

The Use of Harmonic Scalpels in Thyroidectomies: Clinical Experiences

Tiroidektomide Harmonik Kesici Kullanımı: Klinik Deneyim

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Abstract

Objective: Many studies have been conducted to investigate the efficacy of harmonic scalpels in thyroidectomies. Here, we present our clinical experiences with the instrument.

Materials and Methods: The study was conducted at the General Surgery Department of the Ataturk University School of Medicine between January 2005 and July 2008. It was a prospective, randomized, controlled study. Patients with benign nodular goiter (BNG) were included in the study and randomly divided into three groups. The first group consisted of 47 patients, the second group consisted of 57 patients, and the third group consisted of 41 patients. Patients in the first group underwent the classical thyroidectomy. Those in the second group had only the superior thyroid arteries and veins ligated (with silk or polyglactin), while the other vascular structures were divided using a harmonic scalpel. In the third group, all arteries and veins of the thyroid gland were divided using a harmonic scalpel. In each group, mean operation time, amount of bleeding, amount of postoperative drainage, and other postoperative complications were recorded.

Results: Operation time was significantly lower for patients in the third group. The degree of bleeding and postoperative drainage was lower in the second and third groups with respect to the first group. There was no significant difference among the groups in terms of the development of transient hypocalcemia or voice impairment.

Conclusion: We conclude that the use of harmonic scalpels for a thyroidectomy is safe, shortens operative time, and decreases intraoperative bleeding.

Keywords: Harmonic scalpel, Thyroid, Surgery

Özet

Giriş: Harmonik kesici (HK) farklı cerrahi işlemlerde gittikçe daha fazla kullanılmaktadır. HK'nin tiroidektomideki etkinliğinin saptamak için çok sayıda çalışmalar yapılmıştır. Biz burada HK'nin tiroidektomide kullanımı ile ilgili olarak kendi deneyimlerimizi sunmayı amaçladık.

Gereç ve Yöntem: Çalışma Atatürk Üniversitesi Tıp Fakültesi genel Cerrahi Anabilim Dalı'nda Ocak 2005 Temmuz 2008 tarihleri arasında yapıldı. Çalışma, kontrollü, prospektif ve randomize olarak planlandı. Selim nodüler guatrı olan hastalar çalışmaya dahil edildi. Hastalar 3 gruba ayrıldı. Birinci grup 47, ikinci grup 57 ve üçüncü grup ise 41 hastadan oluşmaktaydı. Birinci gruba klasik tiroidektomi yapıldı. İkinci grupta sadece üst tiroid arterleri ve venleri ipek veya poliglaktin ile bağlandı ve diğer damarsal yapılar HK ile kesildi. Üçüncü grupta tiroidin tüm arterleri ve venleri HK ile kesildi. Ortalama ameliyat süresi, kanama miktarı, ameliyat sonrası drenaj miktarı ve diğer ameliyat sonrası komplikasyonlar not edildi.

Bulgular: Ameliyat süresi 3. grupta önemli oranda kısaydı. Ameliyattaki kanama miktarı ve dreni olan hastalarda ameliyat sonrası dönemde drenaj miktarı 2. ve 3. grupta daha düşüktü. Geçici hipokalsemi ve ses kısılmasında gruplar arasında önemli bir fark yoktu.

Sonuç: HK'nin tiroidektomide güvenli bir biçimde kullanılabileceği, ameliyat süresini kısalttığı ve ameliyatta meydana gelen kanamayı azalttığı sonucuna vardık.

Anahtar Kelimeler: Harmonik kesici, Tiroid, Cerrahi

Introduction

The use of harmonic scalpels in various operations has led to shorter operation times and less intraoperative bleeding. Since the introduction of the classical thyroidectomy by Kocher in the late 1800s, thyroidectomy has become widely used [1]. As control of bleeding is crucial to the success of thyroidectomy, the introduction of the harmonic scalpel to the thyroidectomy procedure may be beneficial. Further, some studies have suggested that harmonic scalpels are safe to use in thyroidectomies. We add to these studies by reporting the results of a prospective, randomized, controlled study on the use of harmonic scalpels in thyroidectomies on patients with benign nodular goiter (BNG).

Materials and Methods

This study was conducted at the General Surgery Department at the Ataturk University School of Medicine between January 2005 and July 2008. It was a prospective, randomized, controlled study. Only consenting patients with benign nodular goiter were included in the study. Patients with the following conditions were excluded: known or suspected thyroid malignancies, retrosternal goiter, cervical goiters with substernal components, giant goiters, previous thyroid or other cervical operations, hemorrhagic diathesis or co-existing cardiac, and pulmonary or other systemic diseases.

Patients were randomly divided in three groups. The first group underwent classical thyroidectomy. In this group, thyroidectomy was performed by ligating the superior and inferior thyroid arteries, veins and other small vessels with an appropriate suture material (silk or polyglactin) that was selected according to the operating surgeon's preference.

In the second group, only the superior thyroid arteries and veins were ligated, while all other vascular structures were divided using a harmonic scalpel (Harmonic ACE, Ethicon Endo Surgery).

In the third group, all arteries and veins of the thyroid gland (including the superior and inferior arteries and veins) were divided using a harmonic scalpel. Division of the gland for near-total thyroidectomies was also performed by harmonic scalpel.

The operations were all performed by the same team and

the operating surgeons were experienced in the area of thyroidectomy. The trials were blinded. Suction drains were placed according to the operating surgeon's preference. Mean operation time, amount of bleeding, amount of postoperative drainage, and other postoperative complications (hypocalcaemia, voice impairment, and so on) were recorded. The amount of intraoperative bleeding was calculated by summing over the amount of aspirated blood and sponges used during the operation.

The results were analyzed statistically using the statistical package SPSS 12.0 for Windows (SPSS, Chicago, IL, USA). The data from the three groups were compared with each other. Analysis was performed using the Mann-Whitney U test for continuous variables, and the chi-squared test or Fisher exact test for categorical variables. $P < 0.05$ was considered statistically significant.

Results

All patients were operated on for BNG. The first group consisted of 47 patients, the second group consisted of 57 patients, and the third group consisted of 41 patients. Age, gender, surgical technique, mean operation time, amount of bleeding, amount of postoperative drainage, postoperative complications, and hospitalization time for each group are shown in Table 1.

Operation time was significantly lower in the third group. The statistical difference among operation times in the different groups is as follows: first and second groups ($P < 0.05$), first and third groups ($P < 0.01$), and second and third groups ($P < 0.05$).

The amount of operative bleeding was lower in the second and third groups. When statistically evaluated, there were significant differences between the first and second groups ($P < 0.01$) and the first and third groups ($P < 0.01$). There was no difference between the second and third groups ($P > 0.05$).

The amount of postoperative drainage in patients with drains was lower in the second and third groups than in the first group. Significant differences were found between the first and second groups ($P < 0.01$) and the first and third groups ($P < 0.01$). No difference was found between the second and third groups ($P > 0.05$).

Regarding postoperative complications, the most common was transient hypocalcemia. However, there was no significant difference among the groups in the development of transient hypocalcemia. Voice impairment was present only in one case in group two. In the other groups, there were no cases of voice impairment and the statistical difference among the groups was not significant. Immediate reoperation for postoperative bleeding was necessary only in group two. Statistical analysis revealed no significant difference in hospitalization time among the groups.

Discussion

In the last 20 years, thyroid surgery has undergone significant changes. Specifically, the type of surgery (total vs. subtotal

Table 1. Characteristics of the groups

	Group 1 (n=47)	Group 2 (n=57)	Group 3 (n=41)
Age (years)	45.6 (24-61)	43.8 (28-58)	46.1 (27-57)
Gender (M/F)	11/36	15/42	17/24
Surgical technique	Total thyroidectomy	24	30
	Near total thyroidectomy	23	27
Amount of intraoperative bleeding (ml)	142±87	121±65	82±67
Operation time (min)	120±31	94±24	76±17
Postoperative drainage* (ml/day)	46±14.1	31±6.4	30.4±4.5
Postoperative hypocalcemic symptoms	None	1	None
Postoperative voice impairment	None	1	None
Other complications	None	1 (reoperation)	None
Hospitalization time (days)	1.7	1.8	1.8

*In patients with drains

thyroidectomy) has shifted, and more and more people undergo operations for thyroid diseases [2]. Indeed, thyroid surgery is now a routine operation, especially in endemic regions like ours. We performed this study to present the possible advantages and disadvantages of using harmonic scalpels in thyroid surgery. The use of harmonic scalpels during thyroid operations results in less bleeding and shorter operation times. Since its introduction, this instrument has been used in a variety of operations and has helped surgeons achieve better bleeding control.

Prevention of unwanted intraoperative bleeding is important in thyroid surgery because bleeding causes confusion of the anatomic and surgical planes and compromises the identification of the inferior laryngeus nerve and parathyroid glands. Furthermore, bleeding causes operative time to lengthen inappropriately and necessitates the use of drains. For each of these reasons, it is important to choose a 'clear' thyroid surgery [3, 4].

Bleeding in thyroid surgery can occur from the main arteries and veins of the gland (a.v. thyroidea inf, sup), small tributaries, or the gland itself (due to inappropriate dissection resulting in ligation and inadvertent traction). The Ultracision harmonic scalpel has been approved by the United States Food and Drug Administration for the ligation of vessels up to 3 mm in diameter. Thermal damage is limited to 0-2 mm beyond the tissue grasped within the forceps of the device [5-7]. The second generation of the harmonic scalpel [Harmonic ACE] is even more appropriate because it is approved for closing vessels up to 5 mm in diameter [3]. We used this instrument in our study, allowing us to use it to divide vessels as large as the superior artery. It has already been reported that this device is safe and effective for this vessel [4]. Furthermore, in our near-total thyroidectomy cases, the division of the gland was also done with a harmonic scalpel. We observed that the harmonic scalpel was also safe for the division of the gland.

During thyroidectomy, the dissection, ligation, and division of the major thyroid vessels are time consuming. We showed that it is possible to shorten operative time by the use of a harmonic scalpel. Statistical analysis showed that operative time was shorter in operations where a harmonic scalpel was used to seal the small vessels of the thyroid gland. Operative time was further shortened when the harmonic scalpel was used for all of the vessels (including main arteries and veins). While a study by Leonard and Timon [1] concluded that use of a harmonic scalpel was not superior to conventional techniques with respect to operative time, many other studies reported decreases in operative time of between 6 and 78 minutes [8-16].

We showed that the amount of bleeding was reduced in groups where harmonic scalpels were used, which contributes to the shorter operative times. Barczynski et al. [3] reported that a 60.8% decrease in intraoperative bleeding in their series. The decrease was not so pronounced in our series.

Salami et al. [17] have stated that the use of harmonic scalpels resulted in decreased postoperative drainage, which also prevents postoperative surgical site infections. Similarly, we found that the amount of postoperative drainage in patients treated with harmonic scalpels was reduced with respect to the controls. The reduction in intraoperative bleeding allows for more precise control of small vessels, which contributes to of the reduction in

postoperative drainage. Surgeons preferred not to place drains in cases with low intraoperative bleeding, and we observed that the number of these cases was higher in the harmonic scalpel groups.

Barczynski et al. [3] reported no serious intraoperative or postoperative bleeding following the use of a harmonic scalpel. We observed postoperative bleeding with the need for immediate re-operation in only one patient. The exact cause of bleeding was not clear, but the small vessels (not the main vessels) were bleeding. We think that the failure of the harmonic scalpel to seal these vessels was associated with the specific technique, rather than the instrument. It is known that inadvertent traction of the vessel during use of the harmonic scalpel can lead to bleeding [3,4]. We think that this case of bleeding does not suggest a general failure of the harmonic scalpel to seal vessels.

The major complications of thyroid surgery are voice impairment and hypocalcemia. An important issue concerning the use of new sealing modalities is the extent of lateral thermal conduction and associated tissue injury. Some authors have attributed these two complications to the lateral thermal effect of harmonic excitation. Several studies in the literature, however, show that harmonic scalpels can be used safely in thyroid surgery with no increase in the number of complications [9-12,18-21]. We observed complications in group two where harmonic scalpels were used to control smaller vessels. In the group where harmonic scalpels were used to control all vessels, there were no complications. For the patient with voice impairment, the affected nerve was the superior laryngeus nerve. The operating surgeon thought that this was caused by the extensive dissection of the superior pole of the gland. The exact reason for the single case of transient hypocalcemia we observed is also not clear. We attributed this to the wide dissection of the parathyroid glands and transient ischemia. Barczynski et al. [3] reported that they performed blunt dissection with the harmonic scalpel down to 5 mm away from these structures, which is twice the reported safe distance. We think that proper identification of the laryngeus nerve and parathyroids and avoidance of excess manipulation will prevent these complications. According to our findings, postoperative complications are not related to the use of harmonic scalpels.

The cost of harmonic scalpels in thyroid surgery must also be discussed, since some authors have argued that this device is not cost-effective [1]. It is commonly agreed that the potential added cost to the procedure by the use of the harmonic scalpel should be compared with the substantial benefit in surgical time-savings [3,22,23]. Yildirim et al. [24], who conducted a study on the use of harmonic scalpels in Turkey, reported that the increased cost of using harmonic scalpels was not significant. Furthermore, they found that using the device at least 15 times reduces the price of surgery. However, they provide no information about how many times the device should be used or how effective it is when used repeatedly. We have not made a comparison between the costs for each group and therefore cannot say if the use of this device is cost-effective in our country or not. However, we must at least acknowledge that the device must be imported, and thus that it is more expensive than it would be in those countries where it is manufactured.

In conclusion, harmonic scalpels can be used in thyroid

surgery. It can effectively control vessels, reduce intraoperative bleeding, and shorten operative time. It is important to know the operating principles of this device to use it safely. The cost-effectiveness of this device must be further investigated.

Conflict interest statement The authors declare that they have no conflict of interest to the publication of this article.

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