Otolaryngology–Head and Neck Surgery (2006) 134, 852-855

ORIGINAL RESEARCH

Coblation adenotonsillectomy: An improvement over electrocautery technique?

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OBJECTIVES: To compare postoperative complication rates of coblation and electrocautery adenotonsillectomies.

STUDY DESIGN: Retrospective chart review.

RESULTS: From January 2000 to June 2004, 1997 pediatric patients underwent adenotonsillectomy. 745 coblation, and 1252 electrocautery tonsillectomies were performed. Primary bleed, secondary bleed, and dehydration were seen in 3, 35, and 23 coblation, and 9, 41, and 64 electrocautery tonsillectomies, respectively. Data analysis revealed no significant difference in primary and secondary hemorrhage rate, but a higher dehydration rate in the electrocautery group ($P = 0.0423$). A total of 602 coblation, 763 curette/cautery, and 632 electrocautery adenoidectomies were performed. Neck pain was seen in 0, 17, and 3 patients, respectively. Data analysis showed a higher incidence of neck pain with the curette/cautery technique compared with coblator and cautery techniques ($P = 0.0006$ and $P = 0.0119$, respectively).

CONCLUSIONS: Coblation tonsillectomy had similar rates of primary and secondary hemorrhage when compared with electrocautery tonsillectomy but a lower incidence of postoperative dehydration. Coblation adenoidectomy caused less postoperative neck pain than curette/cautery adenoidectomy without significant advantage over cautery adenoidectomy.

EBM rating: B-3b

Adenotonsillectomy continues to be one of the most common procedures performed in the United States with an estimated 259,000 cases performed at an annual cost of approximately $500 million.[1] It is associated with postoperative complications such as hemorrhage, pain leading to decreased oral intake and dehydration, and neck pain. Traditionally, the use of electrocautery and "cold" instruments (scissors, snare, or knife) has been the preferred methods of performing tonsillectomy. Electrocautery lends the advantage of improved hemostasis whereas cold tonsillectomy produces less thermal injury, which is thought to lead to less postoperative pain and dehydration.[2] Newer methods of tonsillectomy now in use include harmonic scalpel dissection, microdebrider-assisted intracapsular tonsillectomy, and coblation. Coblation adenotonsillectomy functions by causing the dissociation of isotonic saline between 2 electrodes into sodium ions that break molecular bonds between tissues. It allows for dissection of the tonsils at temperatures between 60°C and 70°C, much lower than those produced by electrocautery. This is thought to correlate with a decrease in postoperative pain and improved oral intake. Animal studies have demonstrated that coblation is associated with faster wound healing, less extent of inflammation and granulation tissue production, and less tissue injury as compared with electrocautery.[3] To date, no large scale study had compared the rate of postoperative complications of electrocautery and coblation tonsillectomy in pediatric patients.

METHODS

A retrospective chart review of patients who underwent adenotonsillectomy at Children's National Medical Center in Washington, DC, from January 2000 to June 2004, for adenotonsillar hypertrophy or chronic adenotonsillitis was performed. This study was approved by the hospital's institutional review board (IRB No 3453) and a Health Insur-

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0194-5998/$32.00
doi:10.1016/j.otohns.2005.11.005

ance Portability and Accountability (HIPPA) waiver was obtained. Charts were obtained by searching for CPT codes 42820 (adenotonsillectomy age <12) and 42821 (adenotonsillectomy age >12).

Charts were evaluated for age, gender, indications for surgery, underlying medical conditions, surgical technique used, and any postoperative complications. Patients with underlying bleeding disorders, serious medical conditions, or disorders leading to developmental delay that could potentially contribute to postoperative complication were excluded. Comparisons for rate of primary hemorrhage (that occurred during the first 24 postoperative hours), secondary hemorrhage (that occurred after 24 hours), and emergency room (ER) visits for dehydration or poor oral intake, were made for coblation and electrocautery tonsillectomy with Chi-square analysis with Yates correction. Rates of ER visits for neck pain or stiffness that compared coblation, electrocautery, and adenoid curette/cautery adenoidectomy were also compared with Chi-square analysis with Yates correction.

RESULTS

There were 1997 patients, ages 1 to 18 years (mean, 72 months; median, 64 months; range, 12 to 211 months) who underwent adenotonsillectomy. Of these 1997 patients, 1252 had tonsillectomy with electrocautery (age mean, 72 months; median, 64 months; range, 12 to 211 months) and 745 by coblation (age mean, 73 months; median, 64 months; range, 12 to 209 months). Techniques used for adenoidectomy were: 602 coblation (age mean, 71 months; median, 63 months; range, 12 to 209 months); 763 adenoid curette with hemostasis obtained by electrocautery (age mean, 71 months; median, 65 months; range, 12 to 211 months), and 632 electrocautery alone (age mean, 74 months; mean, 65 months; range, 15 to 211 months).

Review of all coblation tonsillectomy patients revealed 3 (0.4%) episodes of primary hemorrhage, 35 (4.7%) episodes of secondary hemorrhage, and 23 (3.1%) ER visits for dehydration. For electrocautery tonsillectomy, 9 (0.7%) episodes of primary hemorrhage were seen, 41 (3.3%) episodes of secondary hemorrhage, and 64 (5.1%) ER visits for dehydration. Chi-square analysis showed no statistical difference in the rate of primary and secondary hemorrhage for the 2 techniques ($P = 0.5587$ and $P = 0.1371$, respectively). Of the 88 patients with postoperative hemorrhage, 30 required operative management (12 coblator and 18 electrocautery). Chi-square analysis showed higher ER visits for dehydration for the electrocautery group ($P = 0.0423$).

Analysis of the complication rates seen in patients who underwent tonsillectomy by surgical techniques and age (<3, ≥ 3 years, respectively) was performed. In patients who underwent coblation tonsillectomy and who were under 3 years of age (n = 104), there were 0 (0%) episodes of primary hemorrhage, 7 (6.7%) of secondary hemorrhage and 6 (5.77%) ER visits for dehydration. Electrocautery tonsillectomy (n = 187) revealed no (0%) episodes primary hemorrhage, 1 (0.5%) episode of secondary hemorrhage, and 10 (5.4%) episodes of dehydration. Chi-square analysis in this age group showed the rate of secondary hemorrhage to be higher with coblation tonsillectomy ($P = 0.00651$) but showed no difference in the rates of primary hemorrhage and dehydration (primary hemorrhage P value not calculable and $P = 0.8798$ for dehydration).

In patients who underwent coblation tonsillectomy who were 3 years or older (n = 641), 3 (0.5%) episodes primary hemorrhage, 28 (4.4%) secondary hemorrhage, and 17 (2.7%) ER visits for dehydration were seen. With electrocautery tonsillectomy (n = 1066), 9 (0.8%) episodes of primary hemorrhage were seen, 40 (3.8%) of secondary hemorrhage, and 54 (5.1%) ER visits for dehydration. Chi-square analysis for this age group showed the frequency of ER visits for dehydration to be significantly higher in the electrocautery tonsillectomy ($P = 0.0218$) but showed no difference in rates of primary or secondary hemorrhage ($P = 0.5472$ and $P = 0.6155$, respectively).

Analysis of the complication rates seen in patients who underwent tonsillectomy by surgical indications (adenotonsillar hypertrophy [ATH] versus chronic tonsillitis [CT] versus both [B]) was then carried out. In the ATH group (n = 1831), 12 (0.7%) episodes of primary hemorrhage, 64 (4.0%) of secondary hemorrhage, and 81 (4.4%) ER visits for dehydration was seen. Chronic tonsillitis group (n = 76) revealed no primary hemorrhage, 4 (5.3%) cases of secondary hemorrhage, and 2 (2.6%) episodes of dehydration. The group with diagnosis of B (n = 90) had no episodes of primary hemorrhage, 8 (8.9%) episodes of secondary hemorrhage, and 4 (4.4%) of episodes dehydration. Chi-square analysis showed no difference in the primary hemorrhage and dehydration rate among the 3 groups. There was also no difference in the secondary hemorrhage rate between the ATH and CT groups ($P = 0.6180$) or CT and B groups ($P = 0.5499$). The only significant difference was seen in the rate of secondary hemorrhage between groups ATH and B ($P = 0.0190$).

Further analysis of the patients by surgical techniques and indications for surgery showed that of the 745 patients who underwent coblation tonsillectomy, there were 686 patients with diagnosis of ATH, 23 with CT, and 36 with B. Patients who underwent coblation tonsillectomy for ATH had 3 (0.4%) episodes of primary hemorrhage, 30 (4.4%) of secondary hemorrhage, and 21 (3.1%) ER visits for dehydration. Patients who underwent coblation tonsillectomy for CT had no (0%) episodes of primary hemorrhage, 1 (4.2%) of secondary hemorrhage, and no (0%) ER visits for dehydration. Patients who underwent coblation tonsillectomy with a diagnosis of B had no (0%) primary hemorrhage, 4 (11%) of secondary hemorrhage, and 2 (5.6%) episodes of dehydration.

In the 1252 patients who underwent electrocautery tonsillectomy, 1145 were for ATH, 53 for CT, and 54 for B.

Those who underwent electrocautery tonsillectomy for ATH had 9 (0.8%) episodes of primary hemorrhage, 34 (3.4%) of secondary hemorrhage, and 60 (5.2) ER visits for dehydration. Patients who underwent electrocautery tonsillectomy for CT had no (0%) episodes of primary hemorrhage, 3 (5.7%) episodes of secondary hemorrhage, and 2 (3.8%) ER visits for dehydration. Patients who underwent electrocautery tonsillectomy for B had no (0%) episodes of primary hemorrhage, 4 (7.4%) episodes of secondary hemorrhage, and 2 (3.7%) episodes of dehydration.

Chi-square analysis was performed to compare complication rates between coblation and electrocautery tonsillectomies for different surgical indications (ATH, CT, B). In the CT and B groups, there were no statistical differences in the rates of primary hemorrhage (P values were not calculable), secondary hemorrhage ($P = 0.8139$ and $P = 0.8206$, respectively) and dehydration rates ($P = 0.8696$ and $P = 0.6762$, respectively) between the 2 techniques. In the ATH group, there were no differences in the rate of primary ($P = 0.5512$) and secondary hemorrhage ($P = 0.1466$); however, a significantly higher rate of dehydration ($P = 0.0378$) was seen in the electrocautery group when compared with the coblation group.

Review of adenoidectomy patients revealed no (0 of 602, 0%) ER visits for neck pain/stiffness made in patients who underwent adenoidectomy by coblation, 17 (17 of 763, 2.2%) in the combined adenoid curette and electrocautery group, and 3 (3 of 632, 0.5%) in the electrocautery alone group. Chi-square analysis showed no significant difference in the occurrence of neck pain/stiffness that necessitated ER visits for the coblation and electrocautery adenoidectomy groups ($P = 0.2652$) but a higher incidence in the curette/cautery adenoidectomy group compared with both coblation ($P = 0.0006$) and electrocautery ($P = 0.0119$). There were no postadenoidectomy bleeds.

DISCUSSION

During the past decades, tonsillectomy has typically been performed by either electrocautery dissection or a "cold" technique. Several studies have compared their postoperative complications and found that electrocautery resulted in decreased perioperative blood loss while typically increasing the intensity and duration of postoperative pain. Nunez et al,[2] in a prospective randomized controlled trial, showed that children who underwent tonsillectomy with electrocautery over the first 12 postsurgical days took 7.5 more doses of analgesics than those undergoing cold dissection or snare (95% CI), took 2.5 more days to return to a normal diet ($P < 0.05$), and more than double the number sought outpatient care for pain, otalgia, poor diet, pyrexia, and/or bleeding (54% to 23%, $P < 0.05$). Electrocautery was associated with half the perioperative blood loss.

Tonsillectomy with harmonic scalpel and microdebrider are now also performed. Willging and Wiatrak,[4] in a prospective study of 117 pediatric patients demonstrated that use of harmonic scalpel may be associated with less postoperative pain when compared to electrocautery. Their study indicated that children sleep more soundly on postoperative days 1, 2, 3, and 14 with lower postoperative pain scores on days 2, 3, and 4 when tonsillectomy was performed with harmonic scalpel without significant differences in both primary and secondary hemorrhage. Shinhar et al[5] compared harmonic scalpel tonsillectomy to both electrocautery and cold dissection in a retrospective study of 316 patients. He reported rates for primary hemorrhage of 1.3%, 2.8%, and 3.0%, respectively, and rates for postoperative dehydration requiring admission of 1.3%, 2.8%, and 3.0%. No report for secondary hemorrhage was given. Sorin et al[6] reviewed the complications of pediatric microdebrider intracapsular tonsillectomy and found that 3.2% presented with tonsil regrowth with return of snoring, and a 0.35 % rate of both primary and secondary hemorrhage (1 bleed on day 1, another on day 5).

Recent studies have focused on comparing coblation tonsillectomy to previous modalities. In comparing rates of hemorrhage, Belloso et al[7] found in a prospective observational cohort study of over 100 children a substantially diminished rate of secondary hemorrhage with coblation tonsillectomy versus cold dissection in pediatric patients (0.95% vs 4.77%, $P < 0.05$) in a study that included over 100 children. This is in contrast to Noon and Harsgreaves[8] who compared the rate of postoperative hemorrhage in adult coblation tonsillectomy versus dissection with bipolar coagulation in 65 patients in a retrospective study. They found a significantly higher percentage of bleeding in the coblation group (22.2% vs 3.4%) and coblation tonsillectomy was subsequently abandoned in their department. In both of these studies the definitions of primary and secondary hemorrhage were similar to ours. To date, no large study had compared the rate of hemorrhage in pediatric coblation and electrocautery tonsillectomy before ours.

Many studies have examined postoperative pain. Philpott et al,[9] in a prospective randomized control trial, studied 92 adult patients, and compared coblation versus cold tonsillectomy. They found no significant difference in postoperative pain, swallowing, otalgia, at 1, 3, 7, and 14 days. In a limited prospective randomized study of 34 pediatric patients, Shah et al[10] indicated no significant difference in morphine consumption, pain, recovery scores, and return to normal diet and activity between electrocautery and coblation. This is in contrast to Stoker et al[11] who in their prospective controlled study found in comparing coblation to electrocautery tonsillectomy that fewer coblation patients contacted the physician regarding postoperative complications (33% vs 54%, $P = 0.081$), experienced nausea (35% vs 62%, $P = 0.013$), discontinued prescription narcotics 1 day earlier (7 days vs 8 days, $P = 0.071$), and took half as many daily doses. Chang,[12] in looking at 100 pediatric patients in a prospective randomized blinded study, found patients who underwent coblation tonsillectomy had less

pain at days 1, 3, and 5 after surgery when compared with electrocautery.

Our study involves the largest number of pediatric patients to date in comparing coblation tonsillectomy to electrocautery. It was performed as a retrospective study and as such was able to look at end measures that included emergency room visits for pain/dehydration, bleeding, and neck pain, without studying intermediate measures such as pain medicine consumption, oral intake, and calls made to physician as this information was not readily available.

Our analysis showed that patients who underwent surgery with coblation were admitted to the ER with complaints of pain or dehydration at a significantly diminished rate, which indicates a decrease in postsurgical pain. When looking at all patients, we found no significant differences in the rates of primary hemorrhage for coblation and electrocautery tonsillectomy groups. Similarly, when the rates of primary hemorrhage were analyzed by age of the patients (<3, ≥ 3 years), no significant differences were seen.

Analysis of all patients showed no significant differences in the rate of secondary hemorrhage for coblation and electrocautery tonsillectomy groups. When the rate of secondary hemorrhage was analyzed by age of the patients (<3, ≥ 3 years), no significant differences were seen in the ≥ 3 year age group. However, in the <3 year age group, an increased incidence of secondary hemorrhage was seen in the coblation tonsillectomy group. This difference should be interpreted with caution because of the small n value (coblation bleed, n = 7; electrocautery bleed, n = 1) and may warrant further study.

When comparing all patients who underwent tonsillectomy for differing indications without taking into account the surgical technique, a higher secondary hemorrhage rate was seen in the patients with a diagnosis of both CT and ATH as compared with ATH alone. This elevated rate of secondary hemorrhage was not seen in patients with a diagnosis of CT when compared with either ATH or B. With respect to the complication rates between coblation and electrocautery tonsillectomies for different surgical indications (ATH, CT, B), a higher rate of dehydration was seen with the electrocautery technique when compared with the coblation technique in the ATH group. These two positive findings should be interpreted with caution due to the disparate n values among the 3 indication groups.

Neck pain and stiffness are known complications of adenoidectomy and reported to occur in up to 10% of cases typically usually during the fourth to seventh postoperative day.[13] Pain is typically thought to be caused by cervical muscle spasm but may include cervical adenitis and abscess.[14] To date, no study has compared the rate of neck pain when performed by different techniques. We found a significantly higher incidence of neck pain/stiffness in patients who had undergone adenoidectomy by curette followed by electrocautery hemostasis. Presumably, this is because the curette adenoidectomy technique violates a deeper tissue plane when compared with the other techniques and requires additional cauterization of the exposed muscle. This complication was not seen with coblation adenoidectomy and very rarely with electrocautery adenoidectomy alone. It should be noted that none of our patients were diagnosed with Grisel's syndrome.

CONCLUSION

Coblation tonsillectomy had similar rates of postoperative primary and secondary hemorrhage when compared with the electrocautery technique in children over 3 years, but it had a significantly lower incidence of postoperative dehydration. Coblation tonsillectomy may be associated with a higher rate of secondary hemorrhage in children less than 3 years of age. Coblation adenoidectomy caused less postoperative neck pain than curette/cautery adenoidectomy but did not show significant advantage over cautery adenoidectomy. Coblation adenotonsillectomy may offer less postsurgical morbidity when compared with electrocautery adenotonsillectomy.

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