



## Patient safety incidents associated with tracheostomies occurring in hospital wards: a review of reports to the UK National Patient Safety Agency

B A McGrath and A N Thomas

*Postgrad Med J* 2010 86: 522-525 originally published online August 13, 2010

doi: 10.1136/pgmj.2009.094706

---

Updated information and services can be found at:

<http://pmj.bmj.com/content/86/1019/522.full.html>

---

*These include:*

### References

This article cites 14 articles, 4 of which can be accessed free at:

<http://pmj.bmj.com/content/86/1019/522.full.html#ref-list-1>

### Email alerting service

Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

---

### Notes

---

To order reprints of this article go to:

<http://pmj.bmj.com/cgi/reprintform>

To subscribe to *Postgraduate Medical Journal* go to:

<http://pmj.bmj.com/subscriptions>

# Patient safety incidents associated with tracheostomies occurring in hospital wards: a review of reports to the UK National Patient Safety Agency

B A McGrath,<sup>1</sup> A N Thomas<sup>2</sup>

<sup>1</sup>University Hospital of South Manchester, Wythenshawe, Manchester, UK  
<sup>2</sup>Intensive Care Unit, Hope Hospital, Salford, UK

## Correspondence to

Dr Brendan McGrath, Intensive Care Unit, University Hospital of South Manchester NHS Foundation Trust, Wythenshawe, Manchester M23 9LT, UK; [brendan.mcgrath@nhs.net](mailto:brendan.mcgrath@nhs.net)

Received 21 November 2009

Accepted 29 May 2010

Published Online First

13 August 2010

## ABSTRACT

**Background** Tracheostomies are increasingly common in hospital wards due to the rising use of percutaneous and surgical tracheostomies in critical care and bed pressures in these units. Hospital wards may lack appropriate infrastructure to care for this vulnerable group and significant patient harm may result.

**Objectives** To identify and analyse tracheostomy related incident reports from hospital wards between 1 October 2005 and 30 September 2007, and to make recommendations to improve patient safety based on the recurrent themes identified. The study was performed between August 2008 and August 2009.

**Methods** 968 tracheostomy related critical incidents reported to the National Patient Safety Agency over the 2 year period, identified by key letter searches, were analysed. Incidents were categorised to identify common themes, and root cause analysis attempted where possible.

**Results** In the 453 incidents where patients were directly affected, 338 (75%) were associated with some identifiable patient harm, of which 83 (18%) were associated with more than temporary harm. In 29 incidents (6%) some intervention was required to maintain life, and in 15 cases the incident may have contributed to the patient's death. Equipment was involved in 176 incidents and 276 incidents involved tracheostomies becoming blocked or displaced.

**Conclusions** By identifying and analysing themes in incident reports associated with tracheostomies, recommendations can be made to improve safety for this group of patients. These recommendations include improvements in infrastructure, competency and training, equipment provision, and in communication.

## INTRODUCTION

Patients with tracheostomies are increasingly cared for on general hospital wards. Patients may have been transferred from critical care units for continuing care or admitted with pre-existing tracheostomies or laryngectomies. These patients are at a particular risk of harm as problems with tracheostomies may rapidly develop into life threatening airway emergencies. Ward staff may lack the skills to prevent, recognise or manage these problems appropriately.<sup>1</sup> These issues have been recognised in guidance on the management of patients with tracheostomies issued by the UK National Patient Safety Agency (NPSA).<sup>2</sup>

A 'patient safety incident' is defined as 'any unintended or unexpected incident which could have harmed or did lead to harm for one or more patients being cared for by the NHS (National

Health Service)'.<sup>3</sup> Patient safety incident reports are submitted by NHS staff using local reporting systems. Each NHS organisation is then expected to submit these reports electronically to the NPSA. This process involves a free text description of the incident together with location details and a classification. Details of the submission process have previously been described.<sup>4</sup> Reports are submitted from Trusts in batches and then held in a searchable database.

This paper aims to identify and review relevant incident reports in order to identify themes associated with tracheostomy care on hospital wards. Subsequent analysis of grouped incidents allows underlying causes to be identified and develops a better understanding of the risks associated with tracheostomies. We aimed to make recommendations to improve patient safety and reduce risks to this vulnerable group of patients.

## METHODS

### Definitions

We defined tracheostomy incidents as patient safety incidents involving tracheostomies which occurred on hospital wards, excluding critical care areas, operating theatres or recovery areas. This group of incidents included blockages and the unplanned removal or displacement of airway devices.

### Database search strategy

The review was conducted using similar methodology to that which we used previously to review airway incidents reported to the NPSA from critical care units.<sup>5</sup> We searched the NPSA incident database using a previously described search strategy,<sup>6,7</sup> using key words and letter sequences to identify incidents that may have involved tracheostomies. The search was limited to adult patients where the reported location of the incident was a hospital ward (table 1). The search covered the period from 1 October 2005 to 30 September 2007, and was conducted in February 2008 to allow time for reports of incidents to be submitted. The identified incidents were then incorporated into an Access database (Microsoft Office 2007) and the description of each incident was read and reviewed.

### Inclusions and exclusions

We included incidents relating to tracheostomy tubes, 'mini tracheostomies' and open tracheostomy stomas. Equipment incidents relating to the oxygen supply, suction and essential bedside equipment provision were also included.<sup>1,8</sup>

**Table 1** Text descriptions of airway incidents contain repetitive words<sup>5</sup>

Letter sequences:				
ETT	ET tube	Tubat	Trach	Traco
Teach	Speaking v	Nasal t	Laryng	fenestrated
Airway	Cuff (excluding 'BP' and 'pressure cuff')		Inner tube	NTT

All of the identified airway incidents contained at least one of the sequences shown above. We then selected all of the incidents that contained at least one of these letter sequences from the sample of all patient safety incidents submitted to the NPSA during the defined time frame. Incidents include a location field, and we excluded 'intensive care', 'high dependency' and 'critical care' from our search results. For initials, all letter spaces and full stop combinations were included.

Incidents that on review clearly did not involve the airway were excluded from analysis. Repeat incidents, paediatric and any incidents involving critical care units were also excluded.

### Classification of incidents

The free text descriptions allowed us to categorise the incidents as follows:

- ▶ Incidents directly affecting patient care
- ▶ Equipment incidents
- ▶ Displaced or blocked tracheostomy tubes
- ▶ Incidents related to documentation, communication or infrastructure

Root cause analysis was attempted based on the individual descriptions and further classification undertaken. For example, with displaced tracheostomy tubes, we attempted to analyse the frequency of associated events such as patient agitation, the patient being nursed in a secluded location, the methods of fixation, and how the event was detected and subsequently managed.

### Data analysis

The data were analysed by simple cross-tabulation to examine the relative frequencies of events and the relationships to the levels of harm suffered. Statistical comparisons were made using  $\chi^2$  tests. By demonstrating that recurring events or themes were consistently associated with patient harm, we were able to make recommendations to improve patient care.

## RESULTS

The letter sequence search identified 1541 relevant incidents from the NPSA database. Of these, 968 were associated with tracheostomies—453 directly affecting patients, with the remaining 515 not directly affecting individual patients.

### Levels of harm

In the 453 incidents where patients were directly affected, 338 (75%) were associated with some identifiable patient harm, of which 83 (18%) were associated with more than temporary harm. In 29 incidents (6%) some intervention was required to maintain life, and in 15 cases the incident may have contributed to the patient's death. There were 15 cardiac arrests and 26 respiratory arrests described in these incidents. Details of the type of tracheostomy tube were only provided in 107 incidents (76 with inner tube, 15 without inner tube, 9 'mini-tracheostomies', and 7 open stomas).

### Equipment incidents

One hundred and seventy-six of the 453 incidents directly affecting patients involved equipment; these are summarised in table 2. Examples of particularly serious equipment problems included bronchoscopes or other airway equipment needed in an emergency not being available out of hours, incorrect use of equipment where oxygen tubing was connected to air outlets, or where speaking valves, Passy Muir valves and tracheostomy caps were inappropriately used.

### Blocked and displaced tubes

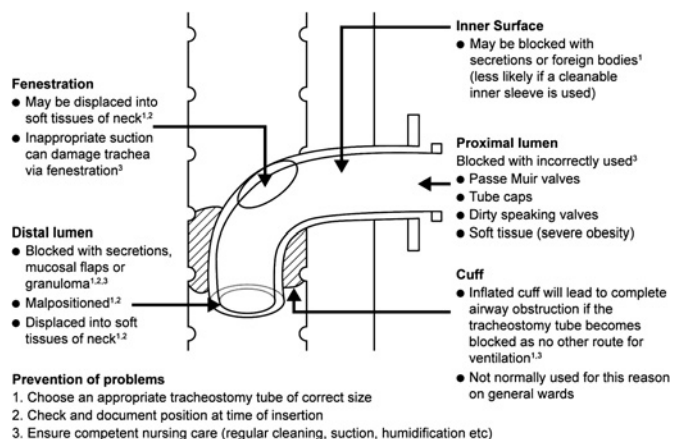
Two hundred and seventy-six of the 453 incidents directly affecting patients involved either blocked tubes (129 incidents) or displaced tubes (147 incidents). Blocked tubes were significantly more likely than displaced tubes to be associated with more than temporary harm (blocked tubes: 47 of 129 incidents (36.4%); displaced tubes: 19 of 147 incidents (12.9%);  $p < 0.0001$ ). The descriptions of incidents suggested problems with staff competencies may have contributed to at least 32 incidents of blocked tubes and two incidents of tube misplacement. Unfortunately, the description of incidents only allowed contributing factors to be identified in a small number of these reports. Where contributing factors were identified these included problems with staffing (33 incidents), equipment (111 incidents) and, for tube displacement, patient agitation (30 incidents) or turning patients (12 incidents). Methods of identifying displaced or blocked tubes were described in 118 incidents and included visibly obvious tube displacement (43 incidents), inability to pass suction catheters (16 incidents), cyanosis or measured fall in oxygen saturation (27 incidents) or respiratory distress (23 incidents).

Examples of problems that may result in tracheostomy tubes becoming blocked along with methods of prevention are shown in figure 1.

**Table 2** Frequency with which problems with equipment were described in the incident reports

	Level of harm										
	n	No harm		Some harm		More than temporary harm					
All equipment related incidents	176	84	47.7%	92	52.3%	26	14.8%				
Suction equipment	33	15	45.5%	18	54.5%	6	18.2%				
No spare tracheostomy tubes	67	50	74.6%	17	25.4%	6	9.0%				
Oxygen equipment	25	6	24.0%	19	76.0%	3	12.0%				
All unavailable equipment	100	57	57.0%	43	43.0%	16	16.0%				
All incompetent equipment use	46	15	32.6%	31	67.4%	8	17.4%				
	Equipment problems										
	n	Unavailable	Incompetent	Failure	Faulty	Other					
All equipment related incidents	176	100	56.8%	46	26.1%	23	13.1%	8	4.5%	16	9.1%

An individual incident could be classified in multiple fields.



**Figure 1** Examples of problems that may result in tracheostomy tubes becoming blocked along with examples of methods of prevention.

### Infrastructure and communication

When all incidents were reviewed, including the 515 incidents where no individual patient was directly affected, the following additional issues were commonly identified. Problems with a lack of appropriate beds or trained staff were described in 243 incidents, of which 40 affected individual patients. Problems with communication within the healthcare team were described in 115 incidents. Ninety of these incidents affected individual patients and 72 incidents could be further classified. The most serious communication incidents occurred when staff could not be contacted in an emergency; nine episodes of more than temporary harm occurred in these 33 incidents. An additional 18 incidents described poor handover of information when patients were transferred into the ward. Other incidents related to poor handover between multidisciplinary teams or recording of information about routine care of tracheostomies.

### Summary of recurrent problems identified and relevant recommendations

There were a number of recurrent problems that contributed to incident evolution or severity that would be potentially avoidable. These are summarised below along with recommendations.

#### 1. Lack of ward beds or trained staff

This is a difficult area to address, but examining the hospital's population and patient needs could ensure that patients are cared for on appropriate wards. Minimising lengths of stay by full implementation of the National Institute for Health and Clinical Excellence (NICE) guidance on identification of the acutely unwell adult<sup>9</sup> and NICE guidance on rehabilitation after critical illness<sup>10</sup> reduces the burden on Trusts of caring for these patients. Better training of staff expected to care for tracheostomy patients against agreed competencies is covered in the third recommendation below.

#### 2. Equipment not available when needed

A simple solution is to provide a box of appropriate airway equipment to accompany the patient until decannulation of the tracheostomy.<sup>11 12</sup> Early identification of tracheostomy patients transferred from critical care would allow the provision of equipment to be checked in advance. It should be ensured that there is access to endoscopes out of hours and that staff know how to get the equipment (instructions can be provided on the airway box accompanying the patient). Restricting the number of wards on which patients with tracheostomies are nursed

means that wards accepting these patients should be better equipped and staffed by competent nursing and medical teams.<sup>13</sup>

### 3. Incorrect use of equipment and other aspects of poor staff knowledge and skills

Teaching about tracheostomies should be provided during undergraduate and mandatory training.<sup>1</sup> 'Just in time' refresher training should be provided around the time of transfer to the ward.<sup>14–16</sup> This may be provided by staff with particular knowledge—for example, physiotherapists or critical care outreach staff.<sup>12 17</sup> This training can include very basic information—for example, printed material that accompanies the patient. Collecting patients with tracheostomies on a small number of wards would allow staff on those wards to develop skills during regular patient contact.

### 4. Improved communication

Critical care outreach teams should be used to ensure good liaison between critical care units and hospital wards. Ensure a structured handover<sup>18</sup> and that patients are not transferred out of hours.<sup>9 19</sup>

### 5. Use of tracheostomy tubes that are not appropriate for use on general wards

Do not transfer patients to ward areas until they have an uncuffed tracheostomy tube that has an inner lumen that can be removed and cleaned.<sup>20</sup> Follow Intensive Care Society<sup>21</sup> and NPSA<sup>2</sup> guidance on the care of patients with tracheostomies. Ensure patients are frequently reviewed by staff with the experience to decannulate patients appropriately as soon as they no longer require a tracheostomy.

## DISCUSSION

By searching the NPSA critical incident database, we were able to identify incident reports associated with tracheostomies occurring in hospital wards. These incidents were associated with significant identifiable patient harm and often reflected basic knowledge, equipment and organisational deficiencies. By classifying and further analysing similar incident reports, we are able to identify areas where care could be improved to reduce risks to patients.

We have made recommendations which we believe will improve the care of patients with tracheostomies on hospital wards. Addressing the lack of appropriately staffed and equipped ward beds would be expected to reduce the number of critical incidents that occur. This is a complex issue, however, and would require organisational changes in many Trusts. The expansion in provision of internet based resources makes training more accessible for staff without necessarily incurring significant training costs. Some of our recommendations are simple and achievable and would be expected to minimise the impact of an adverse event should it occur. These include the provision of emergency equipment box at the bedside of a patient (which can typically be stocked for less than £100 (€120, US\$150) and does not need to be opened and re-stocked unless in an emergency), and ensuring only tracheostomy tubes suitable for the ward environment are used. Simple bed-head signs discriminating between tracheostomy and laryngectomy patients (along with other details of the tracheostomy) are another simple measure which may be expected to reduce harm.

Not all of the relevant incidents will have been reported to the NPSA during the study period for many reasons, including

## Main messages

- ▶ Analysis of patient safety incidents has identified recurrent themes relating to infrastructure, equipment and competency.
- ▶ Significant harm can occur when patients with tracheostomies are cared for on hospital wards.
- ▶ There is evidence that adequate and appropriately staffed and equipped beds for ward tracheostomy patients could reduce patient safety incidents.

## Current research questions

- ▶ Further research could clarify whether better tracheostomy tube design and technologies to secure them would reduce inadvertent displacement.
- ▶ Assessing the impact of interventions such as targeted training for staff and cohorting tracheostomy patients together onto designated fully equipped 'tracheostomy wards' would validate our recommendations.

inadequacies of the reporting system,<sup>22</sup> fear of the consequences of reporting incidents,<sup>23</sup> and perceptions as to how incidents would be used to improve patient care. We cannot estimate the total number of incidents that would have occurred in the time period or the level of harm they will have caused to patients. The description of the incidents was often very incomplete so that, for example, in more than half of the incidents where tubes became blocked or displaced, it was not possible to establish causative factors or identify how the problem was recognised. The incidents do, however, clearly show that patients are significantly harmed as a result of problems with tracheostomy tubes and that preventable factors are often associated.

Unfortunately, even with the interventions suggested, the presence of a tracheostomy will always place the patient at some additional risk. For this reason, incidents involving tracheostomies should be recorded fully and accurately reported to the NPSA to allow them to be collected and analysed, thus allowing recommendations to be made to improve patient care.

Further research could clarify whether better tracheostomy tube design along with technologies to secure them would reduce inadvertent displacement. Assessing the impact of interventions such as targeted training for staff and cohorting tracheostomy patients together onto designated fully equipped 'tracheostomy wards' would validate our recommendations.

**Acknowledgements** The study was conducted with help from staff in the NPSA, particularly S Khunpha who carried out the database search. The NPSA has

approved the publication of the results published in this paper, although the views expressed are those of the authors and not necessarily those of the NPSA.

**Competing interests** None declared.

**Contributors** Article data and manuscript contributed to by both authors.

**Provenance and peer review** Not commissioned; externally peer reviewed.

## REFERENCES

1. **Heafield S**, Rogers M, Karnik A. Tracheostomy management in ordinary wards. *Hosp Med* 1999;**60**:261–2.
2. **National Patient Safety Agency**. *Protecting patients who are neck breathers*. London: NPSA, 2007. <http://www.nrls.npsa.nhs.uk/resources/?entryid45=59793> (accessed Aug 2009).
3. **National Patient Safety Agency**. *Putting patients first*. London: NPSA, 2008. <http://www.patientsafetyfirst.nhs.uk> (accessed Aug 2009).
4. **Shaw R**, Drever F, Hughes H, *et al*. Adverse events and near miss reporting in the NHS. *Qual Saf Health Care* 2005;**14**:279–83.
5. **Thomas AN**, McGrath BA. Patient safety incidents associated with airway devices in critical care: a review of reports to the UK National Patient Safety Agency. *Anaesthesia* 2009;**64**:354–7.
6. **Thomas AN**, Galvin I. Patient safety incidents associated with equipment in critical care: a review of reports to the UK National Patient Safety Agency. *Anaesthesia* 2008;**63**:1193–7.
7. **Thomas AN**, Panchagnula U. Medication-related patient safety incidents in critical care: a review of reports to the UK National Patient Safety Agency. *Anaesthesia* 2008;**63**:726–33.
8. **Simpson TP**, Day CJ, Jewkes CF, *et al*. The impact of percutaneous tracheostomy on intensive care unit practice and training. *Anaesthesia* 1999;**54**:186–9.
9. **National Institute for Health and Clinical Excellence**. *Acutely ill patients in hospital: recognition of and response to acute illness in adults in hospital (Clinical guideline 50)*. London: NICE, 2007. <http://www.nice.org.uk/guidance/CG50> (accessed Aug 2009).
10. **National Institute for Health and Clinical Excellence**. *Rehabilitation after critical illness (Clinical guideline 83)*. London: NICE, 2009. <http://www.nice.org.uk/guidance/CG83> (accessed Sep 2009).
11. **Cassery P**, Lang E, Fenton JE, *et al*. Assessment of healthcare professionals' knowledge of managing emergency complications in patients with a tracheostomy. *Br J Anaesth* 2007;**99**:380–3.
12. **Lewis T**, Oliver G. Improving tracheostomy care for ward patients. *Nurs Stand* 2005;**19**:33–7.
13. **Choate K**, Barbetti J, Sandford M. Tracheostomy: clinical practice and the formation of policy and guidelines. *Aust Nurs J* 2003;**10**:17–19.
14. **Dara S**, Ashton R, Farmer C. Engendering enthusiasm for sustainable disaster critical care response: why this is of consequence to critical care professionals? *Crit Care* 2005;**9**:125–7.
15. **Merriam S**, Caffarella R. *Learning in adulthood—a comprehensive guide*. 2nd edn. San Francisco: Jossey-Bass Inc, 1998:83–91.
16. **North west Regional Tracheostomy Group Guidelines**. 2009. <http://www.tracheostomy.org.uk> (accessed Nov 2009).
17. **Norwood MG**, Spiers P, Bailiss J, *et al*. Evaluation of the role of a specialist tracheostomy service. From critical care to outreach and beyond. *Postgrad Med J* 2004;**80**:478–80.
18. **Petersen LA**, Brennan TA, O'Neil AC, *et al*. Does housestaff discontinuity of care increase the risk for preventable adverse events? *Ann Intern Med* 1994;**121**:866–72.
19. **Critical Care Stakeholder Forum**. *Quality Critical Care: beyond 'comprehensive critical care'*. London: Department of Health, 2005. <http://www.dh.gov.uk/en/Publicationsandstatistics> (accessed Jun 2009).
20. **NHS Quality Improvement Scotland**. *Best practice statement: caring for the patient with a tracheostomy*. <http://www.nhshealthquality.org> (accessed Jun 2009).
21. **Intensive Care Society**. *Standards for the care of adult patients with a temporary tracheostomy Intensive Care Society*. 2008. <http://www.ics.ac.uk> (accessed Jul 2009).
22. **Harris CB**, Krauss MJ, Coopersmith CM, *et al*. Patient safety event reporting in critical care: a study of three intensive care units. *Crit Care Med* 2007;**35**:1068–75.
23. **Vincent C**, Stanhope N, Crowley-Murphy M. Reasons for not reporting adverse incidents: an empirical study. *J Eval Clin Pract* 1999;**5**:13–21.