

EXECUTIVE SUMMARY

While it is generally accepted that airway management may sometimes be problematic and that complications occur, it was not known how frequently these occur or the nature of the events. NAP₄ sets out to address this.

The 4th National Audit Project of the Royal College of Anaesthetists and the Difficult Airway Society (NAP₄) was designed to answer the questions;

- What types of airway device are used during anaesthesia and how often?
- How often do major complications, leading to serious harm, occur in association with airway management in anaesthesia, in the intensive care units and in the emergency departments of the UK?
- What is the nature of these events and what can we learn from them, in order to reduce their frequency and consequences?

Phase one of the project established that approximately three million patients are anaesthetised in the UK each year in the NHS and delineated the airway devices used to manage these.

Phase two sought to identify all cases of major complications of airway management in the same population as in phase one, but also in ICUs and emergency departments. Each reported case was reviewed by an expert panel to ensure the correct cases were included and to maximise the amount that could be learnt. In total 186 cases met inclusion criteria and were reviewed in detail.

We acknowledge that it is very likely that not all relevant cases were reported to the project and this is discussed in detail in Chapter 5. We estimate that the project might have detected as few as one in four relevant cases.

Major findings

This report is an in-depth analysis of the reviewed cases. Each chapter includes a final section enumerating learning points and recommendations. The recommendations are extensive in number and breadth, reflecting the unique opportunity this project offers to examine airway management in the UK.

This summary does not reproduce or cover all findings in the report but highlights the major themes running through the report. Those with a responsibility for organising airway management policy and for carrying out airway management are encouraged to read the relevant parts of the report in full, including detailed recommendations. The recommendations are reproduced in a single document in Appendix 5.

- Approximately 2.9 million general anaesthetics are administered in the United Kingdom National Health Service each year. In approximately 56% of these cases the airway management is with a supraglottic airway device (SAD), 38% with a tracheal tube and 5% with a face mask.

Clinical themes

- **Poor airway assessment** contributed to poor airway outcomes. This was due to omission, incomplete assessment or a failure to alter the airway management technique in response to findings at assessment. Assessment to predict both potential airway difficulty and aspiration risk were equally important.
- Poor planning contributed to poor airway outcomes. **When potential difficulty with airway management is identified a strategy is required.** An airway plan suggests a single approach to management of the airway. A strategy is a co-ordinated, logical sequence of plans, which aim to achieve good gas exchange and prevention of aspiration. Anaesthetists should approach airway management with strategies rather than plans.
- **Failure to plan for failure.** In some circumstances when airway management was unexpectedly difficult the response was unstructured. In these cases outcome was generally poor. All anaesthetic departments should have an explicit policy for management of difficult or failed intubation and for impossible mask ventilation (e.g. formal adoption of the Difficult Airway Society guidelines as departmental policy) and for other airway emergencies. Individual anaesthetists should use such strategies in their daily practice.
- The project identified numerous cases where **awake fiberoptic intubation (AFOI) was indicated but was not used.** The project methods did not enable us to determine why AFOI was not used but there were cases suggesting, lack of skills, lack of confidence, poor judgement and in some cases lack of suitable equipment being immediately available. This latter problem was prevalent on ICU. Awake intubation should be used whenever it is indicated. This requires that anaesthetic departments and individual anaesthetists ensure such a service is readily available.
- Problems arose when **difficult intubation was managed by multiple repeat attempts** at intubation. The airway problem regularly deteriorated to a 'can't intubate can't ventilate' situation (CICV). It is well recognised a change of approach is required rather than repeated use of a technique that has already failed.



EXECUTIVE SUMMARY

- Events were reported where **supraglottic airway devices were used inappropriately**. Patients who were markedly obese, often managed by junior trainees, were prominent in the group of patients who sustained non-aspiration events. Numerous cases of aspiration occurred during use of a first generation SAD in patients who had multiple risk factors for aspiration and in several in whom the aspiration risk was so high that rapid sequence induction, should have been used.
- **SADs were used to avoid tracheal intubation in some patients with a recognised difficult intubation**. There was often no evidence of a back-up plan. Under these circumstances if the airway is lost (e.g. due to oedema or mechanical displacement) this becomes an anaesthetic emergency. Awake fiberoptic intubation or fiberoptic intubation through a SAD before surgery may offer a lower risk alternative to SAD use in cases of known difficulty with tracheal intubation.
- Anaesthesia for **head and neck surgery** featured frequently in cases reported to NAP₄. These cases require careful assessment and co-ordinated planning by skilled anaesthetists and surgeons. Excellent teamwork is required as when any part of this process fails the risk of adverse outcomes is high.
- Management of the **obstructed airway** requires particular skill and co-operation between anaesthetist and surgeon. This is best performed in a fully equipped environment with full surgical, anaesthetic and nursing support. An operating theatre is the ideal location. Tracheostomy under local anaesthesia may offer a safer alternative to tracheal intubation after induction of anaesthesia, and it should be actively considered. When surgical airway performed by a surgeon is the back-up plan, preparation should be made so this is instantly available.
- The proportion of **obese patients** in case reports submitted to NAP₄ was twice that in the general population, this finding was even more evident in the morbidly obese. Too often obesity was not identified as a risk factor for airway difficulty and the anaesthetic technique was not modified. Particular complications in obese patient included an increased frequency of aspiration and other complications during the use of SADs, difficulty at tracheal intubation and airway obstruction during emergence or recovery. When rescue techniques were necessary in obese patient they failed more often than in the non-obese. Obesity needs to be recognised as a risk factor for airway difficulty and plans modified accordingly.
- There was a **high failure rate of emergency cannula cricothyroidotomy**, approximately 60%. There were numerous mechanisms of failure and the root cause was not determined; equipment, training, insertion technique and ventilation technique all led to failure. In contrast a surgical technique for emergency surgical airway was almost universally successful. The technique of cannula cricothyroidotomy needs to be taught and performed to the highest standards to maximise the chances of success, but the possibility that it is intrinsically inferior to a surgical technique should also be considered. Anaesthetists should be trained to perform a surgical airway.
- **Aspiration was the single commonest cause of death in anaesthesia events**. Poor judgement was the likely root cause in many cases which included elements of poor assessment of risk (patient and operation) and failure to use airway devices or techniques that would offer increased protection against aspiration. Several major events occurred when there were clear indications for a rapid sequence induction but this was not performed.
- **Failure to correctly interpret a capnograph trace led to several oesophageal intubations going unrecognised in anaesthesia**. A flat capnograph trace indicates lack of ventilation of the lungs: the tube is either not in the trachea or the airway is completely obstructed. Active efforts should be taken to positively exclude these diagnoses. This applies equally in cardiac arrest as CPR leads to an attenuated but visible expired carbon dioxide trace.
- **One third of events occurred during emergence or recovery** and obstruction was the common cause in these events. Post-obstructive pulmonary oedema was described in one in ten reports. This phase of anaesthesia, particularly when the airway was difficult at intubation or there is blood in the airway, needs to be recognised as a period of increased risk and planned for.
- The commonest cause of the events reported to NAP₄, as identified by both reporters and reviewers, appeared to be **poor judgement**. While this assessment is made with hindsight it was a consistent finding. The next most common contributory factor was education and training. Choosing the safest technique for airway management may not necessarily be the anaesthetist's most familiar. It may be necessary to seek the assistance of colleagues with specific skills, for example in regional anaesthesia or airway management.

EXECUTIVE SUMMARY

- In more than a third of events from all sources; during anaesthesia, in ICU and the emergency department, airway management was judged to be poor. More often there were elements of both good and poor management. In approximately one fifth of cases airway management was judged to be exclusively good.

ICU and the emergency department

- **At least one in four major airway events reported to NAP₄ was from ICU or the emergency department.** The outcome of these events was more likely to lead to permanent harm or death than events in anaesthesia. Analysis of the cases identified gaps in care that included: poor identification of at-risk patients, poor or incomplete planning, inadequate provision of skilled staff and equipment to manage these events successfully, delayed recognition of events and failed rescue due to lack of or failure of interpretation of capnography. The project findings suggest avoidable deaths due to airway complications occur in ICU and the emergency department.
- **Failure to use capnography in ventilated patients likely contributed to more than 70% of ICU related deaths.** Increasing use of capnography on ICU is the single change with the greatest potential to prevent deaths such as those reported to NAP₄.
- **Displaced tracheostomy, and to a lesser extent displaced tracheal tubes, were the greatest cause of major morbidity and mortality in ICU.** Obese patients were at particular risk of such events and adverse outcome from them. All patients on ICU should have an emergency re-intubation plan.
- **Most events in the emergency department were complications of rapid sequence induction.** This was also an area of concern in ICU. RSI outside the operating theatre requires the same level of equipment and support as is needed during anaesthesia. This includes capnography and access for equipment needed to manage routine and difficult airway problems.

Airway management is a fundamental anaesthetic responsibility and skill; anaesthetic departments should provide leadership in developing strategies to deal with difficult airways throughout the entire organisation.

Interpretation of results

Many of the events and deaths reported to NAP₄ were likely to have been avoidable. Despite this finding, the incidence of serious complications associated with anaesthesia is low. This is also true for airway management in ICU and the emergency department, though it is likely that a disproportionate number of airway events occur in these locations. The aim of this report is that detailed attention to its contents and compliance with the recommendations will make airway management safer.

Many of the findings of NAP₄ are neither surprising nor new, but the breadth of the project, covering the whole of the UK for a full year, will hopefully provide impetus to changes that can further improve the safety of airway management in the UK in anaesthesia, intensive care and the emergency department. Our goal should be to reduce serious complications of airway management to zero.

Dr Tim Cook, Dr Nick Woodall, Dr Chris Frerk

