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Outcome Assessment of the Endoscopic Surgery for Laryngeal Trauma Management

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Abstract:

Background: *Laryngeal trauma which could be lead to death or laryngeal stenosis if not being discovered and treated is one of the important emergencies in otolaryngology.*

Methods: *Prospective clinical trial study using the optique rigid to evaluate and insert the tracheal balloon under suspension laryngeal endoscopy to dilatation and maintain the fracture of laryngeal trauma. Using the balloon of the No.5 endotracheal tube like laryngeal stent during 10 to 14 days.*

Results: *54 laryngeal trauma cases (92.3% male) have been treated by endoscopic surgery at Ear-Nose-Throat (ENT) Department at Cho Ray Hospital in Ho Chi Minh City from May 2015 to August 2016. Closed trauma is more frequent than open trauma. Hoarseness, dyspnea, and subcutaneous emphysema are mostly seen. Endoscopy, CT-scan help to diagnose the trauma location with 85.1% success percent.*

Conclusions: *The method balloon pharyngoplasty under suspension laryngeal endoscopy to management of laryngotracheal trauma is non-invasive, not difficult and technique can ensure a successful outcome.*

Keywords: ***assessment, endoscopic, laryngeal, outcome, trauma.***

1. Introduction

Laryngeal injuries rates are rare, however they often have serious consequences for the voices, airways and esophagus of affected individuals and the laryngeal injuries death rate can be as high as 40%.[1],[2] Correct diagnosis and prompt management are effective measures to prevent respiratory failure and death laryngeal injuries rare in 1:137,000 to 1:5000 patients who are injured.[3],[4] Moreover, recent data suggest that its prevalence may be higher than previously reported.[5] The traditional treatment is open surgery with or without using stents.[6] The development of flexible and rigid endoscopy opens a new method for many non-invasive interventions.[7] The advantages of such surgery are the rapid recovery time, decreased time lost from work, smaller scars, reduced cost and, perhaps, better results.[8],[9] Endoscopic surgery in management of laryngeal injuries have been performed in the Ear-Nose-Throat Department at Cho Ray Hospital since May 2007. Since then, this study has obtained some promising results.

2. Methods

2.1. Study design and sample

Prospective and descriptive clinical trial with two methods. Input methods using the data of 54 laryngeal trauma cases are treated by balloon laryngoplasty under suspension laryngoscopy at Cho Ray Hospital from May 2015 to August 2016. All cases were graded 2nd, 3rd or 4th injury degree according to Schaefer.[3],[9] The cartilage injuries were confirmed based on CT-scan and endoscopy. Output methods using data of all cases were graded 1st injury degree and the case with large lost of the substance and need the flap to reconstruction.

2.2. Study materials

Study materials consist of laryngeal endoscope, Camera, Light source, monitor; optical laryngeal endoscope 0º, 25º; endo tracheal tube No.5, Nelaton tube, sphygmometer for balloon; CT-scan films for all cases; patient information: history, trauma mechanism, clinical examination, patient status when discharged; follow up: tracheostomy tube removal, endoscope, respiratory function.[7,8,10]

3. Results

3.1. General characteristics of patient

Laryngeal trauma mostly happened in males (92.3%) especially from 20 to 40 years old (61%) who are in working age and using vehicles. The main cause of injury is traffic accident (85.2 %) with moto-bike. The blunt injury is frequently 37cases (68.5%) caused by the hard objects

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hitting the front neck. The thyroid, cricoid, and trachea cartilage is compressed between the hard object anterior and the cervical spines posterior. In our series, the cricoid, the thyroid are fractured, so the injuries are graded 2nd, 3rd and 4th degree according to Schaefer. There are three most common symptoms: hoarseness, dyspnea, emphysema (Table 1).

Table 1: Classification graded 2nd, 3rd and 4th degree according to Schaefer

Classification	n (%)
Grade II	4 (7.4)
Grade III	14 (25.9)
Grade IV	36 (66.6)
Total	**54 (100.0)**

3.2. Endoscopy and CT-scan

All 54 cases are evaluated by endoscopy. The laryngeal endoscopy can be used early to evaluate the mucosa and lumen of the airway including edema, mucosal tear, hematoma, fixation movement of the arytenoids and vocal cord, narrowing or stenosis. CT-scan is applied in all cases because it is valuable in diagnosis laryngeal injuries. It can reveal the cricoid, thyroid fracture, stenosis, edema, subcutaneous or mediastinal emphysema (Figure 1-6). The cricoid help to maintain the lumen of the larynx especially the hypolarynx. Therefore, cricoid injury frequently results in stenosis of the larynx. We have 41 cases with cricoid fracture.

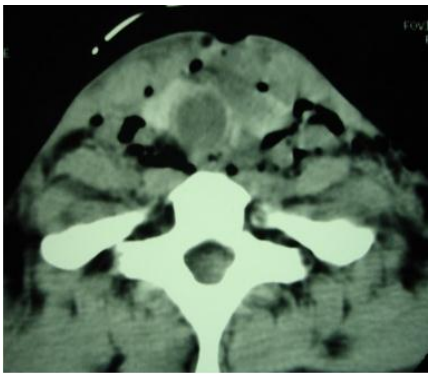

Figure 1: CT-scan of the completely laryngeal stenosis, emphysema

Figure 2: Fiber-optic laryngoscopy of the laryngeal stenosis

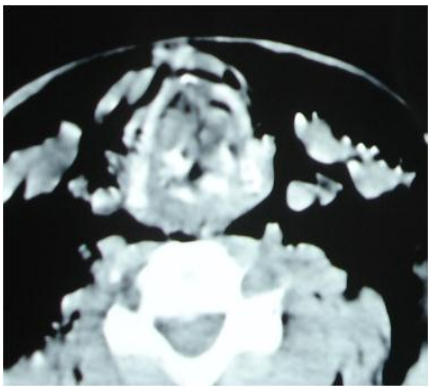

Figure 3: CT-scan of the thyroid and cricoid fracture, emphysema, laryngeal stenosis

Figure 4: Fiberoptic laryngoscopy with hematoma, stenosis, edema, mucosal tear.

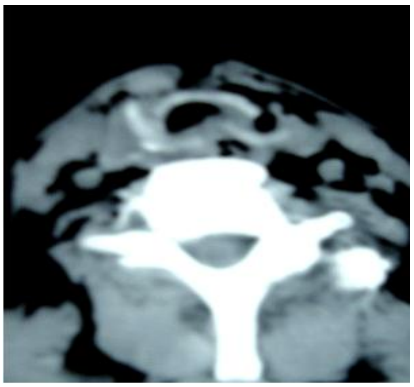

Figure 5: CT-scan of the cricoid fracture, emphysema, laryngeal stenosis

Figure 6: Fiberoptic laryngoscopy with edema, mucosal tear, laryngeal stenosis

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3.3. Treatment evaluation

3.3.1 Emergency treatment

Securing the airway by tracheotomy or placing endotracheal tube. The tracheotomy was the most used method, accounting for more than half the number of emergencies (n=32, 59.2%). Surgeons without tracheostomy also had a high percentage of the total (33.3%). Technique for endotracheal tube was relatively small with 4 cases accounting for 7.4%.

3.3.2 Surgical technique

Most of the cases are operated 6 to 72 hours after injury. 2 cases are delayed until 1week because of combined other injuries (Figure 7). Suspension laryngoscopy and the balloon of the No.5 tracheal tube is inserted into the segment laryngeal trauma under direct telescopic visualization. The balloon is then inflated to a pressure of 30 cm H2O during 1-2 minutes for dilatation (Figure 8, Figure 9). In case need the stent, stenting by using the balloon of the No.5 endotracheal tube was cut but keep the balloon (Figure10) and pull through in to the larynx by pass through the tracheotomy hole with Nelaton tube guider.

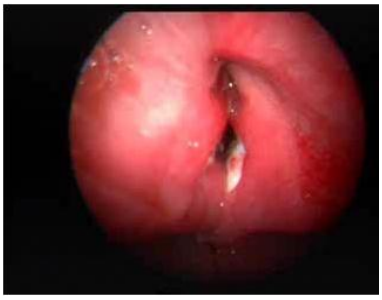

Figure 7: Before plasty

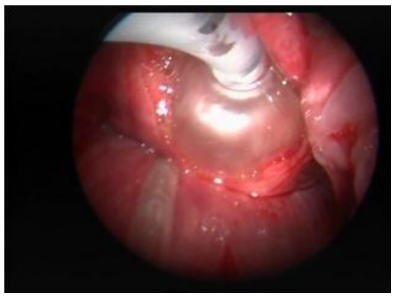

Figure 8: No.5 tracheal tube is inserted. The balloon is inflated

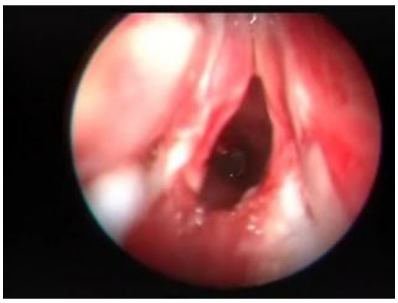

Figure 9: After balloon laryngoplasty

Figure 10: The No.5 endotracheal tube was cutted (keep the baloon), connect to Nelaton tube by a Nylon 5.0 in the head and connect with the other Nylon 5.0 in the end

Table 2: Laryngeal fracture and treatment (n=54)

Laryngeal fracture	n (%)	Treatment	n (%)
Without tracheostomy	18 (33.3)	Endotracheal tube's balloon placement	35 (64.8)
Tracheotomy	32(59.2)	Balloon laryngeal plasty simple	17 (31.4)
Endotracheal tube	4 (7.4)	Aboulker placement	2 (3.7)

Cut the Nelaton sonde and the Nylon in the head of the balloon. Fixed the stend over the canule below by Nylon 5.0 in the end of the balloon. Pressure of the balloon stenting is maintained under 23 cm H_2O for 7 days. Take out the balloon after 7 days through the tracheotomy hole. Endotracheal tube's balloon placement is the most widely used treatment (n=35, 64.8%). Aboulker must be place for a long time in 2 cases with late operation (after injury 1 week) (Table 2).

3.4. Treatment evaluation

The follow up evaluate the endotracheal tube removal rate is 96.2% after 2 to 4 weeks (in 52 patients except 2 cases with Aboulker placement) (Figure 11). After surgery, we evaluate the voice according to Tolga with 3 degrees in every follow-up. Results evaluated with roughness group and breathiness group are quite high with the rate 50.0% and 40.7%, respectively (Table 3).

The results fiber-optic endoscopy and respiratory function are frequently optimistic in early injuries. The occurrences of vocal cord paralysis, small granulation, and aboulker placement account for a small proportion of 11.1%, 14.8%, and 3.7%, respectively. (Table 3.)

The respiratory function is made 4 to 6 months with good results at normal and near normal rates 85.1% and 11.1%, respectively (Figure 12, Figure 13, Table 3).

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Table 3: Treatment evaluation

Characteristics	n (%)
Endoscopy result	
Vocal cord paralysis	6 (11.1)
Small granulation	8 (14.8)
Larynx and hypolarynx nearly normal	44 (81.4)
Aboulker placement	2 (3.7)
Voice Results	
Roughness	27 (50.0)
Breathiness	22 (40.7)
Hoarseness	3 (5.5)
Stent	2 (3.7)
Total	52 (96.2)
Respiratory function	
Normal	46 (85.1)
Near normal	6 (11.1)
Total	52 (96.2)

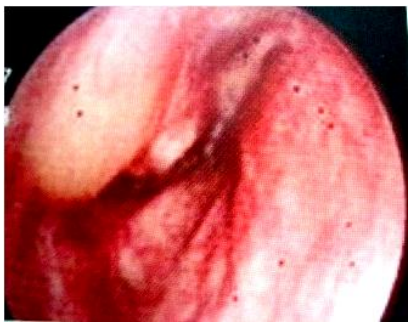

Figure 11: Before balloon laryngoplasty

Figure 12: 2 years after balloon laryngoplasty

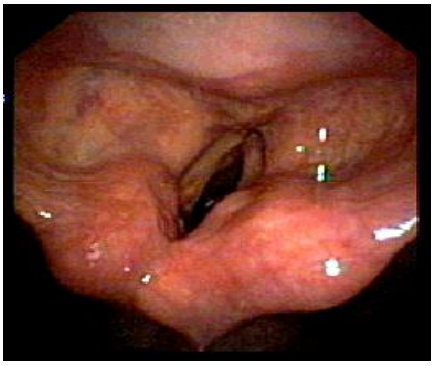

Figure 13: 2 years after balloon laryngoplasty

4. Discussion

4.1. Epidemiology

In the study, 54 patients participated with the majority being male patients (n=52, 96.3%) and working age from 21 to 40 cases (55.8%) because of traffic accidents (moto-bike) 46 cases (85.2 %). Similar studies in the world have found that adolescents aged 24 to 44 are more likely to suffer from the rare condition of laryngeal trauma.[3,11,12]

4.2. Clinical aspects

Dyspnea, hoarseness, and emphysema are most common symptoms of the laryngeal trauma. Combination of endoscope and CT-scan helps to diagnosis effectively and prevent unnecessary open operation as well as stenosis. The effectiveness of imaging methods in diagnosis has been demonstrated in the study by Minerva Becker et al.[5]

4.3. Treatment aspects

Emergency with the trauma of the larynx cartilage from work is can cause dyspnea. For the 2nd degree laryngeal dyspnea, tracheotomy is required.[3],[13] Specific treatments by using balloon laryngoplasty under suspension laryngeal endoscopy is a safe means of establishing the airway for laryngeal trauma. It is an effective procedure for the management especially blunt laryngeal trauma. The result in early operated group is better than in the delayed operated one. Success percentage was 85.1% with normal respiratory function.

5. Conclusion

The method balloon pharyngoplasty under suspension laryngeal endoscopy to management of laryngotracheal trauma is non-invasive, not difficult and technique can ensure a successful outcome.

6. Acknowledgements

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7. Declarations

Funding: None
Conflict of interest: None declared
Ethical approval: The study was approved by School of Medicine, Vietnam National University Ho Chi Minh city, Ho Chi Minh City.

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