely tested.

22. Health NZ acknowledged that staff did not follow the relevant standards and practice and apologised for the distress and additional concern this caused Baby B and her whānau.

Health NZ paediatric significant case review

23. In response to the concerns raised by Baby B's family, Health NZ conducted an internal review. In relation to the NGT issue, the review identified the following:
 - a) the NGT was curled back on itself, which indicates the issue probably occurred at the point of insertion rather than through coughing or movement;
 - b) the 'pop' or 'whoosh' test (where air is injected into the NGT and the stomach is checked for air sounds) that nursing staff occasionally used to check Baby B's NGT placement is not a conventional method of checking NGT placement;
 - c) it was unclear whether the two pH tests (results: pH 4) reflected correct initial positioning of the NGT or measured secretions from the upper airway;
 - d) Baby B's chest X-ray changes were not unusual for children with bronchiolitis and an upper right lung collapse, so it was not possible to definitively state that the chest changes were a result of the NGT misplacement;
 - e) antibiotic cover was appropriate.

Analysis

NGT insertion

24. The Lippincott protocol required that NGT placement be checked at the time of insertion via a pH test. Contrary to protocol, this was not done in Baby B's case, and I am critical of Health NZ for this. Health NZ have been unable to provide a reason as to why this did not occur.
25. Having reviewed the records, I consider that deficiencies in the internal processes and forms contributed to this error. The NGT care record, used for recording the insertion, does not match or reflect the requirements of the Lippincott paediatric protocol.
26. The NGT care record states that reference should be made to the Lippincott paediatric protocol, but the record itself does not include a tick box for pH testing to confirm correct placement. Instead, the placement confirmation tick box relates to the completion and review of an X-ray. Health NZ told HDC that an X-ray is not routinely used to check the NGT position in paediatric patients. Consequently, with no X-ray and no tick box for pH, no clear confirmation method of NGT placement is available on the NGT care record form.
27. Staff conducting the insertion are guided by the NGT care record and its tick boxes. Acknowledging that usual paediatric process did not involve X-ray, there was no further in-built process for staff to confirm correct placement, despite the protocol requiring a pH test to be completed.
28. The record also appears to be generic in nature, for use with all patients, without checks or requirements embedded in the form related to specific paediatric needs. For example, the

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form requires tube size to be recorded but does not reflect the specific requirements in the Lippincott protocol, which is that sizes #5 to #8 French are appropriate for infants.

29. I accept that the NGT care record states that staff should refer to the Lippincott protocol; however, I consider that the absence of clear guidance and direction for staff in the NGT care record, specifically requiring confirmation of a pH test as per the protocol, created an unacceptable risk that potential misplacement of Baby B's NGT at time of insertion would not be identified. On the basis that the NGT care record did not clearly reflect the requirements in the Lippincott protocol, I am of the view that this is a systemic issue rather than an individual one, and I am critical of Health NZ for failing to ensure the NGT care record met the appropriate standard, resulting in the failure to conduct a pH test at the point of insertion to confirm placement.

NGT monitoring

30. The Lippincott protocol required that the NGT position and function be evaluated by using the indicator strip (pH test) before use. Health NZ told HDC that the recommended practice was to check the position of the NGT via a pH test before administration of any substance (eg, fluid, medication, or enteral feeding) in the tube and that this should be routinely recorded on the paediatric fluid balance chart where there is a specific section for pH. Other than a space on the fluid balance chart to record pH, it is unclear how the requirements of this recommended practice were communicated to staff.
31. Except for the two tests on 21 July 2022, this monitoring did not occur for Baby B between 21 and 23 July, at which point the misplacement was identified and the NGT removed.
32. Subsequently, Baby B endured a period of approximately two days without adequate oversight of her NGT placement and, as a result, multiple opportunities to identify and make corrections if a misplacement had occurred were missed.
33. Further, and as outlined above, the NGT care record requires that an NGT check be performed every four hours, but I note that these checks do not require pH testing. I consider that the absence of this on the NGT care record created further missed opportunities to identify any issues with Baby B's NGT placement. Baby B's NGT care record also indicates that, between 21 and 23 July, the required four-hourly checks were completed intermittently with at times large gaps between checks.⁷
34. Health NZ has acknowledged that the relevant standards for monitoring Baby B's NGT were not met but have provided no explanation for why this occurred.
35. I consider the failure to adequately monitor Baby B's NGT placement unacceptable and in contravention of the required protocol and practice, and I am critical of Health NZ for this failure.

⁷ No record on the morning/early afternoon of 21 July; the last record for 21 July at 8.20pm, and the next record at 3.15pm on 22 July.

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Provisional decision

36. Right 4(2) of the Code of Health and Disability Consumer's rights (the Code) states that 'every consumer has the right to have services provided that comply with legal, professional, ethical, and other relevant standards.'
37. In Baby B's case, in accordance with the relevant protocol and recommended practice, Health NZ was required to conduct a pH test to confirm the correct placement of the NGT at the point of insertion and before each use of the tube. This did not occur.
38. Having reviewed all information, I consider there was a 'disconnect' between the relevant protocol and how it was implemented in Health NZ's processes. Health NZ did not provide clear direction on the NGT care record that a pH test must be performed at insertion, nor did it include in the NGT care record a requirement to test the pH as part of the four-hourly NGT nursing checks or before any use of the tube.
39. I consider the provision of a hyperlink to the relevant protocol to be inadequate. Internal processes and practice documents such as the NGT care record should directly reflect the core requirements of the protocol to appropriately direct staff and ensure clear compliance and mitigation of risk.
40. I acknowledge that pH checks were built into the separate fluid balance chart, but it remains unclear how this requirement was communicated to staff or how well it was understood.
41. For the reasons outlined above, I find Health NZ in breach of Right 4(2) for failing to confirm correct placement of the NGT via a pH test at insertion and multiple points between 21 and 23 July 2022, as required by the relevant standards.

Actions taken since the event

42. Health NZ advised of the following changes made since this event:
 - a) A paediatric significant case review was undertaken, and recommendations were made for improved patient safety.
 - b) The Paediatric Medical Leader, Head of Department, Paediatric Nurse Leader, Clinical Nurse Manager, and the Quality Service were made aware of the event and review.
 - c) All paediatric and ACU nursing staff at the time of this event were made aware of the findings and completed an online learning package and clinical practice training in NGT management.
 - d) The incident was further reviewed by Nursing Leadership and the Tauranga Nurse Educator with the recommendation to discontinue the use of the Lippincott guideline for paediatrics and refer only to that of the Starship (Paediatric) Hospital. The Starship guideline provides specific paediatric care management and a comprehensive guide to NGT placement checks, including taking pH tests:
 - at the point of insertion

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- before administering any feed or medication
 - with each change of formula and enteral pump set change and at least once per shift if the infant is having continuous feeds
 - if the position of the pen, tape, or centimetre mark has moved
 - following any episode of vomiting, retching or coughing.
- e) The NGT Care Record in place at the time was reviewed. A new Paediatric NGT Care Record referring to the Starship clinical guidelines was introduced. This new form requires that a pH test is required to confirm placement, before any use, and to be checked four-hourly if the infant is on continuous feeds.
- f) At every handover, paediatric nurses comment on the patient's current pH record, and the pH is recorded on the NGT care record and in the fluid balance chart.

Follow-up actions

43. A copy of the final report, with details identifying the parties removed, except Health NZ and Whakatāne Hospital, will be placed on the Health and Disability Commissioner website, www.hdc.org.nz, for educational purposes.

Dr Vanessa Caldwell

Deputy Health and Disability Commissioner

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