

How Should the Surgical Approach In Thyroidectomy Be Selected? A Prospective Study Comparing the Trauma of 3 Different Thyroidectomy Surgical Approaches

Chen-xing Jian, MD,* Li-min Wu, MD,* Zi-fang Zheng, MD,* Wei Liu, MD,*
Jian-ying Fang, MSc,† and Hai-jian Tu, MSc‡

Objective: To compare the trauma of 3 different surgical approaches and provide a reference for clinicians in choosing the operative procedure.

Patients and Methods: A total of 150 patients were divided into the total endoscopic thyroidectomy (TET), endoscopic-assisted thyroidectomy (EAT), and conventional open thyroidectomy (COT) groups, with 50 patients in each group. The peripheral blood C-reactive protein (CRP) levels at different postoperative time points, operative time, intraoperative blood loss, postoperative drainage volume, postoperative pain, degree of satisfaction with the incision appearance, postoperative extubation time, and swallowing discomfort 3 months after surgery were compared among the groups that received different surgical approaches.

Results: The operative time of TET was longer than that of COT and EAT. The intraoperative blood loss was significantly lower in the TET and EAT groups than in the COT group. The postoperative drainage volume was lowest after EAT and highest after TET. The extubation time was significantly shorter after EAT than after TET and COT. The 6-hour CRP level was significantly higher after TET than after EAT and COT, and the 24-hour CRP level was better in the EAT group than in the other 2 groups. The CRP levels at 72 hours postoperatively were lowest in the EAT group and highest in the TET group. Postoperative pain was significantly lower after EAT than after TET and COT. Cosmetic satisfaction was highest in the TET group and lowest in the COT group. Swallowing discomfort was lowest in the EAT group and highest in the TET group. There was a positive correlation between the drainage volume on the first postoperative day, the drainage tube removal time, dysphagia, and the CRP level in each period. There was a positive correlation between pain, cosmetic satisfaction and CRP in 2 of the time periods.

Conclusions: All 3 types of thyroidectomy are safe and reliable in benign tumor resection. Therefore, in clinical practice, the age, sex, and cosmetic needs of the patients, and the oncological safety should all be considered to provide patients with the most appropriate recommendations. In view of oncological safety, TET should be carefully selected for malignant tumor resection.

Key Words: thyroidectomy, surgical approaches, trauma

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Endoscopic thyroidectomy quickly became popular around the world because of the advantage of having no incision scar on the neck. Various endoscopic surgery techniques have been developed.^{1–5} At present, the 3 most common surgical methods used by our team are total endoscopic thyroidectomy (TET), endoscopic-assisted thyroidectomy (EAT), and conventional open thyroidectomy (COT). Few scholars have compared the degrees of trauma of thyroid surgery performed using these 3 approaches, and understanding how to balance trauma and esthetic needs is becoming increasingly important in clinical practice. Therefore, we designed this prospective non-randomized controlled trial. The purpose of this study was to compare the trauma of 3 different surgical approaches and provide a reference for clinicians in choosing the operative procedure. All operations were performed by the same team of surgeons. To pass the learning curve,^{6,7} we started this study after >80 cases of each technology were encountered.

PATIENTS AND METHODS

General Information

From July 2016 to December 2018, 150 patients at the Affiliated Hospital of Putian University underwent COT, TET, or EAT, with 50 patients receiving each type of surgery. The TET group included 8 males and 42 females, with an average age of 38.4 ± 12.08 years. The COT group included 12 males and 38 females, with an average age of 43.93 ± 9.63 years. There were 9 males and 41 females in the EAT group, with an average age of 46.56 ± 8.66 years. Postoperative pathology was benign in all cases.

Inclusion and Exclusion Criteria

The inclusion criteria were as follows: (1) Patients and their family members independently chose the surgical approach. (2) The preoperative conventional imaging results indicated a unilateral goiter tumor. (3) The diameter of a single tumor nodule was <4 cm. (4) No serious lesions were found in vital organs, such as the heart, liver, lungs, and kidneys. (5) The patient's preoperative C-reactive protein (CRP) level was normal. The exclusion criteria were as follows: (1) The primary condition was combined with hyperthyroidism and thyroiditis. (2) The patient had a history of neck surgery or radiotherapy. (3) The preoperative diagnosis was thyroid carcinoma. (4) The tumor diameter was >4 cm. (5) The patient could not tolerate general anesthesia or surgery. (6) The patient underwent a second

Received for publication March 8, 2019; accepted September 20, 2019. From the Departments of *Minimally Invasive Surgery; †Medicine; and ‡Clinical Laboratory, Affiliated Hospital of Putian University, Putian, Fujian Province, China.

The study was approved by the ethics committee of the Affiliated Hospital of Putian University, Putian, Fujian, China (Approval No. 201606).

All study participants provided written informed consent.

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Reprints: Li-min Wu, MD, Department of Minimally Invasive Surgery, Affiliated Hospital of Putian University, Putian, Fujian Province 351100, China (e-mail: ptxywlm@126.com).

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FIGURE 1. Conventional open thyroidectomy method. [full color online](#)

operation because of postoperative bleeding. (7) The patient had an inflammatory disease.

Surgical Procedure

In COT, the incision length was ~6 to 8 cm, and the operation was carried out by conventional methods. An ultrasound scalpel was used instead of an electric knife (Fig. 1). In EAT, a 5-mm endoscope, an ultrasound scalpel, and vascular forceps were used (Fig. 2). In TET, a chest-breast approach was applied (Fig. 3).

Observational Indexes

The CRP levels in peripheral blood (mg/L) were determined at 6, 24, and 72 hours after surgery. The operative time (min), intraoperative blood loss (mL), postoperative drainage volume (mL) on the first day after surgery, and drainage tube removal time were also recorded. The visual analog scale score (0 to 10) was used to assess pain on the first day after surgery. Patient satisfaction with the appearance of the incision was scored on the basis of a custom satisfaction scale (0 to 10), as was the 3-month postoperative dysphagia discomfort (0 to 10 points).

Statistical Analysis

EpiData 3.0 was used to establish a database and input data. SPSS 19.0 software was used for data processing and descriptive analysis. The measurement data are expressed as



FIGURE 2. Endoscopic-assisted small-incision thyroidectomy. [full color online](#)



FIGURE 3. Total endoscopic thyroidectomy through the chest-breast approach. [full color online](#)

$x \pm s$, and the intraoperative blood loss and postoperative drainage volumes are expressed as the means. Multiple sets of data were compared using the F test, 2 sets of data were compared using the q test, and differences with $P < 0.05$ were considered statistically significant. As some data did not conform to a normal distribution or were hierarchical, Spearman correlation analysis was used to analyze the correlation between various variables and CRP.

RESULTS

Unilateral thyroidectomy was performed in all cases. There were no cases of transit opening in the EAT or TET groups. No patients experienced complications, such as symptomatic parathyroid gland injury or uncontrolled intraoperative hemorrhage. One case of temporary recurrent laryngeal nerve injury occurred in each group, and all patients recovered within 3 months after surgery. No permanent recurrent laryngeal nerve injury was found in any of the cases. During the course of the study, no patients were excluded from the trial because of postoperative hematoma. The pathologic results of all cryosections were benign. The operative time was longest in the TET group and shortest in the COT group. The intraoperative blood loss was significantly lower in the TET and EAT groups than in the COT group. The postoperative drainage volume was lowest in the EAT group and highest in the TET group. The time of drainage tube removal was significantly earlier in the EAT group than in the TET and COT groups (Table 1).

The 6-hour postoperative CRP level was significantly higher in the TET than in the EAT and COT groups, and the 24-hour postoperative CRP level showed an advantage for the EAT procedure. The 72-hour CRP level was lowest in the EAT group and highest in the TET group, as shown in Table 2.

Pain on the first day after surgery was significantly lower in the EAT group than in the TET and COT groups. Patients in the TET group had the highest levels of cosmetic satisfaction, followed by those in the EAT group and the COT group. Swallowing discomfort occurred in all 3 groups, but the degree of this discomfort was lowest in the EAT group and highest in the TET group (Table 3).

The results of the correlation analysis between CRP and other outcome variables are shown in Table 4. There was a positive correlation between the drainage volume on the first postoperative day, the drainage tube removal time, dysphagia, and the CRP level in each period. There was a

TABLE 1. Surgical Trauma Indexes

Group	Operative Time (min)	Blood Loss Volume (mL)	Drainage Volume on First Postoperative Day (mL)	Drainage Tube Removal Time (d)
1. COT (50 cases)	52.50 ± 6.88	15	50	4.04 ± 0.81
2. EAT (50 cases)	62.40 ± 7.10	8.5	27.5	2.96 ± 0.78
3. TET (50 cases)	76.12 ± 9.12	8	66.5	4.28 ± 0.83
<i>P</i> _{COT-EAT}	0.000	0.000	0.000	0.000
<i>P</i> _{COT-TET}	0.000	0.000	0.000	0.14
<i>P</i> _{EAT-TET}	0.000	0.26	0.000	0.000

COT indicates conventional open thyroidectomy; EAT, endoscopic-assisted thyroidectomy; TET, total endoscopic thyroidectomy.

positive correlation between pain, cosmetic satisfaction, and CRP in 2 of the time periods. There was no significant correlation between intraoperative blood loss and CRP in any period.

DISCUSSION

Since Huscher et al¹ completed the world’s first endoscopic thyroid surgery in 1997, some researchers have demonstrated that endoscopic thyroidectomy, including transoral endoscopic thyroidectomy is a safe procedure in appropriately selected patients, on the basis that good open surgeons can overcome the learning curve of the endoscopic procedure.²⁻⁵ However, the use of TET through the chest-breast approach remains controversial in malignant tumors because the thoroughness of lymph node dissection in the supraclavicular region is questionable.⁸ Therefore, this study discusses only the differences in trauma among the 3 surgical methods within the scope of benign tumors. A prospective randomized controlled study comparing trauma caused by TET, EAT, and COT has been rarely reported. This study is a prospective, non-randomized controlled trial. Most of the time in clinical practice, patients make the choice of the type of thyroidectomy procedure, so a randomized trial is difficult to complete.

The inflammatory reaction of surgical stress reflects the trauma of surgery to some extent. CRP is a reliable marker of acute phase response.⁹⁻¹² Therefore, in this study, we used CRP to assist in determining the trauma of the 3 surgical methods. Correlation analysis showed a positive correlation between some variables and CRP, the results suggest that the drainage volume on the first postoperative day, the drainage tube removal time, postoperative dysphagia, pain, and cosmetic satisfaction may be used as reference indexes for surgical invasiveness. We divided the trauma evaluation into 2 categories: physiological trauma and psychological trauma. Physiological trauma indicators include CRP levels at different postoperative time points, operative time,

intraoperative blood loss, postoperative drainage volume, and postoperative extubation time. Indicators of psychological trauma include postoperative pain, degree of satisfaction with the incision appearance, and swallowing discomfort 3 months after surgery.

The results show that the anesthesia time was slightly longer in the COT group, but the EAT group showed obvious advantages in the following physiological trauma measures: blood loss, drainage volume on the first postoperative day, drainage tube removal time, and postoperative CRP levels. There were also significant advantages in the following psychological trauma measures: pain on the first day, cosmetic satisfaction, and dysphagia at 3 months. In terms of the overall traumatic impact of the 3 approaches, EAT should, theoretically, be the least traumatic procedure. Therefore, it is suitable for patients with low requirements for neck incision and small tumors, which provides great advantages for some patients, but this technique requires a stable and skilled team, which is also the basic condition for the completion of this operation.

In terms of psychological trauma, such as postoperative quality of life and comfort level, the TET group showed significant advantages among patients with high cosmetic needs. However, there were some disadvantages in terms of physiological trauma. Incision translocation during TET is at the cost of greater physical trauma. Therefore, this technology is advantageous only for cosmetic surgery. Patients with high incision requirements and benign tumors can choose this method.

In clinical practice, there are still some patients, such as those with secondary surgery, with previous neck treatment history, or with large tumors, and patients who need central region lymph node or lateral lymph node dissection, for whom the above 2 surgical approaches are obviously not

TABLE 2. Postoperative CRP Levels

Group	6 h	24 h	72 h
1. COT (50 cases)	6.54 ± 0.85	11.60 ± 1.69	16.12 ± 1.93
2. EAT (50 cases)	6.30 ± 1.11	8.67 ± 1.47	11.71 ± 2.96
3. TET (50 cases)	7.87 ± 2.12	12.58 ± 3.24	19.81 ± 5.62
<i>P</i> _{COT-EAT}	0.41	0.000	0.000
<i>P</i> _{COT-TET}	0.000	0.33	0.000
<i>P</i> _{EAT-TET}	0.000	0.000	0.000

COT indicates conventional open thyroidectomy; CRP, C-reactive protein; EAT, endoscopic-assisted thyroidectomy; TET, total endoscopic thyroidectomy.

TABLE 3. Postoperative Comfort Scores (0 to 10)

Group	Pain on First Postoperative Day	Cosmetic Satisfaction	Dysphagia at 3 mo
1. COT (50 cases)	2.86 ± 1.40	2.94 ± 1.63	3.22 ± 1.69
2. EAT (50 cases)	1.72 ± 0.95	6.02 ± 1.33	2.02 ± 1.12
3. TET (50 cases)	2.96 ± 0.92	9.50 ± 0.68	4.12 ± 1.31
<i>P</i> _{COT-EAT}	0.000	0.000	0.000
<i>P</i> _{COT-TET}	0.65	0.000	0.002
<i>P</i> _{EAT-TET}	0.000	0.000	0.000

COT indicates conventional open thyroidectomy; EAT, endoscopic-assisted thyroidectomy; TET, total endoscopic thyroidectomy.

TABLE 4. Correlations Between CRP and Other Outcome Variables

CRP	Blood Loss Volume (mL)	Drainage Volume on First Postoperative Day (mL)	Drainage Tube Removal Time (d)	Pain on First Postoperative Day	Cosmetic Satisfaction	Dysphagia at 3 mo
CRP 6 h						
Correlation coefficient	-0.137	0.462	0.324	0.099	0.296	0.192
P	0.094	<0.001	<0.001	0.230	<0.001	0.018
CRP 6 h						
Correlation coefficient	0.099	0.632	0.365	0.316	0.112	0.349
P	0.228	<0.001	<0.001	<0.001	0.174	<0.001
CRP 6 h						
Correlation coefficient	0.035	0.655	0.403	0.362	0.241	0.355
P	0.668	<0.001	<0.001	<0.001	0.003	<0.001

CRP indicates C-reactive protein.

suitable, so there are still many patients who are unable to undergo endoscopic procedures. Moreover, our experiment still has its limitations. Because this study focuses on only 2 of the endoscopic surgery methods and does not discuss other endoscopic surgery procedures, the results should not be considered to represent all the differences between endoscopic surgery and open surgery.

In the present study, there were no instances of permanent recurrent laryngeal nerve injury, superior laryngeal nerve injury, or irreversible hypocalcemia. The exclusion criteria we set during the initial design of the experiment included postoperative hematoma, mainly as a consideration of the effect of postoperative hematoma on CRP as a bias. However, by the end of the study, no patients were excluded because of postoperative hematomas. Therefore, all 3 surgical methods were safe and reliable.

CONCLUSIONS

All 3 types of thyroidectomy are safe and reliable for benign tumor resection. In clinical practice, the age, sex, and cosmetic requirements of patients and oncological safety should be weighed to provide patients with the most appropriate suggestions. In view of oncological safety, TET should be carefully selected for malignant tumor resection.

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