Acute External Laryngeal Injury

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Abstract

A retrospective study of 35 patients with acute external laryngeal injury who were treated at Maharaj Nakorn Chiang Mai Hospital from January 1989 to 1998 was done. Eighty-six per cent of the patients with blunt trauma had been injured from a motor vehicle accident and the rest had a penetrating injury from a stab wound. The frequent signs and symptoms were hoarseness, skin contusion, pain and subcutaneous emphysema. The severity of the injury was classified into minor and major groups. There were 2 patients in the minor group and 33 in the major group. Both patients in the minor injury group had good result from conservative treatment. All patients in the major injury group, except one with left vocal cord paralysis, required surgical management. No airway problem was found in any patient and only one patient had unintelligible voice after treatment. Twenty-three per cent had minor complications and responded well to conventional treatment. Early diagnosis and proper management gave the best outcome of the patient's airway and voice.

Key word : External Laryngeal Injury, Classification of Severity of Injury, Internal Laryngeal Stent

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Acute external laryngeal injury is relatively uncommon when compared to injury to other parts of the body[1-4]. This is due to the flexibility and elasticity of the laryngeal cartilages and the protection by the mandible, sternum, and cervical spine[4,5]. The most common cause of injury is motor vehicle accident which results in blunt injury while violent crime may result in both penetrating and blunt injuries[3,4,6].

While the diagnosis of penetrating laryngeal injury is straightforward, a patient with blunt injury often has serious multiple injuries. Therefore, if a high degree of suspicion is not made even after an airway is established, a laryngeal injury

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may go unrecognized until the extubation is attempted. This usually causes poor voice quality, aspiration or laryngeal stenosis which requires prolonged tracheotomy and multiple reconstructive procedures[4,6-8].

This paper reports a clinical analysis of 35 cases of acute external laryngeal injury seen over a period of 10 years. The purpose was to analyze the etiology, mechanism of injury, clinical manifestation, diagnostic tool and clarify clinical assessment and management.

MATERIAL AND METHOD

A retrospective study of 35 patients with acute external laryngeal injury who were treated at Maharaj Nakorn Chiang Mai Hospital from January, 1989 to December 1998 was performed. Case histories were reviewed with respect to age, sex, etiology of the injury, clinical manifestation, site and severity, management and result.

The diagnoses were confirmed by fiberoptic laryngoscopy or roentgenography or both. Treatment results were evaluated for speech and adequacy of airway patency.

RESULTS

A total of 35 patients included 28 males and 7 females with a mean age of 38.2 years (range, 15-68 years) were obtained over the 10-year period (Fig. 1). Motor vehicle accidents accounted for all of the blunt injuries (30 patients), the remainders with penetrating injuries were victims of stab wounds.

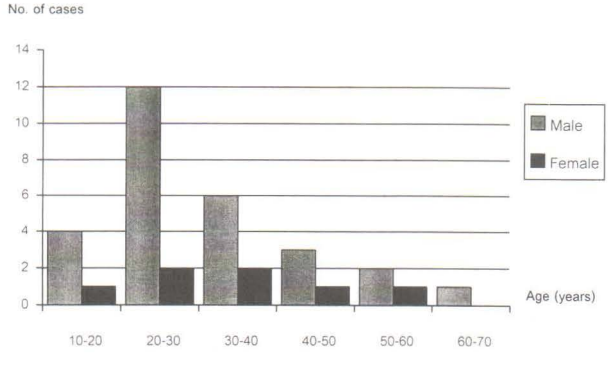

Fig. 1. Histogram shows age and sex distribution.

The presenting symptoms included hoarseness, neck pain, odynophagia, dysphagia and dyspnea (Table 1). Twenty-one cases had neck contusion, 19 had subcutaneous emphysema. Other signs included neck tenderness, stridor, and deformity of laryngeal cartilages (Table 2).

All patients underwent indirect laryngoscopy and/or fiberoptic laryngoscopy and some patients had CT scan examination to determine site and extent of injury. Direct laryngoscopy, bronchoscopy and esophagoscopy were performed in

Table 1. Distribution of symptoms.

Presenting symptoms	No. of cases	%
Hoarseness	28	80
Neck pain	20	57
Odynophagia	18	51
Dysphagia	10	29
Dyspnea	10	29

Table 2. Distribution of signs.

Presenting signs	No. of cases	%
Neck contusion	21	60
Subcutaneous emphysema	19	54
Neck tenderness	15	43
Stridor	14	40
Deformity of laryngeal framework	12	34

Table 3. Classification of injury.

(From Cherian TA, Rupa V, Raman R. External laryngeal trauma : analysis of thirty cases. J Laryngol Otol 1993;107:920-3)

Minor injury

Small superficial lacerations not exposing cartilage.
Small haematoma within larynx.
Mild oedema within larynx.
Undisplaced fracture of laryngeal cartilages.

Major injury

Large mucosal tears exposing cartilage.
Severe endolaryngeal oedema or laryngopharyngeal oedema or large haematoma distorting laryngeal anatomy.
Fracture displacement of laryngeal cartilages.
Vocal cord fixation.

patients who needed operative management. Cherian's criteria[3] was used to classify severity of the injury into minor and major groups (Table 3). Two patients were in the minor category and both suffered from blunt injury. Only mild endolaryngeal edema and small hematoma were found.

In the major injury group, 28 patients had blunt injury, the extent of injury ranged from severe endolaryngeal edema to complete cricotracheal separation (Table 4). In five patients with penetrating injury, 3 had traumatic wounds which passed through the thyrohyoid membranes, 1 had a vertical wound of the thyroid and cricoid cartilages and the other had a horizontal wound of the upper part of the thyroid cartilage.

Treatment depended on the type and severity of injury. Two patients in the minor group were treated successfully by medication including voice rest, close observation, head elevation, humidification and corticosteroids. One patient required tracheotomy on the second day of admission due to progressive laryngeal edema and was successfully decannulated in 3 days.

In the major injury group, 6 patients had oral endotracheal intubation and 2 had endotracheal intubation through the penetrating wound in the emergency room. All of them were switched to tracheotomy by otolaryngologists after consultation. One patient who had left vocal cord immobility and mild edema of the arytenoid was managed conservatively. The rest of the patients underwent surgical exploration within 24 hours after injury. Surgical procedures included debridement of devitalized tissues, mucosal repair with small absorbable suture material, mucosal advancement flap and skin or mucosal grafts. Cartilaginous fractures were reduced and sutured with large non-absorbable suture material. Hyomyoosseous flap was used in a patient who lost the anterior part of the thyroid and cricoid cartilages. Minimal debridement and direct laryngotracheal anastomosis was done in the two patients with cricotracheal separation. In 22 patients with unstable laryngeal frameworks and 12 patients with severe mucosal laceration required internal laryngeal stents which were sponge-filled finger cots. The stents were left in place for 3 weeks in mucosal damage cases and 6 weeks in laryngeal framework fracture cases. All patients had successful stent removal and were decannulated 3-5 days afterward.

The follow-up period ranged from 4 months to 9 years. The outcome was assessed in terms of airway and voice by using Leopold's classification[7] (Table 5). All patients had good airway results. Twenty-eight patients had excellent voice, 6 had fair voice. One patient with poor voice was the one who suffered from severe comminuted thyroid cartilage fracture and immobility of both vocal cords (Fig. 2).

The complications after treatment were minor and responded well with conventional treatment and there was no mortality. (Table 6).

Table 4. Distribution of extent of injury.

Extent of injury	No. of cases
Large mucosal tears	12
Large haematoma	3
Fracture displacement of laryngeal cartilages	22
Vocal cord fixation	1
Cricotracheal separation	2

Table 5. Classification of voice and airway results.

(From Leopold DA. Laryngeal trauma : a historical comparison of treatment methods. Arch Otolaryngol 1983;109:106-12)

Voice results

Excellent	-	normal sounding, thought by the patient and others to be similar to the preaccident voice.
Fair	-	breathy, hoarse, or rough sound, but still voiced.
Poor	-	aphonic, very weak voice, or unintelligible.

Airway results

Good	-	able to assume normal activities for age without restriction, no aspiration.
Poor	-	must restrict activities because of airway obstruction, audible stridor, minor aspiration not requiring tracheotomy.
Trached	-	airway through larynx so poor or aspiration so substantial that tracheotomy was needed.

DISCUSSION

Motor vehicle accident was the only cause of acute blunt laryngeal injury in our patients, while all penetrating injuries of the larynx were the result of injury from knives. The frequent presenting signs and symptoms were hoarseness, contusion of the cervical skin, neck pain, subcutaneous emphysema, odynophagia and neck tenderness.

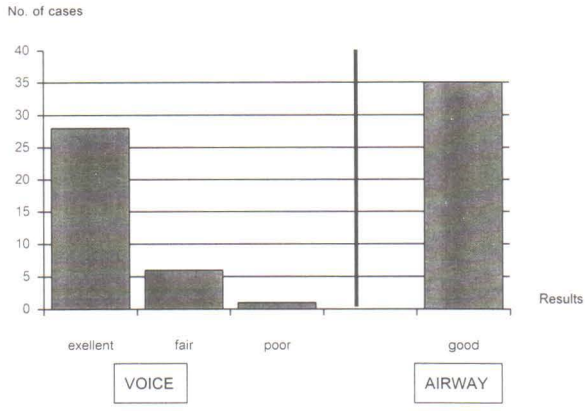

Fig. 2. Histogram shows voice and airway results.

Table 6. Distribution of complications.

Complications	No. of cases
Laryngeal web	3
Subglottic granulation	2
Pneumonitis	2
Pharyngocutaneous fistula	1

Other than history taking and neck palpation, indirect laryngoscopy permitted rapid assessment of the site and degree of injury. Flexible fiberoptic laryngoscopy was used in uncooperative patients. Plain X-ray of the neck was not a diagnostic tool in our management. CT scan examination was found to be beneficial in diagnosis of laryngeal fracture in cases with a moderate degree of injury[2]. These patients had neck and endolaryngeal edema preventing accurate clinical evaluation. CT scan was not indicated in patients who obviously required open surgical management and who had a minimal degree of tissue injury from complete clinical evaluation[2].

Tracheotomy under local anesthesia was performed in laryngeal trauma patient who required airway support because endolaryngeal injury even in a mild degree can be produced further damage by endotracheal tube[4,7]. Endotracheal intubation should be used initially only in some patients with penetrating laryngeal injury whose airway can be seen from the wound but tracheotomy should be done after the patients were resuscitated. Our patients who were intubated by non-otolaryngologists had tracheotomy done as soon as possible.

The patients were classified into 2 groups based on the management strategy. Nonoperative management was reserved for patients in the minor injury group who were expected to have uneventful healing of the larynx[4,9]. Some patients in this group may require temporary tracheotomy due to progressive laryngeal edema after close observation.

Surgical exploration of the larynx was indicated in the major injury group and penetrating laryngeal injury patients[1-8]. Direct laryngoscopy, bronchoscopy and esophagoscopy were done prior to surgical exploration to evaluate endolaryngeal, tracheal and pharyngoesophageal injury. Early surgical exploration (within 24 hours) should be done because it is easier to identify the margin of mucosal and cartilaginous injury, permitting primary approximation of all involved tissue. After a midline thyrotomy, debridement of non-viable tissue, mucosal repair by primary closure, advancement flap or rarely skin or mucosal graft, and close reduction of laryngeal cartilage were done. Internal laryngeal stent was used to stabilize the unstable cartilaginous fracture and prevent mucosal adhesion[9]. Sponge-filled finger cot was used to reduce pressure trauma to the endolaryngeal mucosa which would occur more often from the hard stent. Both ends of the finger cot were tied with heavy silk suture, the suture from the upper end was passed through thyrohyoid membrane and that from the lower end was passed between the cricoid cartilage and trachea. The suture was not passed through the finger cot so secretion and infection would not collect inside the stent. Both ends were tied together over the strap muscles under the skin flap (leaving 2-3 cm of the cut ends for easy identification during the stent removal). This is better than tying the suture over the skin flap because the skin will prevent the stent from moving with the laryngotracheal complex which will produce sheering trauma to endolaryngeal mucosa during swallowing[7]. In our patients, three cases with minimal degree of laryngeal web and two cases with small subglottic granulation were noted after stent removal. Each patient was successfully treated with one episode of endoscopic CO_2 laser surgery.

Result of the treatment in terms of the airway patency was excellent because all of our

patients could breathe after decannulation. Only one patient had poor voice quality because of the extensive laryngeal injury including bilateral vocal cord paralysis, the rest had at least serviceable voice and 70 per cent had good voice. The good outcome of our treatment compared to other reports[3-5] could be from early recognition, immediate surgical exploration, and how to use the internal laryngeal stent.

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การบาดเจ็บภายนอกของกล่องเสียงอย่างเฉียบพลัน

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ได้ทำการศึกษาวิเคราะห์แบบย้อนหลัง ในผู้ป่วยที่ได้รับบาดเจ็บจากภายนอกของกล่องเสียงอย่างเฉียบพลัน จำนวน 35 ราย ที่มารับการรักษาในโรงพยาบาลมหาราชนครเชียงใหม่ ตั้งแต่เดือนมกราคม 2532 ถึงเดือนธันวาคม 2541 เป็นเพศชาย 28 ราย เพศหญิง 7 ราย อายุเฉลี่ย 38.2 ปี ร้อยละ 86 เป็นอุบัติเหตุจากยานพาหนะ ทำให้เกิดการกดกระแทกกล่องเสียง ที่เหลือเป็นการบาดเจ็บจากบาดแผลถูกมีดแทง อาการและอาการแสดงที่พบได้บ่อย คือ เสียงแหบ ผิวหนังฟกช้ำ ปวดคอ และลมใต้ชั้นผิวหนัง ได้แบ่งความรุนแรงของการบาดเจ็บเป็น 2 กลุ่ม คือ บาดเจ็บเล็กน้อย มีผู้ป่วยอยู่ 2 ราย และบาดเจ็บรุนแรง มีผู้ป่วยอยู่ 33 ราย โดย 2 รายที่อยู่ในกลุ่มบาดเจ็บเล็กน้อย และ 1 รายในกลุ่มบาดเจ็บรุนแรงที่มีอัมพาตของสายเสียงด้านซ้าย ได้รับผลดีต่อการรักษาแบบประคับประคอง ผู้ป่วย 32 รายที่เหลือในกลุ่มบาดเจ็บรุนแรงได้รับการรักษาโดยการผ่าตัด ผลการรักษาพบว่าผู้ป่วยทุกรายไม่มีปัญหาเรื่องการหายใจ ในขณะที่ผู้ป่วย 1 ราย ซึ่งมีการบาดเจ็บอย่างรุนแรงของกระดูกอ่อนกล่องเสียง และสายเสียงเป็นอัมพาตทั้ง 2 ข้าง พูดไม่มีเสียง ผู้ป่วยที่เหลือสามารถใช้เสียงได้ปกติหรือใกล้เคียงปกติ ปัญหาแทรกซ้อนขณะหรือหลังทำการรักษาพบร้อยละ 23 เป็นปัญหาที่ไม่รุนแรงและตอบสนองดีต่อการรักษา การวินิจฉัยที่ถูกต้องและการรักษาที่เหมาะสมภายใน 24 ชั่วโมงหลังบาดเจ็บ จะช่วยให้ผู้ป่วยได้รับผลการรักษาที่ดีทั้งเรื่องการหายใจและเสียงพูด

คำสำคัญ : การบาดเจ็บภายนอกของกล่องเสียง, การแบ่งความรุนแรงของการบาดเจ็บ, เครื่องมือยึดรูเปิดภายในกล่องเสียง

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