

## CLINICAL PRACTICE

### AIRWAY ASSESSMENT BY NON-ANAESTHETISTS

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#### Summary

Patients who may require surgery, visit our hospitals daily. Various forms of anaesthesia are given for these surgeries, which include local, regional and general anaesthesia. General anaesthesia may involve the use of devices to maintain a secure and safe airway. The improper management of the airway is still an important cause of morbidity and even mortality in anaesthetic practice. This paper seeks to give guidelines for the non-anaesthetist to be able to identify patients whose airway may be difficult to manage during surgery, since the surgeons see the patients first, long before the anaesthetist does. These airway assessment guidelines have been given based on the various surgical specialties such as general surgery,

maxillofacial and neurosurgery. Specific surgical disorders which have a relatively high percentage of difficult airway have been discussed. They include goitre, mediastinal masses, abscesses and burns around the head and neck. Medical conditions such as diabetes mellitus with expected difficult airway have also been discussed. A simple algorithm has been added as an additional guide. The paper ends with recommendations which include the establishment of difficult airway database and the running of regular workshops for anaesthetists and non-anaesthetists as a means of maintaining skills in the management of the airway of the surgical patient and thus improve on their outcome.

**Key Words:** *Airway assessment, preoperative difficult airway, non-anaesthetist, Mallampati score*

#### Introduction

Every year thousands of patients attend the outpatient clinic with surgical complaints in Ghana. Some of these patients will eventually require surgery which may be minor, intermediate or major. Surgery is done at the various levels of health facilities from the district hospital to the teaching hospital. Depending on the nature of the surgery, patients will require local, regional or general anaesthesia. Some of the patients who require general anaesthesia may require the use of airway devices such as an oropharyngeal airway, laryngeal mask airway or endotracheal intubation. Since the patients are initially seen by the surgeons, long before the anaesthetist does, it is important that the surgeon forms an opinion about the difficulty of the management of the patient's airway which may include intubation.

Difficult intubation of a patient during anaesthesia is classified as anticipated or unanticipated. In one

anaesthetic report, out of 133 cases of difficult airway, 66 were anticipated difficult airway and 67 were not anticipated.<sup>1</sup> This indicates a high rate of anticipated or expected difficult airway in surgical patients. Translated into clinical practice, this study clearly shows that clinical assessment can detect a large percentage of patients with anticipated difficult airway. Hence diligent preoperative airway assessment can improve anaesthesia safety and patient outcome.

It is this group of patients with expected or anticipated difficult airway that the surgeon may be able to identify from the first encounter with the patient, based on some criteria which will be made clearer later in this paper.

This paper is being written as a guide for non-anaesthetists to help them identify some of these patients, if not all of them. Improper management of the airway can lead to various degrees of morbidity or even mortality. The prevalence of difficult intubation is about 1-2% of surgical population.<sup>2</sup> According to a report by a committee of the American Society of Anesthesiologists, even though complications related to the respiratory system have declined over the years they still constituted 32% of all claims<sup>3</sup> in one series.

Since most hospitals in Ghana do not have physician anaesthetists, it is even more important for surgeons working in this country to have some knowledge and expertise in the assessment of the airway of the surgical patient.

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## Definitions

**Airway:** The term airway refers to the extra pulmonary air passage which starts from the nasal passage down to the large bronchi.<sup>4</sup>

**Difficult airway:** A difficult airway is one in which there is a problem in establishing or maintaining gas exchange via a mask and artificial airway or both.<sup>4</sup> Difficult intubation is still responsible for 6.4% of claims according to one closed claims database<sup>5</sup>

Respiratory events are the most common causes of anaesthetic related injuries. They are second only to dental damage.<sup>2</sup> The airway of a surgical patient is so important that a Difficult Airway Society has been formed in the United Kingdom since 1995.<sup>6</sup> The Society aims to improve the management of the airway of patients by anaesthetists and critical care personnel. The Royal College of Anaesthetists of the United Kingdom runs regular workshops on the management of difficult airway to equip or re-equip anaesthetists with the skills and knowledge to enable them to manage such patients.

## Steps required in assessment of the airway

The general principles used in the assessment of every patient can also be used in the airway assessment of a patient, that is: history, examination and investigations.

### History

A detailed medical and surgical history is required. A patient who gives a previous history of difficult airway offers important information. However this information is rarely obtained from patients in our environment as medical practitioners rarely give such information to patients. In the ideal situation, the patient is informed and is also given a letter on discharge from the hospital. Most patients given this information may not even remember to take it to the hospital when requiring surgery especially in an emergency situation.

### Surgical history

Even though every surgical patient potentially has a difficult airway, some are more obvious. This is what was referred to in the introduction as anticipated difficult airway. The patients with anticipated difficult airway can be classified under congenital or acquired causes. The congenital causes include such anomalies as Pierre-Robin syndrome, cleft lip with or without cleft palate, and occipital meningocele. The acquired causes are more common and can be classified under the following headings:

- a. Tumours/growths - in the head and neck region such as thyroid enlargement, ameloblastoma
- b. Trauma – fracture of cervical spine, maxilla, mandible
- c. Endocrine- obesity, acromegaly
- d. Infections- Ludwig's angina, retropharyngeal abscess
- e. Burns around head and neck

This list is not exhaustive neither does it exclude other causes of expected difficult airway. A detailed history should be taken from a patient who presents with any of the above conditions. This should include the onset, any previous management including surgery and any complications encountered during the management. History of radiation therapy for thyroid cancer or any head and neck cancer should be noted as this can lead to contractures around the neck. Contractures around the head and neck from whatever cause may lead to difficult intubation.

In addition to the history of the presenting condition, one has to take past surgical and medical history. The past surgical history should include previous surgery (other than the presenting complaint) and its complications. Any surgery on the cervical spine is an important pointer to expected difficult airway. A medical history is also important in a surgical patient. A patient with a history of diabetes mellitus, rheumatoid arthritis or ankylosing spondylitis may present with difficult airway.

### Examination

Examination of the patient includes general examination and examination specific to the airway. On general examination, obvious abnormalities of the jaw, head and neck areas should be noted. The length and thickness of the neck as well as its range of movement should also be noted. The patient should be able to touch the chest with the tip of the chin. Large head and mandible, deformed mandible, small chin, macroglossia and prominent incisors are all pointers to difficult airway.

In recent years, some female patients come to the hospital with hair styles such as "rasta" and attachment of "human/artificial hair" which sometimes extend below the waist line. When these are tied into bows at the back, the extension of the head during intubation becomes difficult or impossible.

The American Society of Anesthesiologists has updated its guidelines for the management of difficult airway. These guidelines recommend the assessment of the airway using several criteria<sup>7</sup> as no single criterion is specific enough. One of the commonest assessment tools used is the Mallampati classification of the airway.<sup>8</sup> The patient sits up with the tongue maximally protruded. The ability to visualize the faucial pillars, the soft palate and uvula is used to classify patients into four classes: class 1 where there is full visualization of all three structures to class 4 where even the soft palate is not visible. Mouth opening may reveal asymmetry, trismus or pain. As a rough guide a normal mouth opening should admit 3 fingers of the examining hand or should be 3.5-6cm wide.

The weight of the patient is important even though obesity on its own does not necessarily mean difficult airway. General examination should include the hands and feet which may give information about arthritis that the patient may be suffering from.

### *Examination of the upper chest and neck*

Masses may extend from the neck region to the upper chest. These include cystic hygroma and huge thyroids. There could also be huge, hypertrophied scars around the head and neck area which could limit the movement of the neck. Enlarged neck veins may indicate mediastinal masses including extension of thyroid gland.

### **Investigations**

In addition to essential investigations like full blood count and blood urea and electrolytes, one may have to do imaging studies like plain radiographs of the chest, neck and thoracic inlet. Both antero-posterior and lateral radiographs may be required.<sup>4</sup> Ultrasonography of, for example, the thyroid gland may be useful in the evaluation of the airway.<sup>4</sup> One may require CT scans and sometimes MRI to define some of these complex airways. Investigations such as ECG, echocardiograph and /or pulmonary flow volume loops may be required in patients with mediastinal masses.<sup>9</sup> Direct and indirect laryngoscopy; and arterial blood gases may be useful in some patients<sup>4</sup>.

## **Airway Consideration for Specific Specialties**

### **General surgery**

In addition to the general considerations mentioned, above some of the common disorders will be discussed.

*Thyroid gland enlargement:* This is one of the commonest surgical disorders in Ghana. There are a number of districts in Ghana where non-toxic goitre is endemic. In recent years, the average patient present for surgery with good outcome. A thorough history including pressure symptoms should be ascertained from the patient. Any previous thyroid surgery (in cases of recurrence) and complications should be ascertained. The answers to these questions may give a fair idea of the difficulties to be expected as far as the airway is concerned. Malignant thyroid enlargement may involve cervical lymph nodes. The presence of cervical lymphadenopathy will make the airway more complicated and hence more difficult to manage. Mediastinal involvement and tracheal deviation should also be noted.

### *Key points:*

- History- previous surgery, pressure symptoms
- Size of gland
- Malignancy
- Cervical lymphadenopathy
- Mediastinal involvement
- Trachea position

### *Mediastinal masses*

In addition to the thyroid gland which may extend into the superior mediastinum, other masses such as lymph nodes can compromise the airway. Depending on the size of the mass, signs and symptoms such as stridor, orthopnoea, dyspnoea, decreased breath sounds

and wheezes may be present. When there is significant obstruction of the superior vena cava by a tumour, the patient may have what is called the “superior vena cava syndrome.” This is characterised by cyanosis, engorged veins and/or oedema of the upper body.

### *Key points*

- History
- Signs of compromised airway-stridor, orthopnoea, cough
- Rule out “superior vena cava syndrome”

### **Maxillofacial surgery**

Tumours of the jaw of varying sizes, intraoral tumours and fractures of the facial bones are not uncommon in this specialty. Patients may present with huge tumours sometimes with intraoral extension. Some of these intraoral tumours became ulcerated and may also bleed readily on contact. The presence of blood in the oral cavity may obscure the vision of the anaesthetist during laryngoscopy even with the fiberoptic laryngoscope.

Some of these tumours may lead to loosening of the teeth of the patients. The risk of the dislodgement of loose teeth is high during laryngoscopy. If a dislodged tooth is not found, a radiograph may have to be taken to locate the tooth. If the tooth is found in the gastrointestinal system it will be passed per rectum. In the unfortunate situation that the tooth is lodged in the tracheobronchial system, a bronchoscopy or even a thoracotomy may be required.

Dental abscess is not an uncommon emergency in maxillofacial surgery. The infection sometimes spreads to the floor of the mouth and there could be trismus as well. These patients present with expected difficult airway. In some patients with jaw tumours, there may be secondary bacterial infection when the tumour ulcerates. This could also spread to the floor of the mouth. Infection of the floor of the mouth adds to the difficulty of laryngoscopy.

Fractures of the facial bones especially the mandible presents difficulties during laryngoscopy, when the jaw is moved by the laryngoscope. Mandibular fractures may also be associated with dental problems like loose teeth. Soft tissue damage of the face may make placement of the face mask difficult because of pain or bleeding. Most of these patients are usually classified as expected difficult airway.

### *Key points*

- History
- Exclude intraoral tumours/extension
- Note abnormalities in dentition
- Note bleeding on contact

### *Infections including abscesses*

Another group of patients who may present with difficult airway are patients with infections around the head and neck region which may involve the floor of the mouth. This may spread to involve the pharynx or even the larynx which may lead to difficult airway. In

addition to dental abscess which has already been mentioned, Ludwig's angina, retropharyngeal abscess and any infection of the head and neck region may all lead to difficult airway. There is also the additional risk of rupture of the abscess and the soiling of the tracheo-bronchial tree.

#### *Key points*

- History
- Mouth opening
- Neck mobility
- Examination of the floor of mouth

#### **Ear, Nose and Throat**

Laryngeal papilloma and cancers, and nasopharyngeal tumours present special challenges in the management of the airway. These may present as acute upper airway obstruction making the diagnosis of expected difficult airway more obvious. The airway management however, becomes critical in emergency situations as there may be limited time to transfer the patient to a health facility with the necessary expertise. Adult patients with airway obstruction may have a surgical airway done under local anaesthesia. Children, however require general anaesthesia for any intervention as it is difficult to restrain a child who is struggling as a result of hypoxia. The limitation in the supply of consumables and anaesthetic expertise may make the management of such patients difficult at the district hospital level.

In other non-malignant cases, huge tonsils, obstructive sleep apnoea syndrome, nasal obstruction all point to difficult airway. These patients should be identified by history and examination as they may come for another type of surgery not related to any of the above disorders.

#### *Key points*

- History-snoring
- Examination- nose, throat
- Indirect laryngoscopy

#### **Plastic and reconstructive surgery**

This specialty deals with a number of congenital anomalies such as cleft lip with or without cleft palate which may be associated with airway abnormalities. With acquired conditions, such as trauma to the soft tissues of the face and burns injury around the head and neck lead to difficult airway in the patient. Thermal injury of the tracheobronchial system as well as the lung parenchyma may lead to additional airway difficulties. Even though burns injury around the head and neck is a pointer to expected difficult airway, the extent of the difficulty may only become obvious at the time of induction of anaesthesia. Third degree burns around the head and neck may lead to contractures. Patients so affected may require multiple general anaesthesia to correct some other deformities, in

addition to those around the head and neck. They may also require fibreoptic intubation to secure the airway.

#### *Key points*

- History- nature of the injury
- Examination - note especially contractures
- Note other abnormalities

#### **Neurosurgery**

Congenital anomalies such as occipital meningocele and hydrocephalus are causes of expected difficult airway. Most patients in Ghana who present with hydrocephalus come late. Positioning of the head becomes problematic during induction of anaesthesia. This may require stabilization by another person before laryngoscopy can be attempted.

Cervical spine fracture is not uncommon after road traffic accident. These patients will need surgery under general anaesthesia to fix the fracture or deal with any other injury. Intubation of these patients requires expertise which is available at tertiary level of health care. Some of these patients may require fibreoptic intubation.

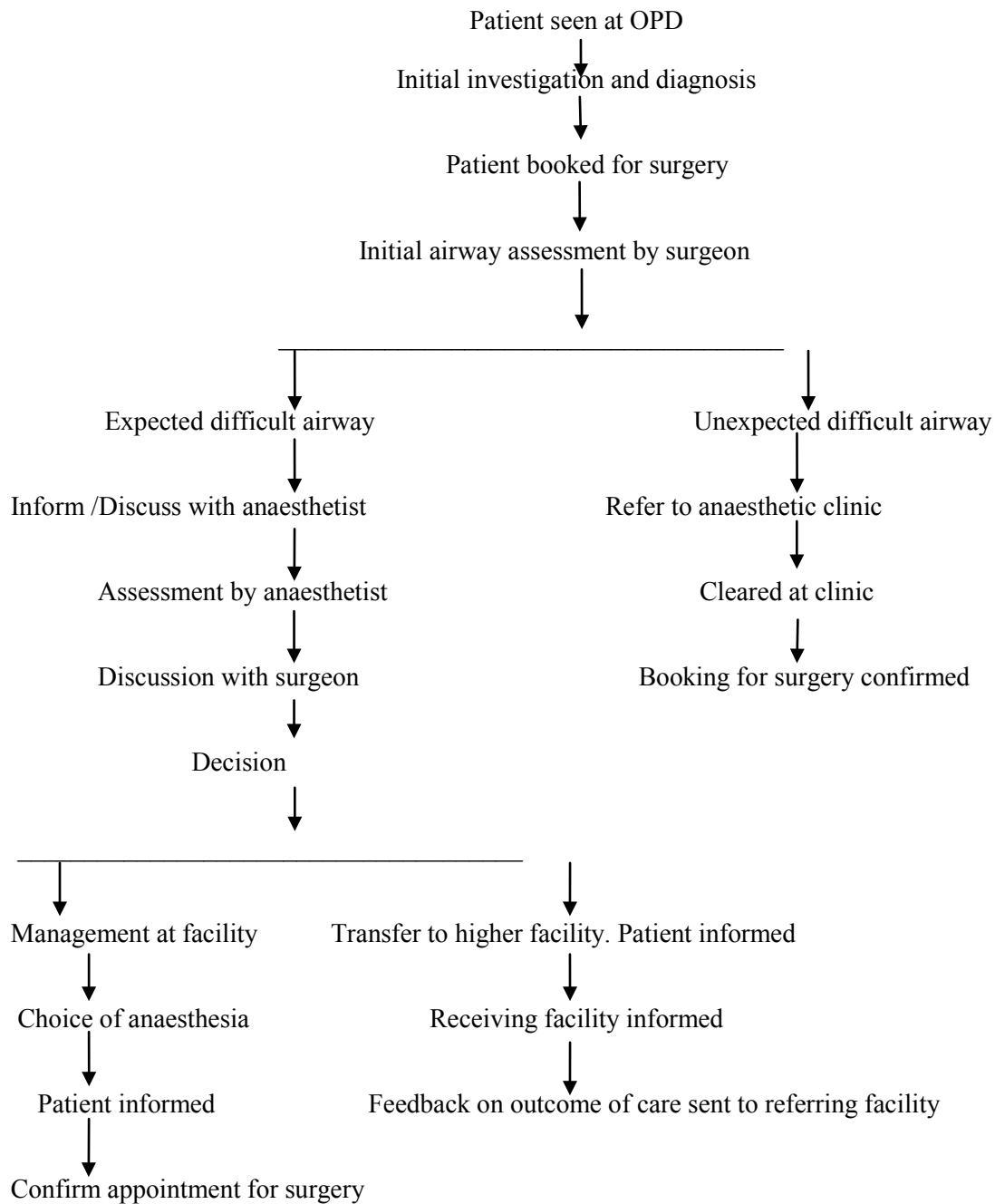
#### **Other surgical specialties**

The above specialties have been discussed because of the more common causes of difficult airway encountered in those specialties. As mentioned earlier under Ear Nose Throat section, a patient may present for surgery of any part of the body and may have difficult airway which may be overlooked if the surgeon does not pay attention to the history. Some of the factors have been mentioned earlier. For example, a patient presents for inguinal hernia repair but on examination, also has thyroid gland enlargement; or the patient who presents for intranasal surgery but has congenital abnormality of the cervical spine.<sup>10</sup> These two case scenarios stress the importance of thorough history and examination of every patient booked for surgery. The patient may not die from the primary disorder but rather from complications of the airway management during anaesthesia.<sup>10</sup> A simple algorithm for airway assessment is shown in Figure 1

#### **Medical Conditions Which May Present With Difficult Airway**

##### ***Diabetes mellitus***

Diabetes mellitus is not uncommon in surgical patients. They may require surgery for complications of the disease or for any other incidental surgery. A study by Amoah and colleagues in the Greater Accra Region put the crude prevalence of diabetes mellitus at 6.3%.<sup>11</sup> The examination of the palms of a diabetic patient especially those with long-standing disease can give a fair idea as to the anticipated difficulty or otherwise of the airway. This is due in part to the diabetic "stiff joint syndrome." The fourth and fifth



**Figure 1.** Algorithm for the airway assessment of a surgical patient

Proximal phalangeal joints are most commonly involved<sup>9</sup>.

The stiffness of the joints can be used to elicit two signs: “palm print”<sup>12,13</sup> and the “prayer sign.”<sup>12,14</sup> The “palm print” tests how much contact a patient’s palm can make on a flat surface. A coloured substance is used as an indicator. The patient is graded from zero when all the phalangeal areas are visible to three when only the tips of the digits are visible. The “prayer sign” is very easy to do at the bedside. The patient is asked to bring both palms together. It is categorized as “positive” when there is a gap between the palms and “negative” when there is no gap between the palms.

The involvement of the cervical spine can result in limited atlanto-occipital joint movement which will make laryngoscopy difficult. This is believed to be due to the glycosylation of tissue protein from chronic hyperglycaemia.<sup>9</sup>

#### **Rheumatoid Arthritis**

Patients suffering from rheumatoid arthritis may present with difficult airway because of cervical spine instability, temporo-mandibular joint or arytenoid joint immobility. The larynx may also be abnormally placed because of erosion and general collapse of the cervical vertebrae.<sup>9</sup>

#### **Obesity**

Morbidly obese patients may present with difficult airway because of their short thick neck, large tongue and redundant oropharyngeal tissue.<sup>9</sup> The large breasts in females may make laryngoscopy difficult. Obese patients desaturate easily at induction and there is the additional risk of regurgitation and/or aspiration during anaesthesia. The importance of securing the airway in the obese patient cannot be overemphasized.

#### **The HIV/AIDS patient**

Patients suffering from AIDS can develop Kaposi’s sarcoma and opportunistic infections such as candidiasis involving the mouth, trachea and bronchi can result in difficult airway.<sup>9</sup>

### **Perioperative management of the patient**

When a patient with expected difficult intubation is being induced, the surgeon should be in theatre until the airway has been secured. Since a certain proportion of patients with unexpected difficult airway may turn out to be difficult, it is essential that the surgeon is not far away to help the anaesthetist in case of difficulty especially in health facilities where the anaesthetist may be alone and also in situations where the anaesthetist may not be experienced enough. In some instances, the surgeon may be required to do a tracheostomy either as an elective procedure under local anaesthesia before the start of the surgery or as an emergency procedure when it becomes impossible to maintain oxygenation by the methods available at that point in time. It is better for the surgeon to establish a surgical airway at the opportune time noting that delay may cause irreversible brain damage.

### **Equipment used in management of difficult airway**

Some of the equipment required for the management of difficult airway are simple and are available in most district hospitals in the Central Region of Ghana as at the beginning of 2012. These include stylets, bougies and laryngeal mask airways. There are other more sophisticated items of equipment for the management of difficult airway such as the flexible fiberoptic laryngoscope which is considered the “the gold standard” for difficult intubation. Another group of equipment which is becoming popular is the Rigid Indirect Laryngoscope. Examples are Airtrach, T-Trach and C-Mac. C-Mac is currently available at the Korle Bu Teaching Hospital in Ghana. These devices view the larynx indirectly with the assistance of a video screen. The learning curve for the Rigid Indirect Laryngoscope is shorter than that of the flexible laryngoscope which views the larynx directly. It is worth noting that the initial and maintenance cost of these equipment is high.

### **Assessment of the paediatric airway**

The assessment of the paediatric airway follows the same principles as that of adults. That is: history, examination and investigations. History of snoring and day time somnolence may be pointers to expected difficult airway. Examination of children may reveal congenital anomalies such as cleft palate and some of the other disorders mentioned earlier. It may be difficult to do certain examinations such as Mallampati classification in children due to lack of co-operation.

### **Recommendations**

The expertise and equipment required in the management of patients with difficult airway are not always available even in tertiary institutions. It is important that the management of health facilities takes steps to acquire some of these equipment. A large number of airway devices continue to be developed by manufacturers. Acquisition of these devices does not necessarily mean that practitioners will have the necessary skills or interest in their use, as revealed in surveys conducted in the USA and Canada where only 2 techniques, namely: direct laryngoscopy and fiberoptic intubation remained the most popular means of intubating patients.<sup>15, 16</sup>

To ensure that anaesthetists, as well as surgeons are trained in the use of these equipment, regular workshops with the use of models and simulators are important. The use of simulators has improved safety in the aviation industry; the same can be applied to anaesthesia.<sup>17</sup> The Ghana College of Physicians and Surgeons can act as a facilitator in the whole process. Regular workshops on the management of the difficult airway can be organised by the College for all Fellows, Members, as well as Residents. The training of all practitioners has become more important as patients may require the

management of their airway outside the operating theatres, especially, when surgery is being done under local anaesthesia and there is no anaesthetist available.

### The Role of Database

Currently there are no data in Ghana on patients with difficult airway and no international database exists either. Some societies and individual hospitals elsewhere, however, have maintained their own database.<sup>18-20</sup> If practitioners, including non-anaesthetists are encouraged to collect data and transmit to a central location, for example, to the Faculty of Anaesthesia of the Ghana College of Physicians and Surgeons, Ghana will soon create a register of patients with difficult airway. Since many patients with difficult airway may return for another operation at a later date, the database can be utilised as the basis for information and the management of such patients. The Difficult Airway Society in the UK has created a national difficult airway base linked to the Medic Alert registry in that country.

### Conclusion

This paper has outlined the assessment of the airway of surgical patients by using the same principles used in the assessment of patients as a whole. That is: history, examination and investigations. Even though all surgical patients have potential difficult airway, some may be more obvious than others. No single criterion is sensitive enough in the diagnosis of difficult airway. Early identification by the surgeon, communication with the anaesthetist and assistance at induction will help in minimizing or preventing critical incidents arising from the airway management of the surgical patient.

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### References

- Pearce A. NAP4 Project- Assessment and planning. Accessed at: [www.rcoa.ac.uk/system/files/CSQ-NAP4-Section3](http://www.rcoa.ac.uk/system/files/CSQ-NAP4-Section3). Accessed on 2nd May 2013.
- Hayward J. Airway Assessment. Accessed at: [gaslog.org.uk/download/?id=32](http://gaslog.org.uk/download/?id=32). Accessed on 2nd May 2013.
- Cheney FW. Changing trends in anesthesia-related death and permanent brain damage. *ASA Newsletter* 2002; 66: 6–8.
- Gupta S, Sharma R, Jain D. Airway Assessment: Predictors of Difficult Airway. *Indian J Anaesth* 2005; 49(4): 257-262. Accessed at: [medind.nic.in/iad/t05/i4/iadt05i4p](http://medind.nic.in/iad/t05/i4/iadt05i4p) Accessed on: 2nd May 2013.
- Miller CG. Management of the difficult intubation in closed malpractice claims. *ASA Newsletter* 2000; 64:13–16.
- Difficult Airway Society. Accessed at: [www.das.uk.co](http://www.das.uk.co) Accessed on: 5th May 2013
- Practice guidelines for management of the difficult airway. An updated report by the American Society of Anesthesiologists Task Force on management of the difficult airway. *Anesthesiology* 2003; 98: 1269–1277. Accessed at: [journals.lww.com/anesthesiology/toc/2003/05000](http://journals.lww.com/anesthesiology/toc/2003/05000). Accessed on: 8th July 2013.
- Mallampati SR. Clinical sign to predict difficult tracheal intubation (hypothesis). *Can Anaesth Soc J* 1983; 30: 316–317.
- Doyle JD. Medical Conditions with Airway Implications. Accessed at: [www.uam.es/departament/medicina/anesnet/gtoa/medical-airway.html](http://www.uam.es/departament/medicina/anesnet/gtoa/medical-airway.html) Accessed on: 8th July 2013.
- Bromiley M. The case of Elaine Bromiley. Accessed at: [www.chfg.org/.../Anonymous\\_Report\\_Verdict\\_and\\_Corrected\\_Timeline...](http://www.chfg.org/.../Anonymous_Report_Verdict_and_Corrected_Timeline...) Accessed on: 2nd May 2013.
- Amoah AGB, Owusu SK, Adjei S. A. Diabetes in Ghana: a community based prevalence study in Greater Accra. *Diabetes Res Clin Pract* 2002; 56: 197-205. Accessed at: [http://dx.doi.org/10.1016/S0168-8227\(01\)00374-6](http://dx.doi.org/10.1016/S0168-8227(01)00374-6). Accessed on: 9th July 2013.
- Reissell E, Orko R, Maunukela EL Lindgren L. Predictability of difficult laryngoscopy in patients with long term diabetes mellitus. *Anaesthesia* 1990; 45: 1024-1027. Accessed at: <http://onlinelibrary.wiley.com/doi/10.1111/j.1365-2044.1990.tb14879.x/pdf>. Accessed on: 9th July 2013.
- Nadal JLY, Fernandez BA, Ecsobar IC, Black M, Rosenblatt WH. Palm print as a sensitive predictor of difficult laryngoscopy in diabetics. *Acta Anaesthesiol Scand* 1998; 42: 199-203. Accessed at: [www.ncbi.nlm.nih.gov/pubmed/9509203](http://www.ncbi.nlm.nih.gov/pubmed/9509203) Accessed on: 9th July 2013.
- McLennan S, Yue D, Marsh M, Swanson B, Delbridge L, Reeve and T Turtle JR. The prevention and reversibility of tissue non-enzymatic glycosylation in diabetes. *Diabet Med* 1986; 3: 141-146. Accessed at: [onlinelibrary.wiley.com](http://onlinelibrary.wiley.com) DOI: 10.1111/j.1464-5491.1986.tb00725.x. Accessed on: 9th July 2013
- Rosenblatt WH, Wagner PJ, Ovassapian A, Kain ZN. Practice patterns in managing the difficult airway by anesthesiologists in the United States. *Anesth Analg* 1998; 87: 153–157. Accessed at: [www.anesthesia-analgesia.org/content/87/1/153](http://www.anesthesia-analgesia.org/content/87/1/153) Accessed on: 9th July 2013.
- Jenkins K, Wong DT, Correa R. Management choices for the difficult airway by anesthesiologists in Canada. *Can J Anaesth* 2002; 49:850–856. Accessed at: [link.springer.com/article/10.1007%2FBF03017419](http://link.springer.com/article/10.1007%2FBF03017419). Accessed on: 9th July 2013.

17. Howard SK, Gaba DM, Fish KJ, Sarnquist F. Anesthesia crisis resource management training: teaching anesthesiologists to handle critical incidents. *Aviat Space Environ Med* 1992; 63:763–770. Accessed at: [books.google.com.gh/books?isbn=0754645983](http://books.google.com.gh/books?isbn=0754645983). Accessed on: 9th July 2013.
  18. Barron FA, Ball DR, Jefferson P, Norrie J. ‘Airway Alerts’ How UK anaesthetists organize, document and communicate difficult airway management. *Anaesthesia* 2003; 58: 73–77. Accessed at: [http://onlinelibrary.wiley.com/doi/10.1046/j.1365-2044.2003.02788\\_6.x/full](http://onlinelibrary.wiley.com/doi/10.1046/j.1365-2044.2003.02788_6.x/full) Accessed on 9th July 2013.
  19. Kerridge RK, Crittenden MB, Vutukuri VL. A multiple-hospital anaesthetic problem register: establishment of a regionally organized system for facilitated reporting of potentially recurring anaesthetic-related problems. *Anaesth Intensive Care* 2001; 29: 106–112. Accessed at: [www.aaic.net.au](http://www.aaic.net.au) Accessed on: 9th July 2013.
  20. Mark LJ, Beattie C, Ferrell CL, Trempy G, Dorman T, Schauble JF. The difficult airway: mechanisms for effective dissemination of critical information. *J Clin Anesth* 1992; 4: 247–251. Accessed at: [http://dx.doi.org/10.1016/0952-8180\(92\)90076-D](http://dx.doi.org/10.1016/0952-8180(92)90076-D). Accessed on: 9th July 2013.
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