Continuing Medical Education Article

Acute epiglottitis in adults

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Acute epiglottitis is an infectious disease of the epiglottis and supraglottic structures, which may progress rapidly to complete airway obstruction. The condition is well recognized in children and management has largely been standardized.¹⁻⁴ It is less commonly recognized that acute epiglottitis may present in adults, with the potential for complete airway obstruction.

History

Cases of "laryngeal abscess" have been reported since the thirteenth century.⁵ Perhaps the most famous case of epiglottitis in an adult was that of George Washington, who died on December 14, 1779. A review of the meticulously recorded presentation and clinical course of the case⁶ suggests that the first President of the United States of America died of epiglottitis.⁷⁻⁹

An early review of the literature on infections of the epiglottis^{9,10} reveals that epiglottitis was initially reported more frequently in adults than in children.

Theisen,¹¹ in 1900, reported three cases of acute epiglottitis and expressed the view that this disease is a distinct entity. Key,¹² in 1916, isolated *H. influenza* ("Bacillus influenzae") from the swollen epiglottis of a young physician, who later recovered. Sinclair,¹³ in 1941, described 10 children who presented with acute epiglottitis and positive blood cultures for *H. influenzae* Type B. Four of the patients died. He concluded that acute epiglottitis is a systemic infection requiring antibiotic and airway management.

Aetiology

Acute epiglottitis is an infectious condition involving the epiglottis and supraglottic larynx, resulting in swelling of

these structures. The swelling stops distally at the vocal cords because of the close adherence of the epithelium at this site.¹⁴ Occasionally the epiglottis is spared, with inflammation limited to the supraglottic larynx.¹⁵ In children, the responsible bacterium is nearly always *H. influenzae*.^{1,2} The condition in adults is most commonly due to *H. influenzae*, but may result from *Streptococcus pneumoniae*, Group A *Streptococcus*, Group F *Streptococcus*, *Staphylococcus aureus*, *Staphylococcus pyogenes*, *Streptococcus viridans*,¹⁶⁻²⁰ or *Fusobacterium necrophorum*.²¹ Two cases of epiglottitis thought to be due to *Haemophilus parainfluenzae* have been reported²³⁻²⁶ and Adenovirus and Respiratory Syncytial Virus have been implicated.²⁰ Blood cultures are most commonly positive if the infection is due to *H. influenzae*.^{20,21,27} Three cases of epiglottitis associated with *Streptococcus pneumoniae* bacteremia and several cases due to *Candida albicans* have been reported in immunocompromised patients.²⁹⁻³⁰

A single case report of epiglottitis due to *Candida albicans* in a healthy nonimmunocompromised patient has appeared.³¹ *Pasteurella multocida* epiglottitis was reported in a patient on home dialysis.³² *Bacteroides melanogenicus* was isolated from an epiglottic abscess in a 30-year-old male homosexual with normal T-lymphocyte subset analysis.³³ A single case of *Klebsiella* epiglottitis was reported by Berthiaume, *et al.*³⁴

It has been suggested that widespread use of antibiotics has resulted in an adult population with less immunity to *H. influenzae*,²⁰ and a greater tendency to develop serious *H. influenzae* infection.

The tissues involved exhibit oedema, neutrophil infiltration and microabscess formation.^{8,35} Abscess formation is more common in adults than in children.³⁶⁻³⁹ In the adult, severity of respiratory distress correlates significantly with the presence of positive blood cultures.^{21,23,37}

Epiglottitis is more common in children than in adults, although one series reported 31 cases of epiglottitis, 20 of whom were adults.⁴⁰

Mortality is high in the adult,^{35,37,41} largely due to misdiagnosis and inappropriate treatment.^{21,42-45} A review of retrospective studies reveals a mortality of

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approximately six per cent. The incidence of acute epiglottitis appears to be increasing in both children and adults.^{2,21,37,45,46} Seasonal incidence varies from series to series.^{8,14,37} Definite geographical differences in incidence do exist.⁴⁷

Clinical presentation

All adult patients presenting with epiglottitis complain of sore throat and dysphagia,^{48,49} often out of proportion to the findings on examination of the pharynx.^{8,19,42,50} The sore throat may be present for several days prior to presentation, averaging two to three days,³⁷ or may begin only hours prior to complete airway obstruction.^{8,42} Often the voice is muffled,^{8,23,42} but not hoarse. Respiratory distress may occur within hours of onset,^{8,48,51} may occur suddenly,^{3,9,23,36,51-55} or may be absent.^{24,33,41}

Symptoms of upper airway obstruction are less common on presentation in adults than in children.⁴⁸ Inspiratory stridor may be present but its absence by no means rules out the diagnosis.

Examination may or may not reveal a pharyngitis. Temperature may be normal or high, in one series averaging 101.7° F. (38.7° C).²⁷ The neck may be swollen^{23,56} and tenderness of the larynx may be elicited by palpation.⁴⁸

Blood cultures are often negative^{17-19,27} but are more reliable than cultures of the pharynx or epiglottis.⁸ *H. influenzae* is the organism most commonly cultured in adults as well as children. White blood cell count is commonly elevated, averaging 14,500.²⁷

Diagnosis may be made by indirect laryngoscopy,^{1,8,21,27} flexible fiberoptic rhinolaryngoscopy,¹⁶ x-ray of the soft tissues of the neck,^{1,8,42} or direct laryngoscopy in the operating room. Indirect laryngoscopy may be carried out if the patient is cooperative and not distressed, but may precipitate complete obstruction if respiratory distress is present,^{42,57} although a large series demonstrated the safety of this technique in adults.²¹

Direct visualization reveals a swollen, inflamed or pale, horseshoe-shaped epiglottis. The aryepiglottic folds are usually inflamed and edematous (Figures 1 and 2).

X-ray of the soft tissue of the neck has traditionally been considered a reliable method of diagnosing or ruling out acute epiglottitis.^{1,8,42,58} A recent retrospective review, however, questions the sensitivity and specificity of soft tissue x-rays as a diagnostic modality in epiglottitis.⁵⁹ Mayo-Smith²¹ also reported four cases of proven epiglottitis, all in adults, where soft tissue x-rays of the neck were read as normal. A further five cases from their study were read as "indeterminate."

It must be emphasized that no patient with suspected epiglottitis should be sent to the X-ray Department unless accompanied by personnel equipped for and capable of

FIGURE 1 The swollen, inflamed, horseshoe-shaped epiglottis of a child with epiglottitis.

FIGURE 2 The same patient, with an endotracheal tube in place.

managing airway obstruction. Preferably, x-rays should be performed in the Emergency Department, if the diagnosis is in doubt.

X-ray examination should not delay airway stabilization in the operating room if any evidence of upper airway obstruction exists. During all examinations the patient

FIGURE 3 X-ray of the soft tissues of the neck at the time of presentation. Note the swollen appearance of the epiglottitis and the ballooning of the air space of the hypopharynx.

FIGURE 4 A normal soft tissue x-ray of the neck. Note the narrow epiglottis.

should be allowed to sit, if so desired, as recumbency may precipitate airway obstruction. Lateral soft tissue x-rays of the neck are taken with the patient's head in the "sniffing" position (extension of the head on the neck with forward flexion of the neck). Soft tissue x-rays of the neck usually reveal swelling of the epiglottis, aryepiglottic folds, arytenoids, uvula and retropharyngeal soft tissues.⁴² All patients exhibit ballooning of the hypopharynx, due to voluntary effort by the patient to maintain minimal resistance to airflow on inspiration.^{42,60} The vallecula is obliterated and the airway is narrowed adjacent to the epiglottis (Figures 3 and 4).

Many cases of epiglottitis in adults are misdiagnosed and this may result in the death of a patient who could otherwise survive with correct management. Clues to the diagnosis are:

- 1 A patient with throat pain out of proportion to the findings on examination of the pharynx
- 2 A sudden onset of sore throat
- 3 Dysphagia
- 4 Voice change, usually muffled rather than hoarse
- 5 A toxic appearance
- 6 Respiratory distress or stridor

7 Pain on external palpation of the larynx

If any suspicion of epiglottitis exists, indirect laryngoscopy and/or x-ray of the soft tissue of the neck should be performed to either confirm or rule out the condition, assuming the patient is not in distress. These investigations should not delay definitive management of the airway of the patient who is in respiratory distress.

Mechanism of obstruction

Sudden fatal airway obstruction may occur in both adults and children with epiglottitis, despite careful observation.^{3,19,47,61,62} Several factors may contribute to sudden airway obstruction:

1 Mechanical Laryngeal Obstruction^{1,42}

As the epiglottis swells, it curls posteriorly, forming a horseshoe shape and obstructing the epiglottic aperture^{19,62,63} (Figure 5). Oedema of the aryepiglottic folds contributes to this process. On inspiration these structures are drawn downward, thus increasing the degree of obstruction and causing inspiratory stridor.^{19,64} Sudden obstruction may occur, however, with minimal involvement of the aryepiglottic folds and a relatively small epiglottis,^{1,61} indicating that mecha-

FIGURE 5 Diagram illustrating transverse section through the normal and inflamed epiglottitis.

nisms other than the "cork in the bottle" must contribute to obstruction. There is a lack of correlation between the size of the epiglottis and the degree of airway difficulty.^{47,61}

- 2 The rigidity of the epiglottis and supraglottic structures may prevent the epiglottis from keeping secretions out of the trachea. Secretions spilling onto the vocal cords may precipitate laryngeal spasm¹ or may contribute to airway obstruction.^{14,42,63,64}
- 3 Respiratory arrest may occur as a result of fatigue.^{1,3,65} This may occur in the absence of complete airway obstruction. It has been demonstrated that manual ventilation is possible in children with epiglottitis who experience respiratory arrest.⁶⁶ This should be attempted in the adult patient while preparing to intubate.

Position may contribute to obstruction. Patients with upper airway obstruction tend to find a position which maximizes their ability to inhale and minimizes upper airway resistance to airflow.³⁹ This is usually a sitting position. Lying the patient down may precipitate obstruction. This fact should be made known to ambulance personnel as the trip to the hospital may well prove fatal if the patient is forced to assume a recumbent position.

It is felt by some authors that adult epiglottitis follows a less fulminating course than childhood epiglottitis and, therefore, many patients are managed medically if airway obstruction is minimal or absent.^{8,14,15,18,37,41,64} That sudden airway obstruction occurs in adults has, however, been clearly documented;^{8,9,21,22,36,49,51-53,61,68,69} sometimes this has occurred while the patient has been under observation in hospital.^{18,21,51,54,61,70} Sudden obstruction may occur in the face of minimal clinical findings^{21,61} and does not correlate well with the size of the epiglottis nor with the degree of airway obstruction.^{1,21,26,47} Clearly, it is difficult to predict which "stable" patient will obstruct suddenly.^{21,70} This suggests that intubation or tracheostomy should be performed in all patients presenting with epiglottitis. Tracheostomy or intubation in emergency situations cannot be expected to produce favourable results.^{38,45,57}

Airway management

The literature is divided as to whether tracheal intubation

or tracheostomy is the procedure of choice for airway stabilization in the adult with epiglottitis. Perhaps the most important factor to be considered is the skill of the personnel responsible for the patient and the facilities available.^{71,72} Nasotracheal intubation is now considered the procedure of choice in children,^{1,2} following inhalation induction with halothane and 100 per cent oxygen. Although mortality in childhood epiglottitis is approximately the same for tracheostomy and tracheal intubation, there is a higher incidence of severe complications with tracheostomy and hospital stay tends to be longer.^{2,14,58} Tracheostomy has generally been considered to be an acceptable alternative in both children and adults,⁷³ but nasotracheal intubation in children and orotracheal intubation in adults is well tolerated and is adequate in most situations. Accidental extubation may occur in adults as well as children and steps to prevent this, including restraint and sedation, if necessary, should be taken.¹⁶

The management of epiglottitis in the child has been well standardized and includes tracheal intubation or tracheostomy in all patients, regardless of clinical condition or airway status.^{1,47,71,74,75} This protocol was developed, following the demonstration that mortality, which was previously 6.1 per cent¹⁴ approaches zero when all patients receive definitive airway stabilization.^{14,74} Currently, mortality in adults approximates six per cent. Deaths occur in patients considered stable, without tracheostomy or tracheal intubation, despite close observation by skilled personnel.^{1,2,14,21,47,74,76}

A number of options for definitive airway management of the adult with epiglottitis have been discussed in the literature.^{77,78} These include:

- 1 Awake oral or nasal intubation^{18,66,79,80}
- 2 Inhalation induction followed by intubation^{3,36,46}
- 3 "Rapid-sequence" induction with intravenous agents and muscle relaxants^{36,46}
- 4 Awake fiberoptic bronchoscopy with nasotracheal intubation⁸¹
- 5 Tracheostomy under local anaesthesia^{8,37,55}

For the patient in extremis, awake intubation or, if unsuccessful, cricothyrotomy should be performed as a life-saving manoeuvre to relieve airway obstruction. Awake intubation may also be carried out in the less acute situation and circumvents the danger of precipitating or increasing airway obstruction by general anaesthesia, but may be poorly tolerated by the patient. Potentially, an attempt at awake intubation could result in laryngospasm and airway obstruction, as illustrated by a case report of airway obstruction following direct laryngoscopy.⁸²

Inhalation induction is the anaesthetic technique of choice in children. It should be noted that children are anaesthetized more rapidly by inhalation than are adults, due to their higher minute volume and lower functional

residual capacity relative to the minute volume. Inhalation induction of the adult is relatively slow and difficult, particularly in the face of airway obstruction. Airway obstruction may worsen or become complete as the patient is anaesthetized.^{46,78} A prolonged excitement phase commonly occurs. Also, there is concern about reflux of gastric contents in the patient with a full stomach.

The majority of papers discussing adult epiglottitis fail to review the anaesthetic technique used.

On reviewing the references cited in this paper eight adult patients were clearly anaesthetized using an inhalation technique. To this can be added eight patients in Hamilton, Ontario since 1972 who received inhalational induction.* This technique had to be abandoned in one case,⁴⁶ due to airway obstruction. In one of our own cases nearly complete airway obstruction occurred at a relatively light plane of anaesthesia, but intubation was carried out successfully and relatively easily. Three of our eight cases were described as "difficult" intubations on the anaesthetic record.

Rapid-sequence induction using intravenous induction agents and muscle relaxants has been used^{36,47} but is hazardous in the patient with upper airway obstruction and is not recommended.

Fiberoptic bronchoscopy in the awake patient, with nasotracheal intubation, has been carried out in adult patients with epiglottitis⁸¹ but requires special skills of the operator. It may be difficult to pass the soft bronchoscope through the narrow laryngeal aperture.²⁶ The placement of the bronchoscope in the larynx will temporarily cause severe airway obstruction.⁸³

Tracheostomy under local anaesthesia is an acceptable option, particularly in patients who, anatomically, appear to be difficult to intubate.^{8,37,55} Disadvantages of tracheostomy include prolonged hospitalization, more severe complications and higher mortality.^{8,71}

An otolaryngologist should be present and scrubbed in the OR during anaesthetic induction and intubation. A tracheostomy tray should be open and ready for use. Rapid cricothyrotomy or tracheostomy may be life-saving if intubation is unsuccessful. A malleable stilette, placed in the endotracheal tube or extending beyond the end of the tube, to be used as a guide into the narrowed supraglottic area, may prove helpful.

Medical management

The mainstay of medical therapy is appropriate antibiotic treatment and meticulous tracheobronchial toilet. Adult epiglottitis is caused by a variety of organisms as opposed

to paediatric epiglottitis which is nearly always due to *Haemophilus influenzae*.

Blood cultures should be taken, as well as a swab of the epiglottis at the time of laryngoscopy, if this is performed. Pharyngeal cultures do not correlate well with blood cultures and their significance is doubtful.²¹ Intravenous antibiotics should be started immediately and should cover for *H. influenzae*, *Staphylococcus Aureus*, *Streptococcus*, and *Pneumococcus*. Thirteen per cent of *H. influenzae* isolates in Canada are resistant to ampicillin⁸⁴ and this correlates with a similar incidence of resistance in other studies.⁴⁶ Chloramphenicol resistance has been reported⁸⁴ and combined resistance occurs but is rare. Coverage must therefore be provided for ampicillin-resistant *H. influenzae*.

The combination of ampicillin and chloramphenicol provide good coverage for *H. influenzae* but poor coverage against *Staphylococcus aureus*. The addition of an antistaphylococcal penicillin, pending culture reports, or the use of a second generation cephalosporin, with activity against both *H. influenzae* and *Staphylococcus aureus* (cefamandole, cefuroxime) should be considered. Both cefamandole³⁴ and cefuroxime⁸⁵ have been used successfully in adult epiglottitis.

The use of steroids¹⁴ is recommended by some authors, despite a lack of statistical evidence of efficacy.^{8,17,18,21,41,55,86}

Meticulous tracheobronchial toilet must be observed to avoid obstruction of the tracheal tube by secretions. Humidified oxygen should be administered with frequent tracheal saline infusions and suctioning under sterile conditions.

Extubation may be carried out when evidence of systemic toxicity has declined and the patient is able to breathe around the plugged tracheostomy tube or the endotracheal tube with the cuff deflated. Indirect laryngoscopy, x-ray or direct laryngoscopy may indicate a decrease in airway obstruction sufficient to allow extubation. Extubation should be carried out under controlled conditions with the appropriate equipment and personnel at the bedside or in the OR should re-intubation be necessary.

Response to adequate antibiotic coverage is usually rapid. Prolonged toxicity suggests that an epiglottic abscess may have formed^{16,34} and indicates reexamination of the epiglottis, with incision and drainage if an abscess is present.

Chemoprophylaxis for close contacts of patients with *Haemophilus influenzae* type B infections has been recommended.^{16,87} Two cases of epiglottitis in adults, following close contact with patients with *H. influenzae* type B meningitis, were reported.⁸⁷

* (Baxter FJ, Dunn GL - unpublished data).

Recommended management

It is the opinion of the authors that a definitive airway stabilization procedure should be carried out on all adult patients with epiglottitis. This may be by tracheal intubation or tracheostomy. Under no circumstances should intravenous barbiturates and/or muscle relaxants be used for this purpose.

The choice between awake intubation, an inhalational induction of anaesthesia or tracheostomy under local anaesthesia should depend on the skills of the personnel involved and the clinical presentation of the patient.^{26,72}

If the option of general anaesthesia is chosen, inhalation induction with oxygen and halothane should be carried out, followed by intubation. An otolaryngologist, prepared to rapidly provide a surgical airway, should be present during any airway procedure.

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