Nursing Practice

Audit

Nasogastric tubes

The efficacy of using X-rays to determine whether or not nasogastric tubes are correctly positioned was measured using retrospective data.

How accurate are X-rays to check NG tube positioning?

In this article...

- Why the position of a nasogastric tube is important
- How to check for the correct position of a nasogastric tube
- Common problems with the positioning of nasogastric tubes

Authors

Hazel Rollins CBE is clinical nurse specialist, gastroenterology and nutrition; Jacqui Arnold-Jellis is nutrition nurse specialist; Andrew Taylor is deputy radiology manager; all at Luton and Dunstable University Hospital.

Abstract

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The position of a nasogastric tube is vitally important for patients’ safety and wellbeing. X-rays are sometimes used to determine whether nasogastric tubes are correctly positioned, but how effective are they?

To find out, we undertook an audit of data from the radiology information system, collating all reports that included the word “nasogastric” from 1 January 2010 until 15 May 2011. For each report the description of tube position was put in one of six categories from “fully compliant with NPSA [National Patient Safety Agency] requirements” to “image missing”. In a second, smaller dataset (cases in which some anatomy was described), we investigated the position of the tube tip as classified using descriptions from radiology reports.

None of the reports contained all of the information required to comply with NPSA’s (2011) guidelines, but most nasogastric tubes (70%) were in the stomach. Twenty-one per cent were reported as being in the oesophagus; advice varied from advancing it further (if uncomplicated) to removing it (if coiled or looped). Four per cent of tubes were seen in the airways (lung or bronchus) with advice for immediate removal.

Nasogastric feeding is common in adult and paediatric practice. Confirming the tube’s position can be challenging but it is a vital part of care – inadvertent administration of feed into the lungs can lead to fatal complications such as pneumonitis.

The gold standard method of detecting the position of nasogastric tubes is by X-ray (Hedberg et al, 2005). However, staff do not use it routinely due to the risk of radiation exposure, cost and delay in feeding (National Patient Safety Agency, 2011; 2005). X-ray is indicated when the tube’s position cannot be confirmed by aspiration.

Our hospital trust’s enteral feeding guidelines require the routine use of low-range pH strips as the first-line method used to check the position of tubes. As such, the number of patients needing X-ray confirmation of the tube position should be relatively small. An audit conducted within the trust in 2006 demonstrated some problems with the quality of images used to confirm tube position and some issues with interpretation. It also showed that many tubes were in the oesophagus at the time of imaging.

The NPSA (2011) alert has drawn attention to the risk of misinterpretation of X-rays used to confirm the position of a nasogastric tube, so, as part of a larger programme of work, it seemed appropriate to revisit X-ray reporting to determine how “gold” the gold standard really is.

Aim

The audit examined the results of X-rays reported as showing a fine-bore nasogastric tube in order to:

- Determine the proportion correctly positioned;
- The efficacy of using X-rays to determine whether or not nasogastric tubes are correctly positioned was measured using retrospective data.

Keywords: Nasogastric tubes/X-ray/ Patient safety

- This article has been double-blind peer reviewed

In this article...

- Why the position of a nasogastric tube is important
- How to check for the correct position of a nasogastric tube
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5 key points

1. The position of a nasogastric tube is vitally important as accidental administration of feed into the lungs can lead to fatal complications.
2. The gold standard method of detecting the position of nasogastric tubes is by X-ray, but this is not used routinely due to the risk of radiation exposure, cost and delay in feeding.
3. X-ray is indicated when the tube’s position cannot be confirmed by aspiration.
4. A recent National Patient Safety Agency (2011) alert drew attention to the risk of misinterpretation of X-rays used to confirm the position of a nasogastric tube.
5. All staff who may request or interpret X-ray images of nasogastric tube positions must be trained and assessed as competent.
Identify the proportion of tubes incorrectly placed (and their position);
Demonstrate the proportion of images that failed to identify the tube position;
Illustrate the quality of reporting as an aid to clinical decision making, and in comparison to the stringent detail required by the new NPSA (2011) alert.

**Method**

We used data from the radiology information system (CRIS), collating all reports that included the word “nasogastric” from 1 January 2010 until 15 May 2011. The lead author assessed the reports for their relevance to this audit. We recorded the patient’s name, hospital number and age on the day of X-ray, the date and time of the X-ray, the position of the tube before and during X-ray and the reported position of the tube. We categorised the description of tube position as follows:

- Fully compliant with NPSA requirements;
- Anatomy described but incomplete;
- Anatomy not described;
- Image not reported;
- Image excluded as no nasogastric tube present;
- Poor image (unable to see tube or tip position);
- Nasogastric tube not identified on image;
- Incomprehensible report;
- Image missing.

In a second, smaller data set (cases where some anatomy was described) we investigated the position of the tube tip.

Reports stating “NG [nasogastric] tube in situ” or “NG tube in good position” were excluded from this data set as no anatomical description was given. The position of the tube tip was classified using descriptions from radiology reports, such as:

- In the chest;
- In the trachea, bronchus or lung;
- In the oesophagus (upper or lower) or gastro-oesophageal junction;
- In the pylorus, duodenal cap or proximal duodenum;
- In the stomach.

(The categories are simplified in the results shown in Fig 1).

We also collected data on the number of times advice was given to advance a tube further into the stomach. The data was analysed using Microsoft Excel.

**Audit findings**

There were 642 images in total. We excluded 45 as they were not X-rays of nasogastric tubes; as such this report relates to 597 images – an increase of 66% per annum since the 2006 audit.

Patients were aged 0–98 years old (median 69 years). Forty (7%) of the images were of children with ages ranging from 0 to 15 years (eight images were of neonates). Another three young people (aged 18 years) were in adult settings, one of whom had recently left paediatric care.

We found a description of the anatomy in 307 X-ray reports although none met the new, stringent criteria laid down in the 2011 NPSA report. The reported tube positions are shown in Fig 1. The data suggested that in 216 cases (70%), the X-ray showed the nasogastric tube to be in the stomach. Seventeen of these reports contained advice to advance the tube further. Sixty-six tubes (21%) were reported as being in the oesophagus, and advice varied from advancing it further (if uncomplicated) to removal (if coiled or looped). Thirteen tubes (4%) were seen in the airways (lung or bronchus), with advice for immediate removal.

None of the reports contained all of the information required to comply with the NSPAs (2011) guidelines. However, there were some examples of good practice with, for instance, an alert sent to the clinician where a problem was noticed (Box 1).

Of the 51% of reports that contained anatomical information (Fig 2), many did not advise whether it was safe to use the tube. A further 17% gave no anatomical information, making it difficult to know how the position had been judged. These simply stated that the tube tip was in the stomach.

Speculative language was used widely in reporting, for example “probably in the stomach” or “NG tube tip positioned in the region of the gastro-oesophageal junction and perhaps should be inserted further.” Occasionally, the language used left the reader confused, for example: “the tip of the NG tube is in the stomach or duodenum.”

**Discussion**

Most patients having a nasogastric tube inserted have the procedure performed blind, at the bedside, by a nurse. Although it is considered a routine procedure, the risks of tube misplacement have become apparent in the last seven years following an earlier NPSA (2005) alert.

Trust procedures and staff training promote the use of safe techniques to confirm the position of tubes before and during use. As a result, the position of most of the tubes should be established with pH testing. However, a significant number of patients undergo X-ray; this number of adult patients appears to have increased dramatically, suggesting that either more patients were being tube fed or staff were using X-ray as the first-line tube check rather than pH testing. This needs to be investigated, as unnecessary reliance on X-ray delays feeding, exposes patients to radiation and increases treatment costs.

This audit is limited by the fact that it is retrospective. As all reports were analysed by the lead author, it is possible there has been some bias in interpretation, however this replicates the method used in our
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2006 audit. Clearly the data suggests a large number of reports were excluded when the position of the tube was probably acceptable; however, under the new guidelines, as no anatomical information was included the criteria used to establish the tube position were not obvious.

As this is a retrospective audit, it was not always clear whether an X-ray was performed to confirm the position of a tube or whether the tube was an incidental finding. X-rays that were not reported by a radiologist have been excluded; as such, this audit does not tell us anything about the number of X-rays carried out solely to confirm the tube position.

Given the high number of misplaced tubes it is worrying that almost a quarter of images were not reported. However, as reporting is not live (range 0–48 days; median two days), the duty remains with the referring clinician to check the image and to escalate if the result is not clear. Doctors requesting an X-ray to check the position of a nasogastric tube should be trained and assessed as competent to do so. An algorithm is available to assist with interpretation.

Twenty-two images were of a poor quality so the position of the tube tip could not be confirmed. This included images in which the tube did not show up and those in which the tip was below the limits of the image. It is important that such images are not allowed out of the department and that teams work together to ensure the best possible image – for example, by appropriate tube selection – is taken; techniques should be undertaken carefully and the patient positioned correctly.

Although the positioning of a proportion of tubes gave cause for concern and required corrective action, it is gratifying that most of those that were reported were in a satisfactory position (70%). This suggests appropriate decision making on the part of the clinicians, in requesting X-rays when the tube position could not be established by other means.

This audit shows that in approximately 21% of cases the tube was in the oesophagus (oesophageus or gastro-oesophageal junction). Clearly aspirate from these patients would not be strongly acidic on pH testing. Seven patients (2%) were reported to have the tube in the duodenal cap or in the proximal duodenum; in such cases, aspirate may be alkaline, making an X-ray essential to confirm the tube position. These results highlight the importance of patients being measured correctly before passing a tube using the anatomical landmarks – if the tube is passed to the appropriate length, the need for X-ray is reduced. It is important to remember, however, that the nose, ear, xiphoid process (NEX) measurement used is a proxy measurement of the anatomy, which may under or overestimate the length of tube required (Beckstrand et al, 2007).

Thirteen patients (4%) were reported to have a nasogastric tube in the trachea, bronchus or lung. This demonstrates the importance of not feeding or putting any fluid into the tube until the correct position has been confirmed. In many cases X-ray reports gave clear instructions regarding the safety of a tube position and the action required, often highlighted by an alert message. However, the common use of speculative language such as “probably in the stomach” would not be reassuring to those using a tube to feed or give medicines to a patient.

It is a matter of concern if the decision to use the tube or not is made by a clinician with rather less experience than a consultant radiologist. Where live reporting is not possible, it is essential all staff who may request or interpret these images are trained and assessed as competent. We worked with consultant safety leads to ensure this training occurs on an ongoing basis. Furthermore, the common use of general language such as “NG tube in situ” or “NG tube in good position” no longer meets the stringent demands of the safety alert. It was recommended the radiology team develop a standard, computerised format that prompts the reporter to give full information.

In 18 reports (6%) the tip of the tube could not be identified on the X-ray. The ability to visualise the tube is essential to patient safety and is dependent on patient factors as well as the quality of the X-ray and the tube. We have worked to address all of these issues within our trust. Radiographers help us to evaluate new tubes by testing their visibility in vitro before they are introduced into clinical practice. The trust provides training to radiology staff to ensure optimal patient position and image quality.

**Feedback**

These findings were disseminated via clinical directors, superintendent radiographers, matrons, ward sisters and nutrition link nurses. We attended ward or department meetings to discuss the outcomes of the audit.

**Recommendations for practice**

The audit resulted in the following recommendations being made:

» Ensure adult and paediatric guidelines give clear information regarding pH testing and the use of X-rays;

» Remember the NEX measurement is a proxy measurement of the anatomy and be careful to measure accurately;

» Ensure X-ray is not routinely used as a first-line test of tube position;

» Consider the standard format to request and report the position of nasogastric tubes as per the NPSA alert;

» Work closely with your radiology department to ensure all NPSA recommendations are implemented and audited.

**Conclusion**

It was disappointing these results were very similar to those found in our previous audit. However, this motivated the team to publish them as an informal discussion within a specialist professional network suggested this information should reach a wider audience.

Our team worked together to provide radiology members of staff with a decision tree to aid decision making about when to X-ray, and have included this audit data in all teaching of medical and nursing staff. We will continue to monitor practice and intend to repeat this work in the future. NT

**References**


