Comparison of Outcomes for Staple and Conventional Closure of the Pharynx Following Total Laryngectomy

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Background: *Closure of the wall of the pharynx is an important step in the total laryngectomy operation. An inadequate closure results in tissue contamination, wound infection, and the development of pharyngo-cutaneous fistula.*
Objective: *To study the outcomes of neo-pharyngeal closure after total laryngectomy by stapler compared with conventional techniques.*
Material and Method: *A retrospective descriptive study of patients undergoing total laryngectomy with either pharyngeal stapling or suturing between January 2007 and December 2011.*
Results: *Twenty-six patients had pharyngeal stapling, while another twenty-six had a conventional pharyngeal closure. The operative time was significantly less in the stapler group ($p < 0.001$).*
Conclusion: *Pharyngeal stapling might be an alternative technique for total laryngectomy.*

Keywords: *Stapler, Total laryngectomy, Conventional, Comparison*

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Total laryngectomy (TLG) is the standard treatment for advanced laryngeal cancer. There is a need to close the pharynx after removal of the larynx, creating a functionally adequate 'neo-pharynx'. The suturing of the neo-pharynx is very important because adequate closure prevents leakage of saliva and food. Leakage from the pharynx causes wound contamination and leads to the development of pharyngo-cutaneous fistula. The patient cannot take food orally after surgery, which makes feeding difficult. The conventional suturing technique is not only time-consuming, but also requires special skill to perform. There is evidence that the longer the operative time, the higher the risk of infection[1,2]. Staplers were first used to reduce the operative time in gastrointestinal surgery. In Thailand, staplers were also used first in digestive tract surgery, such as intestines, oesophagus and haemorrhoids. For the Ear Nose and Throat area, staplers had not been previously used in Thailand, even though Holm first introduced stapling in laryngology in 1969[3]. Previous reports[4-9] of this technique have frequently included less than twenty cases each, with no comparison group of patients who have had conventional suturing of the pharynx. The present study aimed to compare the stapling technique with conventional suturing for closing the pharynx in TLG cases in terms of its results and complications.

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Material and Method

The protocol of this research was reviewed and approved by the ethics committee of Rajavithi Hospital. This is a retrospective descriptive study including patients treated between January 2007 and December 2011 at Rajavithi Hospital, Bangkok. The inclusion criteria were: a diagnosis of laryngeal cancer; suitability for surgical treatment of their disease; and absence of involvement of adjacent areas such as the pyriform fossa, aryepiglotic fold, post-cricoid region, epiglottis or base of tongue. The exclusion criteria were: need for a flap repair using tissue from outside the larynx; recurrent disease; the presence of cancer at another site; and a previous history of surgery for head and neck cancer. Demographic data, stage of disease at the time of surgery, duration of surgery, complications, and length of hospital stay were

recorded. The patients were divided into two groups, stapler and suturing, according to the method used to create the neo-pharynx. The data were analysed comparing the two groups with regard to duration of surgery, complications and length of hospital stay. The authors also studied the relationship between factors that affect wound infection and pharyngo-cutaneous fistula formation (age, past history, smoking history, alcohol consumption, stage of disease) using SPSS statistical software (SPSS Inc., Chicago, USA).

The stapler models routinely used were linear type with an angled handle and 60 mm jaw size, which hold 21 staples and double suture lines (Fig. 1). Some models were reloadable and some were the disposable type.

Surgical technique

Conventional technique: after total laryngectomy is done, the remaining pharyngeal mucosa is closed in two layers: the first is a mucosal/fascial layer with a running method to try to obtain inversion of the mucosal edges into the pharynx; the second is a muscle layer with interrupted method.

Stapling method: Before applying the stapler, the surgeon completely separates the larynx from surrounding tissue and muscular and neuro-vascular connections. Supra-hyoid muscle and soft tissue are separated from the hyoid and dissected soft tissue close to the epiglottis until the tip of the epiglottis can be seen. Tracheal separation from the esophagus is carefully dissected approaching from below or from bottom to top (Fig. 2). The open jaws of a Linear stapler 60 mm are inserted just below the larynx, the stapler jaws are immediately closed, and the larynx is excised by blade along the jaws of the stapler (Fig. 3). The suture will be completely linear following removal of the larynx and the stapler jaws. The second interrupted suture is performed by silk 3/0 just close to the stapler suture line to assist and reduce the tension of the stapler suture line.

Fig. 1 Surgical Stapler "Providium/Tigo TA60"

Statistical analysis

Mean ± standard deviation (SD) and frequency (%) were used to describe subjects' baseline characteristics. Fisher' exact test or Chi-square test was used to compare categorical variables. Student's t-test was performed to assess difference between two means

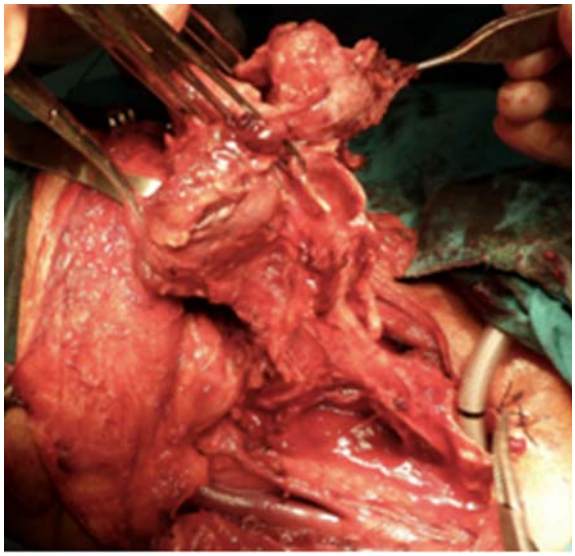

Fig. 2 Total laryngectomy, approach from trachea by separate trachea and larynx from esophagus and hypopharynx

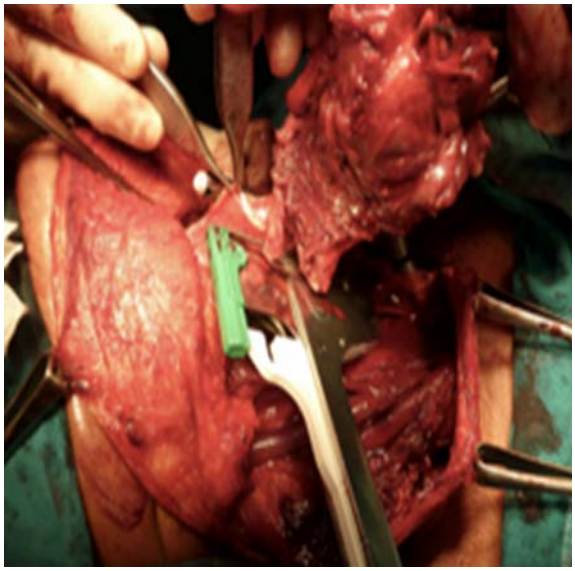

Fig. 3 Insert the stapler between the larynx and hypopharynx and then cut and autosuture by stapler closed the hypopharyngeal stoma

of conventional group and stapler group. A p-value of < 0.05 was considered as statistical significant different.

Results

Fifty-two patients were included in the present study: twenty-six had pharyngeal closure using staples while the other twenty-six had closure by suturing. The demographic data for the two groups were similar in age, sex, smoking history, alcohol consumption, and staging of disease at the time of surgery. Co-morbidity diseases were found significantly more in the conventional group (Table 1). With regard to the two surgical techniques, operative time was significantly shorter in the stapler group ($p < 0.001$) but not significantly different in either the length of hospital stay or the incidence of complications (Table 2).

Discussion

Demographic data were similar in the two groups, so valid comparisons can be made between them. The duration of surgery was significantly shorter when staples were used, and this is in agreement with the findings of Cagler Calli et al[9]. The mean duration of surgery in the present study was 6.6 hours for stapler cases and 8.4 hours for the conventionally-managed patients. A reduction in surgical duration results in less use of anaesthetic agents and fewer complications from prolonged anaesthesia[13].

Table 1. Demographic Characteristics of Subjects

Baseline characteristic	Study Groups (number of patients)		p-value
	Conventional group (n = 26)	Stapler group (n = 26)	
Sex			
Male	24 (92.3%)	25 (96.1%)	
Female	2 (7.7%)	1 (3.9%)	1.000[a]
Age (years)			
Mean ± SD	62.04 ± 9.19	63.86 ± 10.21	
Range	46-75	43-81	0.500[b]
Co-morbidity disease	14 (53.8%)	6 (23.1%)	0.023*[c]
Smoking	25 (96.2%)	24 (92.3%)	1.000[a]
Alcohol	24 (92.3%)	21 (80.8%)	0.419[a]
Staging			
II	1 (3.8%)	1 (3.9%)	
III	16 (61.5%)	20 (76.9%)	
IV	9 (34.6%)	5 (19.2%)	0.548[a]

Values are represented as n (%), Means ± SD. [a] = p-value from Fisher's Exact test, [b] = p-value from Student's t-test, [c] = p-value from Chi-square test. * = Significance at $p < 0.05$

Table 2. The outcome variables between conventional group and stapler group

Outcome variables	Operative techniques		p-value
	Conventional group (n = 26)	Stapler group (n = 26)	
Operating time (hr)	3.54 ± 0.91	2.59 ± 0.82	< 0.001*[a]
Range	(2.1-5.7)	(1.7-4.9)	
Length of hospitalization stay (days)	14.23 ± 5.33	14.57 ± 8.32	0.782[a]
Range	(10.5-29.6)	(8.3-40.2)	
Pharyngocutaneous fistula	3 (11.5%)	2 (7.7%)	1.000[b]
Pneumonia	0 (0%)	1 (3.9%)	1.000[b]
Wound infection	2 (7.7%)	1 (3.9%)	1.000[b]
Dysphagia	3 (11.5%)	2 (7.7%)	1.000[b]

Values are represented as n (%), Means ± SD. * = Significant at $p < 0.05$, a = Student's t-test, b = Fisher' exact test

Despite this, the frequency of pharyngo-cutaneous fistula formation was not significantly different in the two groups in the present study. By contrast, in the studies reported by Jos Gonzales[8] (n = 60 patients) and Cagler Calli[9] (n = 182 patients) the rate of pharyngo-cutaneous fistula was significantly less in those patients in whom staples were used. The rates of pharyngo-cutaneous fistula following stapling reported in the literature vary between 4.0% and 17.0%[4-10]. The pharyngo-cutaneous fistula rate in the present study was lower in the stapler group (2 patients, 7.7%) than in the conventional group (11.5%). The two fistulae which developed in the staple group were small, and they healed within two weeks without further surgical intervention. The failure to achieve statistical significance may simply be due to the relatively small sample size and in any case, the difference could be considered to be clinically significant.

There was no difference in the rate of wound infection and pneumonia between the two groups, which is in agreement with the findings of Altsimi[6] and Ganly[13]. Other authors have reported a reduced length of hospital stay when staples are used[6,7,14], but in the present study there was no difference between the two groups; this is because the policy of the unit in which the surgery was carried out is to keep the patients under observation for 14 days.

Dysphagia was not more common in the stapler group, indicating that the neo-pharynx produced is functionally adequate. However, difficulty in swallowing may be a late complication in some patients following laryngectomy, and this would not have been picked up in the present study. Early feeding by mouth is possible following stapling, which is a significant advantage for the patient.

The stapler technique is simpler to perform than conventional suturing, making it more suitable for use by general ENT surgeons. Given the commonness of laryngeal cancer in the general population, this is a significant advantage.

Conclusion

Total laryngectomy with the creation of a neo-pharynx using stapling was faster to perform than the conventional technique. Less operative time might reduce salivary contamination and tumour seeding time, rendering wound infection and pharyngo-cutaneous fistula formation less likely.

The stapling technique is easy to perform and does not require specialised experience. Stapling of the pharyngeal wall might be an alternative technique for those cases without spread of tumour outside the larynx.

Potential conflicts of interest

None.

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เปรียบเทียบผลการเย็บปิดแผลคอหอยหลังการผ่าตัดเอามะเร็งกล่องเสียงออกด้วยการใช้เครื่องเย็บ STAPLER และการเย็บปิดแบบดั้งเดิม

ภักดี สรรค์นิกร, นทิตา พรนิเวศน์

***ภูมิหลัง**: การเย็บปิดแผลบริเวณคอหอยหลังการผ่าตัดเอากล่องเสียงออก เป็นขั้นตอนที่สำคัญที่สุดของการผ่าตัดเอามะเร็งกล่องเสียงออกในผู้ป่วยที่เป็นมะเร็งกล่องเสียงในระยะที่จำเป็นที่ต้องทำการผ่าตัด เอากล่องเสียงออกทั้งหมด ถ้าเกิดการผิดพลาด ในขั้นตอนการเย็บปิดแผลที่คอหอยก็จะทำให้เกิดการติดเชื้ออย่างรุนแรง และอาจเกิดรูรั่วได้*

***วัตถุประสงค์**: เพื่อศึกษาผลของการเย็บปิดแผลคอหอย หลังการผ่าตัดเอามะเร็งกล่องเสียงออกด้วยการใช้เครื่องเย็บเปรียบเทียบกับวิธีการเย็บแบบดั้งเดิม*

***วัสดุและวิธีการ**: เป็นการศึกษาย้อนหลังในผู้ป่วยที่ได้รับการผ่าตัดเอามะเร็งกล่องเสียงออกทั้งหมด และเย็บปิดแผลคอหอยด้วยการใช้เครื่องเย็บเปรียบเทียบกับวิธีการเย็บแบบดั้งเดิม ที่ใช้กันโดยทั่วๆ ไป ในระหว่างเดือนมกราคม พ.ศ. 2550 ถึงเดือนธันวาคม พ.ศ. 2554*

***ผลการศึกษา**: ผู้ป่วย 26 ราย ได้รับการเย็บปิดแผลคอหอยด้วยเครื่องเย็บและอีก 26 ราย ได้เย็บปิดแผลคอหอย ด้วยวิธีแบบดั้งเดิมพบว่าเวลาที่ใช้ในการผ่าตัดเร็วขึ้นอย่างมีนัยสำคัญทางสถิติ ($p \leq 0.001$) และภาวะแทรกซ้อนต่างๆ ก็มีแนวโน้มน้อยกว่า*

***สรุป**: การใช้เครื่องเย็บปิดแผลที่คอหอยน่าจะสามารถนำมาใช้ได้ดีอีกวิธีหนึ่ง ในการผ่าตัดเอามะเร็งกล่องเสียงออก*