

External laryngeal trauma: analysis of thirty cases

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Abstract

A retrospective analysis of thirty patients with external laryngeal trauma was performed to assess the type and extent of injuries commonly seen as well as the outcome following treatment. Outcome was assessed both in terms of voice and airway. Major laryngeal injuries (19 cases) outnumbered minor injuries (11 cases). A good correlation exists between the symptoms of haemoptysis and stridor at presentation and severity of the injury ($p = 0.002$). Early surgical intervention is associated with better outcome ($p = 0.01$). However there is no statistically significant difference in outcome between major and minor injuries ($p = 0.3$) indicating that other factors are operative in determining outcome. Based on our findings a management strategy for patients with external laryngeal trauma is outlined.

Key words: Wounds and injuries, larynx

Introduction

External laryngeal injuries are uncommon. A recent review (Schaefer, 1991) estimates that less than 1 in 14 000 patients visiting the Emergency Services unit of a hospital is a case of external laryngeal trauma. However, the rising incidence of road traffic accidents as well as individual crime may make these injuries far commoner in the years to come.

While the diagnosis of penetrating laryngeal trauma is straightforward, estimating the extent of laryngeal injury following blunt trauma requires a clearcut diagnostic strategy (Schaefer, 1992). Few reports have correlated the symptoms and signs at presentation with the severity of the injury (Schaefer, 1991). A review of the literature shows the lack of uniformity in the diagnostic and management protocol for external laryngeal trauma at different centres. Controversy exists with respect to the establishment of the airway at presentation with some favouring intubation (Herrin *et al.*, 1979) and others (Nahum, 1969; Olson and Miles, 1971; Bryce, 1972) preferring tracheostomy. In those who require surgical treatment, the timing of surgery is also controversial. While some authors (Bryce, 1972; Schaefer and Close, 1989; Schaefer, 1992) recommend early surgical intervention, others (Fitz-Hugh *et al.*, 1962; Nahum, 1969) have waited for about four or five days before attempting surgical repair.

The present report analyses our experience with 30 cases of external laryngeal trauma seen over a period of four years. Our results have enabled us to devise a simple cost effective diagnostic and management protocol for these patients.

Materials and methods

The charts of patients with external laryngeal trauma

from 1988 to 1992 were reviewed retrospectively. All patients presented to the Emergency Services Department of the Christian Medical College Hospital, Vellore, with a history of having sustained injury to the anterior neck and were referred to the ENT Department for management.

The following features were noted:

- (1) Aetiology of the injury.
- (2) Clinical features at presentation.
- (3) Site and severity of injury; patients were classified as having either major or minor injury based on the extent of the injury.
- (4) Type of treatment received.
- (5) Outcome following treatment.

The results obtained were statistically analysed, using Fisher's exact probability test, to note whether there was any correlation between: (a) symptoms at presentation and severity of injury; (b) outcome and timing of treatment; and (c) outcome and severity of injury.

Results

A total of 30 patients with ages ranging from six to 70 years (mean 30.6 years) formed the basis of this study. There were 27 male and three female patients. Eighteen patients suffered blunt trauma and 12 patients sustained penetrating injury.

Aetiology (Table I)

The commonest cause of injury was vehicular accident (23.3 per cent). Accidental strangulation in all six patients was due to a loose cloth (muffler, towel) tied around the neck being caught in some machinery causing strangulation.

Four cases of cut-throat injury were suicidal and one

TABLE I
AETIOLOGY OF INJURY

Aetiology	No. of patients	Percentage
Accidental strangulation	6	20
Road traffic accident	7	23.3
Bull-gore injury	6	20
Cut-throat injury	6	20
Fall	3	10
Assault	2	6.7
Total	30	100.0

was produced by an accidental cut by a fan blade. All five cases of cut-throat injury and the six cases of bull-gore injury and one case of road traffic accident were penetrating injuries. Two patients suffered injury following assault.

Symptoms (Table II)

Hoarseness or aphonia was found in more than three-quarters of the patients, whereas stridor was present in less than 50 per cent of patients. Active bleeding from the injury site was present in ten of the patients with penetrating injury. The bleeding was not profuse and there were no major blood vessel injuries.

Signs

Patients were classified as having either major or minor injury, based on the extent of injury (Table III). This classification was adopted to facilitate evaluation of the results. The presence of any one of the criteria in a given patient was sufficient to classify a patient into either category. Thirteen out of the 19 patients with major injury and none of the 11 patients with minor injury had stridor. Significant correlation ($p = 0.002$) was found between the presence of stridor and the severity of the injury. Haemoptysis occurred in 15 out of 19 patients with major injury and two out of 11 with minor injury. The presence of haemoptysis was also an index of major injury ($p = 0.002$). However, hoarseness was not a symptom that correlated with the severity of injury ($p = 0.5$).

Except in three cases of minor injury in whom the larynx was well visualized on indirect laryngoscopy, all patients underwent direct laryngoscopy and oesophagoscopy to assess the extent of injury.

The airway was compromised in 43.3 per cent of patients, either due to respiratory obstruction or bleeding into the larynx and trachea. Subcutaneous emphysema was present in three cases of penetrating injury and nine cases of blunt injury.

Vocal fold mobility was restricted in 14 patients (46.7 per cent). The left vocal fold alone was involved in five cases, the right alone in four cases. Bilateral vocal fold fixation was seen in three cases, all three of whom had suffered injury to the subglottis and trachea.

TABLE II
DISTRIBUTION OF SYMPTOMS

Symptom	No. of patients (%)
Hoarseness or aphonia	24 (80)
Stridor	13 (43.3)
Haemoptysis	17 (56.7)
Odynophagia	22 (73.3)

Glottic injuries were the most common finding. This included haematoma of the vocal folds, thyroid fracture with vocal fold fixity and arytenoid dislocation.

Injuries to laryngeal framework

Nine patients had soft tissue injury alone. This included patients with oedema, mucosal lacerations and haematomas. Three patients had undisplaced fractures of the thyroid as the only injury. Eighteen patients had combined soft tissue and cartilaginous injury. Fractures of the thyroid cartilage were the most common followed by combined fractures of the thyroid and cricoid cartilages. The arytenoid was dislocated in one case. Of four patients who had suicidal cut-throat injuries, the cricothyroid membrane was damaged in two and the thyrohyoid membrane in two others. Cricotracheal separation occurred in one case of accidental strangulation of the neck.

Treatment

Depending on the type or severity of the injury, patients underwent either medical or surgical treatment or both. Medical treatment included steroids, antibiotics and nasogastric tube feeds. Three patients were managed with just observation and voice rest. Tracheostomy was required in one patient with minor injury for airway obstruction secondary to oedema and bleeding.

Surgical treatment consisted of laryngeal exploration and repair. This included repairs of mucosal tears, reduction of displaced fractures and suturing of cartilage fragments. In certain cases of major injuries with an unstable laryngeal framework, stenting was required.

For penetrating injuries access to the larynx was gained through the wound itself. Extensions of incisions were made if deemed necessary. For all cases of blunt injury a transverse skin incision at the level of the thyrohyoid membrane (for primarily supraglottic injuries), midpoint of the thyroid cartilage (for primarily glottic injuries) or cricothyroid membrane (for primarily subglottic injuries) was made.

Reconstructive surgery

This was required in five patients who had major laryngeal injuries, three of whom presented late. The type of surgery was determined by the site and extent of the injury.

Timing of presentation and surgical intervention (Table VI)

Most patients (70 per cent) presented within 24 hours of

TABLE III
CLASSIFICATION OF INJURY

Minor ($n = 11$)
Small superficial lacerations not exposing cartilage
Small haematoma within larynx
Mild oedema within larynx
Undisplaced fracture of laryngeal cartilages
Major ($n = 19$)
Large mucosal tears exposing cartilage
Severe endolaryngeal oedema or laryngopharyngeal oedema or large haematoma distorting laryngeal anatomy
Fracture displacement of laryngeal cartilages
Vocal fold fixation

TABLE IV
OUTCOME RELATED TO TIME OF PRESENTATION

Time of presentation	Outcome				
	Major injury (n = 19)			Minor injury (n = 11)	
	Good	Poor	Unknown	Good	Poor
<24 hours	10*	1	1	9	0
1 to 7 days	4	0	0	1	0
>7 days	0	3	0	1	0

Unknown = lost to follow-up; *one patient underwent delayed surgery although she presented early (see Text).

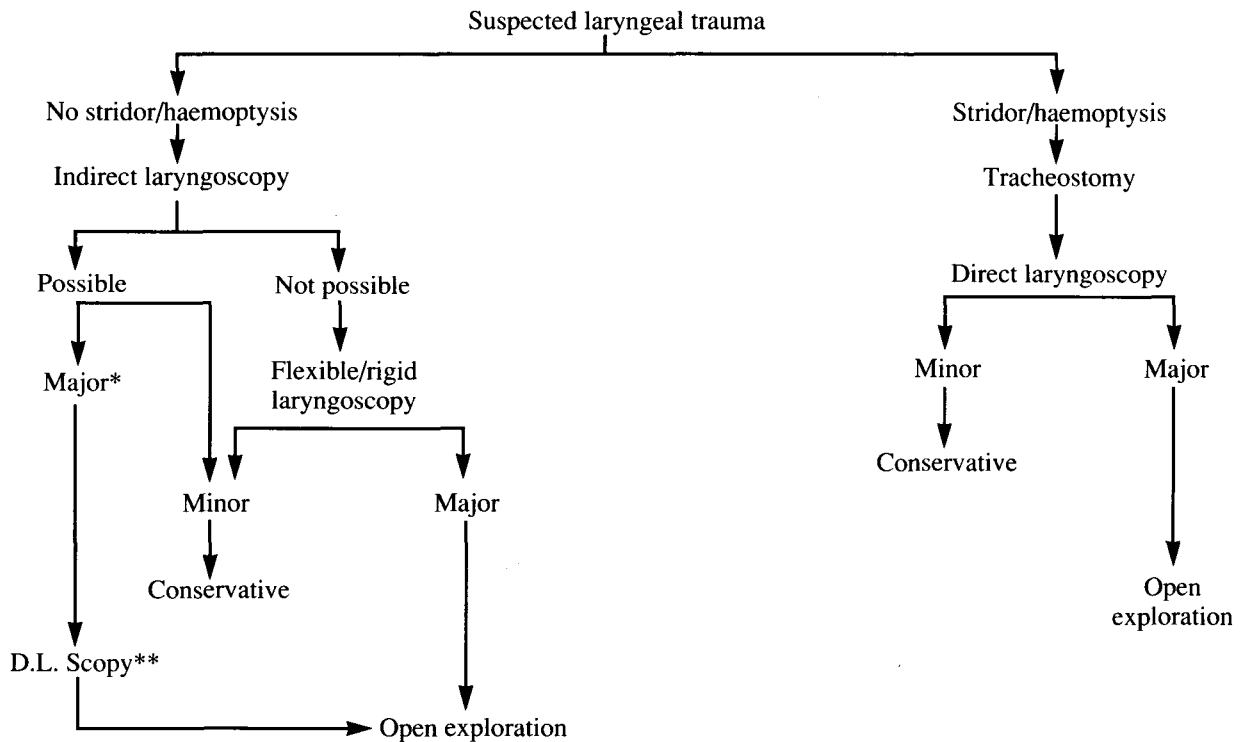
the injury. This included nine patients with minor injuries and 12 with major injuries. Four patients with major injury and one with minor injury presented within seven days of the injury. Three patients with major injury presented late (>one month) after the injury and had established laryngeal stenosis necessitating reconstructive surgery. One patient with minor injury also presented late. In general, patients with major injury were taken up for surgery on an emergency basis soon after presentation. Fifteen out of 16 patients with major injury who presented within one week of the trauma, underwent early surgery (within one week of injury). One patient with undetected major injury who presented with hoarseness alone following blunt injury to the neck, was treated conservatively for a week with steroid and antibiotic therapy but developed stridor two weeks later: CT scanning revealed fracture displacement of the thyroid cartilage which was confirmed at laryngoscopy. She underwent open surgical exploration and repair three weeks after presentation.

Outcome (Table IV)

The follow-up period ranged from one month to four years. There was no mortality in this series. Outcome was assessed in terms of airway and voice. A good outcome was defined as that in which the patient had a normal airway or could be decannulated along with a good or fair, intelligible voice. The following definitions for airway and voice quality were used:

- Good airway: normal airway or patient could be decannulated.
- Poor airway: patient needed a tracheostomy for maintenance of airway.
- Good voice: no hoarseness or close to preinjury voice.
- Fair voice: mild to moderate hoarseness.
- Poor voice: patient cannot raise voice above a whisper.

All 11 patients with minor injury had a good outcome. Thirteen out of 15 patients with major injury who had



*CT scan advisable in cases of massive oedema to rule out or ascertain site of fracture; **In cases of vocal fold fixity to distinguish between arytenoid dislocation and neural injury. If neural entrapment suspected, open exploration is desirable.

FIG. 1
Proposed management protocol (algorithm) for patients with external laryngeal trauma.

early surgical intervention did well while one out of four patients managed by delayed surgery had a good outcome. Thus early surgical intervention was associated with a significantly better outcome ($p = 0.01$).

The single patient with major injury who presented early and had a poor outcome had suffered a fracture of the thyroid with vocal fold paralysis which had not recovered at the time of the last follow-up. Thus, although his airway was good, his voice was poor resulting in a poor outcome. One patient with minor injury who presented late and did well had a haematoma of the vocal folds as the only sign of the injury.

Analysing outcome in relation to severity of injury, it was found that no statistically significant difference in outcome could be found based on the severity of the injury ($p = 0.3$).

Discussion

Road traffic accidents are the commonest cause of external laryngeal trauma (Nahum and Siegel, 1967; Maran and Stell, 1970). Homicidal injury, an important cause of laryngeal trauma in Western patients (Schaefer and Close, 1989) was infrequently seen in our patients. Accidental strangulation by a muffler or towel getting caught in machinery and bull-gore injury was the second commonest cause of trauma in our patients. Bull-gore injuries may rarely involve the larynx and the prevalence of such injury may be related to the social customs in this part of the world.

Based on the management strategy to be adopted, various classifications have been proposed to describe the extent of laryngeal injury. The classification used in the present study (Table III) is similar to that used by Leopold (1983) who compared patients from different reports. In general, patients with minor laryngeal injuries do well with medical management alone and may or may not require tracheostomy. Patients with major injuries invariably need neck exploration with repair of mucosal and/or cartilaginous disruption.

Correlation between the symptoms at presentation and the severity of the injury has not been specifically reported in the literature. In the present series we found a significant association between the presence of stridor and haemoptysis and major laryngeal injury. This has enabled us to draw up a management protocol taking into account these symptoms (Figure 1).

An important determinant of the outcome in terms of voice and airway is the time at presentation and hence the timing of surgery. Patients who presented early had a good outcome irrespective of the severity of the injury. Three patients who presented late with established laryngeal stenosis did poorly both in terms of voice and airway and could not be decannulated. The importance of early operative management has been stressed by several authors (Harris and Ainsworth, 1965; Bryce, 1972; Leopold, 1983; Schaefer and Close, 1989). However, others recommend a delay of three to five days following injury to enable any oedema to resolve (Fitz-Hugh *et al.*, 1962; Nahum, 1969; Olson and Miles, 1971). One patient in our series in whom surgery was delayed because of massive endolaryngeal oedema, eventually had a good outcome, although she required prolonged stenting and tracheostomy.

Radiography of the larynx has limited value in the assessment of laryngeal trauma. Plain X-rays of the neck may be helpful in demonstrating retropharyngeal and subcutaneous emphysema, subglottic narrowing and supra-glottic oedema. Schaefer (1991, 1992) has shown CT scanning to be useful in detecting fractures in patients with massive endolaryngeal oedema. We have employed CT scanning to delineate the nature and extent of injury in select patients with severe endolaryngeal oedema or long-standing laryngeal stenosis, but do not recommend its routine use.

While generalizations regarding management of patients with external laryngeal trauma are possible (Figure 1), individualized treatment especially with regard to surgical repair is necessary. The distinction between major and minor trauma categories should be effected within the first 24 hours after trauma, based on the indirect or direct laryngoscopy findings. Those patients with massive endolaryngeal oedema may require CT scanning to delineate associated laryngeal framework injury. The presence of stridor and haemoptysis are suggestive of major injury. Early surgical intervention is recommended for all major injury to ensure a good outcome.

References

- Bryce, D. P. (1972) The surgical management of laryngotracheal injury. *Journal of Laryngology and Otology* **86**: 547–587.
- Fitz-Hugh, G. S., Wallenborn, W. M., McGovern, F. (1962) Injuries of the larynx and cervical trauma. *Annals of Otology, Rhinology and Laryngology* **71**: 419–442.
- Harris, H. H., Ainsworth, C. Z. (1965) Immediate management of laryngeal and tracheal injuries. *Laryngoscope* **75**: 1103–1115.
- Herrin, T. J., Bruzustowicz, R., Hendrickson, M. (1979) Anesthetic management of neck trauma. *Southern Medical Journal* **72**: 1102.
- Leopold, D. A. (1983) Laryngeal trauma: a historical comparison of treatment methods. *Archives of Otolaryngology, Head and Neck Surgery* **109**: 106–112.
- Maran, A. G. D., Stell, P. M. (1970) Acute laryngeal trauma. *Lancet* **2**: 1107–1110.
- Nahum, A. M. (1969) Immediate care of acute blunt laryngeal trauma. *Journal of Trauma* **9**: 112–125.
- Nahum, A.M., Siegel, A.W. (1967) Biodynamics of injury to the larynx in automobile collision. *Annals of Otology, Rhinology and Laryngology* **76**: 781–785.
- Olson, N. R., Miles, W. K. (1971) Treatment of acute blunt laryngeal injuries. *Annals of Otology, Rhinology and Laryngology* **80**: 704–709.
- Schaefer, S. D. (1991) The treatment of acute external laryngeal injuries. 'State of the art'. *Archives of Otolaryngology, Head and Neck Surgery* **117**: 35–39.
- Schaefer, S. D. (1992) The acute management of external laryngeal trauma: a 27-year experience. *Archives of Otolaryngology, Head and Neck Surgery* **118**: 598–604.
- Schaefer, S. D., Close, L. G. (1989) Acute management of laryngeal trauma. *Annals of Otology, Rhinology and Laryngology* **98**: 98–104.

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