

Comparative Analysis of Three Lobectomy Methods for Papillary Thyroid Cancer

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Purpose: The current study examined the validity and outcomes of three lobectomy methods for papillary thyroid carcinoma (PTC), open surgery, minimally invasive video-assisted thyroidectomy (MIVAT), and endoscopic surgery.

Methods: Between January 2006 and June 2011, 360 patients underwent lobectomy for treatment of PTC. Clinical data were collected and analyzed retrospectively. Open lobectomy, MIVAT, and endoscopic lobectomy were performed in 170 (47.2%, Group A), 81 (22.5%, Group B), and 109 patients (30.3%, Group C), respectively. Median tumor size was 0.5 cm.

Results: No significant differences in tumor size, lymphovascular invasion, extrathyroidal extension, and metastatic lymph node number were observed among the groups. However, the mean number of retrieved central lymph nodes was higher in the open surgery group than in the other groups (8.9, 4.9, and 5.8 in Groups A, B, and C, respectively $P < 0.05$). Postoperative bleeding occurred in one patient each in Group A. Temporary hypoparathyroidism developed in ten, three, and three patients in Groups A, B, and C, respectively. Recurrence occurred in five cases (1.4%), however, no significant difference in short-term recurrence (median duration of follow up: 1,109 days) was observed among the three groups.

Conclusion: The number of retrieved central lymph nodes was higher in the open surgery group. However, no differences in the incidence of complications or short-term recurrence were observed among the groups, indicating that either one of these methods can be recommended as limited surgery for PTC.

Key Words: Thyroidectomy, Papillary thyroid cancer, Minimally invasive surgery

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INTRODUCTION

According to the revised guidelines of the American Thyroid Association, lobectomy is the recommended treatment for small, low-risk, unifocal, intrathyroidal papillary thyroid cancer (PTC).⁽¹⁾ However, thyroid surgery can result in the formation of hypertrophic scars, which are a serious cosmetic concern, particularly in younger patients, although their etiology is not known. In addition, the prevalence of thyroid cancer is higher among women than men and thus minimally invasive procedures such as minimally invasive

video-assisted thyroidectomy (MIVAT) and endoscopic thyroidectomy were developed in the late 1990s to improve the cosmetic outcomes of patients undergoing thyroid surgery.^(2,3)

Several comparative clinical studies have analyzed the different methods of thyroid surgery including MIVAT, endoscopic thyroidectomy and conventional open thyroidectomy. Currently, MIVAT and endoscopic thyroidectomy are considered superior to open thyroidectomy with respect to cosmetic outcomes, hospital stay and postoperative clinical recovery, in addition to their proven safety.⁽⁴⁻⁷⁾ Although

MIVAT and endoscopic thyroidectomy are well-established surgical procedures, comparative analysis of the two has been rare. Definitely, endoscopic thyroidectomy is better than MIVAT in terms of cosmetic outcome because surgical scarring is not made on neck area. However, endoscopic thyroidectomy is associated with longer hospital stay, longer operation time, more immediate pain and increased surgical morbidity than MIVAT.⁽⁸⁾

Likewise, several literatures have been reported comparative analysis of three methods, however, clinical studies comparing these three surgical methods all together are lacking. The aim of the present study was to analyze the validity and outcomes of lobectomy performed using open surgery, MIVAT and endoscopic surgery for the treatment of PTC.

METHODS

Between January and June 2011, the clinical data of 360 patients who underwent lobectomy in single institution for the management of PTC were analyzed retrospectively. Unilateral lobectomy was planned for patients diagnosed as unifocal papillary microcarcinoma without extrathyroidal extension or lymph-node metastasis to central areas according to the results of preoperative neck ultrasonography. None of the patients had a family history of thyroid cancer or a previous history of exposure to radiation. Surgical method was chosen by the preference of the patients. All operations were done by 30-year experienced endocrine surgeon.

Endoscopic procedures in our institution are performed using a gasless transaxillary approach. The surgical procedure used for MIVAT is the same as that of conventional open thyroidectomy except that a surgical skin incision measuring 2.5~3.5 cm is performed lateral to the lesion according to the natural skin crease. In conventional open lobectomy, the skin incision measures 5~6 cm.

Diagnoses of disease recurrence in contralateral lobe or cervical lymph nodes were based only on neck ultrasonography-guided fine-needle aspiration cytology.

The mean age of the patients was 42 years and the male to female ratio was 1 : 6. On final histopathologic examination, the median size of tumors was 0.6 cm and tumor multifocality

was reported in 10.6% (38 out of 360) of patients. In 27.8% of patients (99 out of 360), extrathyroidal extension to soft tissue was detected, and 24.1% of the patients (75 out of 360) had metastasis to central areas. The mean number of retrieved lymph nodes was seven (Table 1).

A fraction of 47.2% (n=170, Group A) of patients underwent conventional open lobectomy and 22.5% (n=81, Group B) underwent MIVAT. The remaining 109 patients (30.3%, Group C) underwent endoscopic lobectomy.

For data analysis of immediate postoperative complications, transient hypoparathyroidism was defined by a parathyroid hormone (PTH) level <10 pg/mL and a serum calcium level <8 mg/dL one day postoperatively.

Clinicopathological data were analyzed with SPSS software (version 19.0, SPSS, Chicago, IL, USA). Differences among the three subgroups were analyzed by one-way analysis of variance (ANOVA) for parametric variables and the Kruskal-Wallis test for nonparametric variables. The confidence interval was set at 95%, and a P value <0.005 was considered statistically significant.

This study was approved by the Institutional Review Board. Informed consent was not obtained because of the retrospective nature of this study.

Table 1. Basic clinical data of 360 patients

Variables, n=360	
Age at diagnosis, yrs*	42
M : F	1 : 6
Pathology	
Size, cm [†]	0.6
Multicentricity	38 (10.6)
Extrathyroidal extension, n=356	99 (27.8)
Vascular invasion, n=349	18 (5.2)
Metastasis to cervical LN, n=311	75 (24.1)
Number of retrieved cervical LN*	7
Number of metastatic LN*	0.5
MLNR*	0.08
Postoperative complication	17 (4.7) [‡]
Follow-up days [†]	1,109

*Mean. [†]Median. Others, presented as n (%). [‡]One case of immediate postoperative bleeding and 16 cases of temporary hypoparathyroidism. LN = lymph node; MLNR = metastatic lymph-node ratio (number of metastatic lymph node(s)/number of retrieved lymph node(s)).

RESULTS

Table 2 shows the comparative data for the three groups. The mean age was lower in Group C than in the other two groups (48, 44, and 41 years in Groups A, B and C, respectively, $P < 0.01$) and the proportion of women was higher in Group C than in the other two groups ($P = 0.011$). Histopathologic examination revealed no statistically significant differences in extrathyroidal extension status and the rate of metastasis to central areas. No significant differences in the mean number of metastatic lymph nodes or the metastatic lymph-node ratio (total number of metastatic lymph nodes/total number of retrieved lymph nodes) were observed among the groups. However, the mean number of retrieved lymph nodes differed among the three groups (8.9, 5.8, and 4.9 in groups A, B and C, respectively, $P < 0.01$).

Transient hypoparathyroidism was detected in 16 patients in immediate postoperative period groups (5.9%, 2.8%, and 3.7% in groups A, B, and C, respectively, $P = 0.434$) and

postoperative bleeding was developed in one patient of Group A, who underwent bleeding control, with no significant differences among the groups. There were no other kinds of postoperative complication including surgical site infection. Local recurrence was found in five patients during the short-term follow up (three, one, and one in Groups A, B, and C, respectively, $P = 0.833$) and the median follow up was 1,109 days. The site of recurrence and management were described in Table 3.

DISCUSSION

Several guidelines recommend unilateral lobectomy as an adequate surgical option for low-risk PTC patients. Although guidelines for the surgical management of differentiated thyroid cancer exist, lobectomy is commonly considered sufficient in patients with unifocal thyroid cancer without clinical risk factors.^(1,9-11) The results of a recent large-scale, long-term follow-up study indicated that lobectomy

Table 2. Comparison of the clinical data among the three groups

Variables, n=360	Group A, n=170	Group B, n=81	Group C, n=109	P value
Age at diagnosis, yrs*	48	44	41	<0.01
M:F	1:04	1:05	1:14	0.011
Pathology				
Size, cm [†]	0.6	0.5	0.5	<0.001
Extrathyroidal extension, n=356	41 (24.1)	24 (30.8)	34 (31.5)	0.284
Metastasis to cervical LN	37 (25)	14 (20.9)	24 (25)	0.785
Number of retrieved cervical LN*	8.9	5.8	4.9	<0.01
Number of metastatic LN*	0.5	0.5	0.4	0.886
MLNR*	0.07	0.09	0.09	0.725
Postoperative complication				
Transient hypoparathyroidism	10 (5.9)	3 (2.8)	3 (3.7)	0.434
Postoperative bleeding	1 (0.6)	0	0	0.571
Recurrence	3 (1.8)	1 (1.2)	1 (0.9)	0.833

*Mean. [†]Median. Others, presented as n (%). LN = lymph node; MLNR = metastatic lymph node ratio (number of metastatic lymph node(s)/number of retrieved lymph node(s)).

Table 3. Brief review of 5 patients who showed tumor recurrence during follow up

Patient number	Initial surgical method	Site of tumor recurrence	Management for tumor recurrence
1	Open surgery	Contralateral lobe	Completion thyroidectomy using open approach
2	Open surgery	Contralateral lobe	Completion thyroidectomy using open approach
3	Open surgery	Ipsilateral lateral neck node	Completion thyroidectomy and selective lateral lymph node dissection (level II~IV) using open approach
4	Endoscopic surgery	Contralateral lobe	Completion thyroidectomy using endoscopic approach
5	Minimally invasive video-assisted surgery	Ipsilateral lateral neck node	Completion thyroidectomy and selective lateral lymph node dissection (level II~IV) using open approach

without radioactive iodine ablation is a valid treatment option for selective patients with PTC who are younger than 45 years, whose tumor diameter is ≤ 4 cm, and who do not show clinical lymph-node metastasis or extrathyroidal extension.(12) Therefore, lobectomy is generally accepted as a treatment option for low-risk PTC patients.

Data on PTC, which accounts for most thyroid malignancies, show consistent disease specific mortality rates and a female predominance.(13) An increase in the worldwide incidence of PTC (14) has triggered an increased need for thyroid surgery using a remote approach, including endoscopic surgery, to prevent the development of neck scars and improve cosmetic outcomes.(15) In recent years, more than 20 techniques for minimally invasive thyroidectomy have been developed and reported,(16) and robotic thyroid surgery is currently being performed,(17) despite controversy surrounding its cost effectiveness.(18)

Several studies have reported comparative data on open surgery and MIVAT, and open surgery and endoscopic surgery. MIVAT is safe and effective for the treatment of small PTC and shows similar oncologic outcomes to those of traditional thyroidectomy.(19) Furthermore, MIVAT has shown similar cost effectiveness (20) and greater patient satisfaction with the cosmetic results (21) than conventional thyroidectomy. Endoscopic thyroidectomy achieves the same surgical completeness and shows superior cosmetic outcomes than open surgery,(4,22) and studies comparing MIVAT and endoscopic surgery have reported similar results regarding safety and cosmetic outcomes, although endoscopic surgery is technically more challenging.(23,24) However, to the best of our knowledge, few studies have compared the three surgical methods so, in the present study, we compared the validity and outcomes of lobectomy performed using open surgery, MIVAT and endoscopic surgery for the treatment of PTC.

The present study population showed a predominance of young, female patients. The mean age was young in all three groups; however, patients who underwent endoscopic surgery showed the lowest mean age and the highest proportion of women. No statistically significant differences were observed between the groups regarding histopathologic and clinical variables, including immediate postope-

rative complications and short-term recurrence; however, the mean number of retrieved lymph nodes was higher in patients undergoing open surgery than in the other groups.

The present study is the first to compare the number of retrieved lymph nodes among patients undergoing lobectomy with three different surgical methods. A previous study conducted in Korea showed that the number of retrieved lymph nodes was higher in patients undergoing open surgery than in those undergoing endoscopic surgery (5.96 vs. 5.05). (6) Only one published study reported data on the number of retrieved lymph nodes in MIVAT, and it was not a comparative study.(24)

The clinical significance of metastasis to cervical lymph nodes in PTC has been the subject of debate. However, according to recent updated published data, metastatic lymph-node ratio (MLNR) is not only an independent predictor of recurrence,(25) but also a strong determinant of disease-specific mortality in long-term follow-up data of PTC.(26) Considering that the number of retrieved lymph nodes is important for calculating the MLNR, our results provide important clues for determining the optimal surgical method for the treatment of low-risk PTC.

The present study had several limitations. First, this was a retrospective study and the data are therefore limited by potential selection bias. Second, the possible effect of patients' preference in choosing a surgical method must be considered. In addition, this study was based on an Asian population, and the emphasis on preventing neck scars among young people cannot be applied to a global population. Another limitation of the current study is that endoscopic surgery in our institution is performed exclusively using a gasless transaxillary approach, which meant that none of the patients underwent endoscopic surgery using other approaches such as a bilateral axillo-breast approach, which is commonly performed worldwide; thus generalization of our results to clinical practice must be done with caution. Finally, the lack of significant comparative MLNR data among the three groups, and the short median follow up time (approximately 3 years) to evaluate the recurrence of PTC, were also limitations; a recent retrospective study with long-term follow up performed in a single institution reported a time to recurrence of 8.1 years.(27)

CONCLUSION

Our analysis of clinical data showed no differences among the three surgical methods regarding immediate post-operative complications and recurrence during a short-term follow-up period. In addition, we confirmed the lack of a correlation between the number of retrieved lymph nodes and oncologic completeness, despite the existence of reports about the clinical significance of MLNR in PTC. Therefore, as all three methods yield similar results, the decision should be based on the clinicians and patients' preference. However, to establish the validity and outcomes of open surgery, MIVAT and the endoscopic approach, additional large-scaled multicenter-based clinical data should be collected and analyzed in a prospective manner.

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