

## **An Audit of Adherence to Nasogastric Tube Safety Standards in a Radiology Department**

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### **Abstract**

#### **Aim**

To audit our department's adherence to the requirements of the 2011 Patient Safety Alert from the National Patient Safety Agency (NPSA) in the UK.

#### **Methods**

A retrospective study was carried out looking at chest radiographs performed in our institution to confirm nasogastric tube position over a period of 11 weeks. The referral information, image quality and report were analysed for each study and compared with the gold standards.

Didactic presentations and posters were delivered to a target audience including the referring practitioners, radiographers and radiologists. The audit was repeated after 12 months to close the loop.

#### **Results**

Marked improvement was observed in the quality of radiographs in the follow up audit in terms of the percentage of studies which were centred lower than normal (36% to 93%), in which the NG tube was clearly seen (86% to 100%), in which the bottom of both hemidiaphragms was visible in the midline (95% to 100%) and in which the tip of the NG tube was visible (72% to 88%). There was however no improvement in the quality of referrals or reports.

#### **Discussion**

Targeted interventions have achieved a marked improvement in the quality of radiographs. Alternative approaches will be needed to reach referrers and reporters. Future approaches may include earlier interventions, a combination of verbal and visual presentations, the introduction of dedicated dictation templates and the inclusion of both hospital boards and frontline staff.

**Keywords:** Audit, Nasogastric, Safety, Chest radiograph

## Introduction

The aim of this study was to audit our department's adherence to the requirements of the 2011 Patient Safety Alert from the National Patient Safety Agency in the UK<sup>1</sup>.

Nasogastric (NG) tubes are commonly used for nutritional support in patients with inadequate or unsafe oral intake and a functional, accessible gastrointestinal tract.

The use of misplaced NG tubes was first recognised as a patient safety issue by the NPSA in 2005<sup>2</sup>. Further patient safety alerts were issued by the NPSA and National Health Service (NHS) in 2011, 2012, 2013 and 2016<sup>1, 3, 4, 5</sup>.

Administration of fluid or medications through a misplaced NG tube is considered a 'never event' in the United Kingdom (UK). Such an error is thus considered in the same category as wrong site surgery, maternal death from post-partum haemorrhage and patient escape from high security mental health services. Never events are considered 'wholly preventable where guidance or safety recommendations that provide strong systemic protective barriers are available at a national level and have been implemented by healthcare providers'<sup>6</sup>.

Despite this, between September 2005 and March 2010, there were 21 deaths and 79 cases of harm attributed to the incorrect placement of NG tubes according to the National Reporting and Learning System<sup>1</sup>.

There were 95 reported incidents between September 2011 and March 2016 where fluid or medications were inappropriately administered through a misplaced tube into the lungs or pleural space. While these figures must be analysed in the context of over 3 million nasogastric and orogastric (OG) tubes inserted in the NHS in the same period<sup>5</sup>, it is clear that there is a real but avoidable risk to the patient safety.

Chest radiograph (CXR) misinterpretation by doctors who did not appear to have received the competency-based training required by the 2011 alert was identified by NHS clinical reviewers as the most common error responsible for harm. PH testing of the gastric aspirates, unapproved tube placement checking methods and communication errors resulting in unchecked tubes were amongst other causes identified.

The radiology department has an important and multifaceted role in the patient safety pathway. Three key radiology requirements were identified in the 2011 alert. Firstly, imaging must be justified. Secondly, the radiographer should ensure that the NG tube is clearly visible on the radiograph, the radiograph is centred lower than normal and that the bottom of both hemidiaphragms is seen in the midline. Thirdly, the radiology report should state both the position of the tube and comment on whether it is safe to proceed with the administration of liquid through the tube.

These formed the basis for the three standards against which our department was audited; the imaging request must be justified by the clinical information provided, the radiograph should be appropriately exposed and centred and the radiology report should state both tube position and comment on safety for use. A target of 100% compliance was selected in our study.

## Methods

The study was performed in a tertiary referral university teaching hospital. A retrospective search was carried out of our department's Radiology Information System (RIS) to identify chest radiographs performed to confirm NG tube placement from 2/12/18 to 19/02/19 using specific search criteria (Figure 1).

58 radiographs were retrieved in the study period. The referral, image and report were analysed in each case.

For each study, seven questions were applied (table 1):

Question
Was the request justified by the clinical information provided?
Was the NG tube clearly seen on the radiograph?
Was the radiograph centred lower than normal?
Was the bottom of both hemidiaphragms visible in the midline?
Was the tip of the NG tube visible?
Did the report include a comment on the position of the tube?
Did the report include a comment on safety for use?

*Table 1: The seven questions applied in each case.*

Specific interventions were set out to target each of our three audit standards.

### *Justification of the imaging request based on the clinical information provided*

As the majority of CXR referrals in our department were made by interns, a decision was made to provide education on appropriate referrals to incoming interns during their induction week in July 2019. A short didactic presentation was given at which attendees were reminded that CXR is a second line test for confirming NG tube placement. The first line test is pH testing of gastric aspirate. A pH between 1 and 5.5 confirms a satisfactory position. CXR should be reserved for cases in which there is no gastric aspirate, the pH is outside the range 1-5.5 or the patient is at high risk of a malpositioned tube, for example, a patient with a reduced level of consciousness. Attendees were also reminded that all imaging must be justified by the clinical information provided. For example, 'NG tube inserted. No gastric aspirate. Position of NG tube?'

### *Acquisition of the chest radiograph with attention to appropriate exposure and centring*

A didactic presentation was delivered to our department radiographers at our annual internal audit meeting in November 2019. A short summary of the 2011 Patient Safety Alert was presented to improve local awareness of the NPSA guidelines. The results of our first audit were presented. By displaying representative examples of adequate versus inadequate radiographs and well-positioned versus malpositioned NG tubes, we were able to stimulate discussion and debate.

*Adequacy of radiology report by clearly stating the tube position and commenting on safety for use.*

A poster was designed presenting NPSA guidelines, highlighting the obligation by the radiologist to document both the position of the NG tube and whether the position is safe for the administration of liquid through the tube (Figure 2). Examples were exhibited of a well-positioned tube and a malpositioned tube with suggested templates for how each could be reported. The poster was printed in A2 size and copies were erected in both the registrar and consultant reporting rooms.

A re-audit was performed in February 2020. An identical sample size of 58 CXRs performed between 23/11/19 and 23/01/20 was retrieved via the RIS using the same criteria as before.

## **Results**

Fifty-eight CXRs were included in both the first and the second audits. Our seven questions were applied to each of the radiographs in both audits.

The percentage of radiographs in which the NG tube was clearly seen on the image improved from 86% to 100%. The percentage of radiographs which were centred lower than normal improved from 36% to 93%. The percentage of radiographs in which the bottom of both hemidiaphragms was visible in the midline improved from 95% to 100%. The percentage of radiographs in which the tip of the NG tube was visible improved from 72% to 88%.

However, the percentage of radiographs which were justified by the clinical information provided disimproved from 7% to 2%. The percentage of reports which made a comment on the position of the tube disimproved from 67% to 59%. The percentage of reports which made a comment on safety for use disimproved from 59% to 57%. The results are summarised in Table 2.

The results of the first audit showed our department fell significantly short of reaching the target value of 100% compliance in terms of justifiability of referrals, quality of radiographs and adequacy of reports.

The targeted intervention with radiographers saw marked improvement in the quality of radiographs in the second audit with a greater proportion of studies being appropriately exposed and centred.

Unfortunately, there was no improvement in the quality of referrals, with only one referral in the second audit being justified by the clinical information provided.

Similarly, there was no positive change in the quality of the radiology reports, with a large proportion of reports both in the first and the second audit failing to comment on the position of the tube or its safety for use.

Patient type	Inpatient
Modality	XR
Exam description	CXR
Reason for exam	NG

Figure 1: The search criteria used in the Radiology Information System.



## CXR for NG Tube Placement

National Patient Safety Agency



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**Catching the tube**  
Confirmation of safe NG tube placement: The duties of the radiology department  
Gerard Lambe

**The standard**

When a chest radiograph is performed for NG tube placement, guidelines from the National Patient Safety Agency in the UK state that the radiology report should include both:

1. The position of the tube

**AND**

2. Whether it is safe to proceed with the administration of liquids through the tube

**Example 1**

The tip of the nasogastric tube is in the stomach

**AND**

it is in a suitable position to commence feeding



**Example 2**

The tip of the nasogastric tube is in the left lung

**AND**

it is in an unsafe position to commence feeding and should be re-sited



**The SJH experience**

In a 2 month audit of reports in St. James's Hospital in 2019:

**38 of 56** reports included a comment on the position of the tube.

**34 of 56** reports included a comment on safety for use.

This will be re-audited later this year. Our target is **100% compliance**.

Figure 2: The poster erected in the registrar and consultant reporting rooms.

Question	Audit 1 (n=58)	Audit 2 (n=58)
Request justified by the clinical information provided	4 (7%)	1 (2%)
NG tube clearly seen on the radiograph	50 (86%)	58 (100%)
Radiograph centred lower than normal	21 (36%)	54 (93%)
Bottom of both hemidiaphragms visible in the midline	55 (95%)	58 (100%)
Tip of the NG tube visible	42 (72%)	51 (88%)
Report makes comment on the position of the tube	39 (67%)	34 (59%)
Report makes comment on safety for use	34 (59%)	33 (57%)

*Table 2: Results of the first and second audits.*

## Discussion

Our success in improving the proportion of chest radiographs with appropriate exposure and centring between the first and second audits may reflect several aspects of our targeted intervention with the radiographers. Firstly, the combination of verbal and visual communication was likely more effective than the visual approach alone which was used with reporters. The presentation that was made to radiographers was short but direct and employed representative examples of radiographs from our own institution to engage their interest. All imaging was anonymised, and message was framed as a patient safety issue rather than a slight on anyone's individual practice. The information delivered was relevant, concise and practical.

By contrast, while the same combination of verbal and visual communication was used to reach incoming interns, it was not immediately relevant to either their past or present experiences. In addition, the message was delivered during a busy induction week and the take-home points may have been diluted by the volume of other information being imparted.

To improve the justification of imaging, future approaches should consider supplementing the didactic presentation at intern induction week with a formal training course and self-assessment as part of their online induction module. The online approach is likely to assume even greater importance in the future as we continue to learn to live and work with the current COVID-19 pandemic.

Medical students rotate through the radiology department for two weeks in the course of their medical training. There is an opportunity at this time to add a short section on justification of CXRs for NG tube placement to the CXR lecture they receive from the radiology registrars in the course of their rotations. Such an approach may mean that the message delivered at intern induction week would serve to remind and reinforce old learnings rather than overburden with new information.

To improve the proportion of radiology reports which state the tube position and make a comment on safety for use, a lesson can be learned from our success with the radiographers. The posters in the reporting rooms could be reinforced by a visual presentation at the 3 monthly departmental discrepancy meeting which is attended by radiologists and registrars. In addition, a dedicated Powerscribe dictation template for 'NG tube CXRs' could be made available to everyone which would facilitate fast and reproducible reporting across the department.

Interestingly, the 2016 Patient Safety Alert in the UK is explicitly stated to be directed at trust boards and those involved in clinical governance rather than at frontline staff. A number of implementation issues were identified which included matters such as inadequate systems designed to ensure that staff had received the relevant competency-based training, concerns regarding bedside documentation containing all safety-critical steps and issues maintaining a stock of relevant equipment such as radio-opaque tubes and pH test strips. Any future interventions which involve the hospital board may help to build on the modest improvements seen after our targeted interventions with frontline staff.

#### **Declaration of Conflicts of Interest:**

The authors declare that they have no conflicts of interest.

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