A Parallel Group Analysis of Tonsillectomy Using the Harmonic Scalpel vs Electrocautery

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Objective: To evaluate efficiency and postoperative morbidity in tonsillectomy using the harmonic scalpel (HS) vs conventional electrocautery (EC).

Design: A retrospective medical chart review of all patients who underwent tonsillectomy at a single children’s hospital during a 32-month period from January 2001 to August 2003.

Patients: The charts of 605 patients who underwent tonsillectomy or adenotonsillectomy were reviewed. The patients were stratified into 2 groups based on the dissecting instrument used (HS vs EC). Each group consisted of 2 subcategories based on age (≤7 years and >7 years). Data collected included age, sex, operative indication, operative time, postanesthetic recovery room time, pain scale scores, postoperative admissions, and postoperative morbidities.

Results: There were significant differences in mean age (P < .001), mean weight (P < .001), and indication for surgery (P < .001) between the 2 methods: HS patients were younger, weighed less, and more often had obstructive symptoms as their primary operative indication compared with the EC group. Average operative times were not significantly different between methods. No differences were noted with respect to recovery time (HS group, P = .10; EC group, P = .30), postoperative oxygen requirements (HS group, P = .07; EC group, P = .99), and postoperative pain scores (HS group, P = .31; EC group, P = .58). There was a significant difference in postoperative admissions between the 2 methods in patients 7 years or younger (P = .005). Finally, we noted a significant difference in postoperative bleeding between the HS (2/292) and EC (13/313) methods when the data were compared per age group (P = .006), but the overall bleeding rate was not statistically significant owing to the small number of total bleeding instances (15/605).

Conclusions: Recent prospective studies indicate that the HS provides advantages over conventional EC with respect to postoperative pain and return to normal activity. This study shows that HS tonsillectomy was as efficient as the conventional EC method. In addition, there was evidence that the rate of postoperative bleeding was significantly reduced by using the HS vs conventional EC.


Although the rate at which tonsillectomy and adenoidectomy are performed today is approximately half the rate of 40 years ago, neither the complications of nor the indications for the procedure have changed greatly during that time.1,2 There have been numerous methods and instruments introduced to perform the procedure, with monopolar electrocautery (EC) being one of the more common methods. In this study, we evaluated the harmonic scalpel (HS), which is an ultrasonic dissector coagulator (Ethicon Endo-Surgery Inc, Cincinnati, Ohio), for its surgical efficiency and rate of postoperative hemorrhage and compared these data with those of conventional EC.3

METHODS

The medical charts of 605 consecutive pediatric patients who underwent adenotonsillectomy or tonsillectomy alone at Kosair Children’s Hospital, Louisville, Ky, between January 2001 and August 2003 were reviewed. All procedures were performed by 1 of 2 attending physicians or under their direct supervision. Both attending surgeons used similar indications for selecting patients to receive HS tonsillectomy. During the initial 12 months of data collection, age 7 years or younger was the primary indication for HS use. During the latter stages of the study, one of us (J.L.G.) increased the age limit to 10 years or younger. The patients were stratified by surgical method (HS vs EC) and then further stratified by age (≤7 years or >7 years). Data collected included age, weight, sex, indication for...
surgery, duration of surgical procedure (calculated from the operative record as time of incision to time the incision was closed; anesthesia time was not included), time in postanesthetic recovery unit, need for postoperative admission, minutes of oxygen therapy required postoperatively, pain scale scores in the immediate postoperative period, and postoperative hemorrhage. Pain scores were taken from postanesthetic recovery unit nursing assessments using the FLACC pain assessment scale, ie, face, legs, activity, cry, and consolability. Each of the 5 categories was scored from 0 to 2, which resulted in a total score between 0 and 10. Intravenous morphine or fentanyl was used for pain control intraoperatively and in the postanesthetic recovery unit. All patients received oral acetaminophen with codeine suspension for home use. Statistical analysis was performed using SPSS software (SPSS Inc, Chicago, Ill) with 2 sample, equal-variance t tests. A χ² test of independence was used to determine statistical significance.

All the operations were performed with the patient under general anesthesia. Both techniques were performed by grasping the superior pole of the tonsil and incising the anterior pillar, so that dissection proceeded from the superior pole to the inferior pole. The EC tonsillectomies were performed with the hand-control Teflon tip cautery set at 20 W fulgurate (Valley Laboratory Electrosurgical Generator, Valley Laboratory, Colo). Suction cautery set to 20 W was used when necessary for additional hemostasis. The HS tonsillectomies were performed using the 10-cm hook-dissecting blade at a setting level of 3. In both groups, adenoidectomies were carried out using the suction cautery set at 30 W.

## RESULTS

A total of 605 patients had evaluable records (320 boys and 285 girls). There were 313 patients in the EC group and 292 in the HS group; 426 patients were 7 years or younger, and 179 were older than 7 years. Of the 426 patients in the younger group, 174 had EC tonsillectomy and 252 had HS tonsillectomy. There were only 40 patients in the older HS group and 139 in the older EC group. The association between age and surgical method was statistically significant (P < .001). Analysis of the grouped data showed an overall average age of 6.3 years. The average age was 7.61 years in the EC group and 4.9 years in the HS group. This age difference was statistically significant (P < .001).

The average patient weight in the HS group was significantly lower than that in the EC group, consistent with the younger group of patients. Obstructive symptoms or adenotonsillar hypertrophy were the most common indications for surgery overall. There was no significant difference in operative time for either method in either age group (Table). In the patients 7 years or younger, the rate of postoperative admission was statistically significant in the HS group compared with the EC group (P < .005), but there was no significant difference in the patients older than 7 years. There were no significant differences among groups for postanesthetic recovery room time, minutes of oxygen therapy required, or pain scale scores.

In evaluating postoperative hemorrhage in the younger group, we found 4 occurrences of bleeding in 174 EC patients and 1 in 252 HS patients; this approached but did not reach statistical significance. In the group of patients older than 7 years, there were 9 occurrences of postoperative bleeding in 139 EC patients and 1 in 40 HS patients; this difference was not significant. When grouped data were analyzed, there was a statistically significant association between method and postoperative hemorrhage (13 occurrences of bleeding in 313 EC patients vs only 2 in 292 HS patients). The overall postoperative hemorrhage rate was consistent with published data at 2.5% (4.1% EC vs <1% HS).[^1][^2]

## COMMENT

The findings in this study support the use of the HS for tonsillectomy, in terms of surgical efficiency, when compared with conventional EC. Although there appears to be a “learning curve” with the initial use of the HS, the operative time required as experience is gained is no different than with EC. Some studies have shown significantly longer operative tonsillectomy times with HS than with EC, but in the present study, there was no significant difference in operative times. The incidence of postoperative hemorrhage was also significantly less in the children 7 years or younger; previous studies have not shown significant differences in postoperative hemorrhage.[^4][^5][^6][^7] The present study was not designed to analyze postoperative pain or recovery times, and we found no difference in the immediate postoperative period pain scale scores.

The obvious limitation of our study is its retrospective nature. The attending physicians’ selection bias for the use of the HS is apparent, with approximately 86% of the HS group being 7 years or younger, and the indication for surgery being adenotonsillar hypertrophy. Stratifying the groups by age allowed for more direct comparison between the 2 methods, since the EC and HS patients 7 years or younger were fairly equivalent. There were significantly more postoperative younger patient admissions in the HS group than in the EC group (85 admissions in the HS group vs 37 in the EC group). Again, this may be owing to selection bias or to basic differences in admission policy per attending physician. The younger, smaller group likely included more children with obstructive sleep apnea, who routinely are admitted for postoperative observation.

### Table. Patient Demographics

<table>
<thead>
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<th>Characteristic</th>
<th>Electrocautery</th>
<th>Harmonic</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Age, mean ± SD, y</td>
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<td>Sex</td>
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<td>156</td>
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<td></td>
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<td>Weight, mean ± SD, kg</td>
<td>34.6 ± 21.4</td>
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<tr>
<td>Indication(s)</td>
<td>Tonsillitis</td>
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<tr>
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<td>ATH or OSA</td>
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<td>Operative time, mean ± SD</td>
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<td>17.1 ± 6.90</td>
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</table>

Abbreviations: ATH, adenotonsillar hypertrophy; OSA, obstructive sleep apnea.

[^1]: The mean differences in age and weight were significant (P < .001), as was the association between method of tonsillectomy and indication (P < .001). The difference in operative time was not significant (P = .25).
[^2]: The obvious limitation of our study is its retrospective nature. The attending physicians’ selection bias for the use of the HS is apparent, with approximately 86% of the HS group being 7 years or younger, and the indication for surgery being adenotonsillar hypertrophy. Stratifying the groups by age allowed for more direct comparison between the 2 methods, since the EC and HS patients 7 years or younger were fairly equivalent. There were significantly more postoperative younger patient admissions in the HS group than in the EC group (85 admissions in the HS group vs 37 in the EC group). Again, this may be owing to selection bias or to basic differences in admission policy per attending physician. The younger, smaller group likely included more children with obstructive sleep apnea, who routinely are admitted for postoperative observation.

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There were 2.4% of EC patients 7 years or younger who had postoperative bleeding compared with the 0.4% of HS patients. This difference approached but did not reach statistical significance ($P=.07$). Most of the postoperative bleeding occurred in the EC group overall (13 occurrences), and this difference was statistically significant when studied as grouped data (15 occurrences of bleeding overall; $P<.001$). It is likely that additional patients with minor bleeding could have been missed, but our review included only those who sought medical attention. The small number of HS patients older than 7 years made it difficult to determine whether there were any real differences in postoperative bleeding in the older children; there have been reports of increased risk of bleeding in older children and teenagers, so this would warrant further study. Previous studies comparing HS to EC tonsillectomy have not shown significant differences in the rate of postoperative hemorrhage. Postoperative bleeding in a small child can rapidly become life-threatening, so a significant reduction of bleeding occurrences in this group could be very important in reducing the overall morbidity of the operation.

In conclusion, previous studies have shown a decrease in postoperative pain with the use of the HS for tonsillectomy. Our study underlines the operative efficiency of the HS dissecting instrument when compared with conventional EC and suggests that the rate of postoperative bleeding is lower. The trend toward decreased posttonsillectomy bleeding warrants further investigation in children older than 7 years.

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REFERENCES