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Cold Dissection Versus Coblation-Assisted Adenotonsillectomy in Children

Nina L. Shapiro, MD; Neil Bhattacharyya, MD

Objective: **To compare intraoperative efficiency and postoperative recovery between cold dissection adenotonsillectomy (CDA) and coblation-assisted adenotonsillectomy (CAA).** ***Methods:*** **A prospective, randomized, single-blind trial of pediatric patients aged 2 to 16 years undergoing adenotonsillectomy was conducted. Patients were randomized to undergo either CDA or CAA. Measured intraoperative parameters included surgical duration and intraoperative blood loss. Measured postoperative parameters included a 14 day caregiver questionnaire that recorded a daily pain rating using the Wong-Baker FACES pain scale, pain medication use, days to return to a normal diet, and days to return to a normal caregiver routine. Postoperative complications were also recorded. Intraoperative and postoperative measures were statistically compared between groups.** ***Results:*** **Forty-six children with a mean age of 6.7 years (23 CDA and 23 CAA) were randomized and completed the study. Mean age and sex distributions were similar between groups ($P > .05$). Surgical times were significantly shorter for the CAA group versus the CDA group (11.2 min vs. 17.0 min, $P < .001$). Intraoperative blood loss was statistically lower for both the adenoidectomy and tonsillectomy portions of the procedure for the CAA group versus the CDA group ($P < .001$ and $P < .001$, respectively). There was no statistically significant difference in reported daily pain scores between groups ($P = .296$, analysis of variance). Both groups returned to normal diet ($P = .982$), and caregivers returned to their normal routine on similar postoperative days ($P = .631$).** ***Conclusions:*** **CAA offers better operative speed and intraoperative hemostasis as compared with CDA. However, CAA does not result in poorer postoperative pain scores or recoveries despite these intraoperative advantages.** ***Key Words:*** **Adenotonsillectomy; pediatric; coblation; cold dissection.**

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INTRODUCTION

Adenotonsillectomy is one of the most common surgical procedures in the United States.[1] Despite its frequency and history, investigators continue to seek improvement in many factors relating to the performance of and postoperative recovery from adenotonsillectomy. Features characteristic of an ideal technique for adenotonsillectomy would include ease of performance including speed and intraoperative hemostasis as well as minimization of postoperative pain and bleeding complications. Needless to say, debate continues as to which technique yields the best outcome. Many methods for adenotonsillectomy have been explored, but the two most common methods for adenotonsillectomy have been electrocautery (electrosurgery) and cold dissection. Cold dissection adenotonsillectomy (CDA) potentially minimizes morbidities associated with thermal injury. However, hemostasis after dissection is usually obtained with either monopolar or bipolar cautery, which create varying degrees of thermal injury to the surrounding tissue, which in turn may lead to increased postoperative pain. Electrocautery adenotonsillectomy typically affords greater operative speed and less operative blood loss but may increase patients' reported postoperative pain and risk of postoperative hemorrhage.

More recently, several additional methods of adenotonsillectomy have been explored, largely related to advances in surgical instrumentation and equipment. These newer techniques include laser-assisted, harmonic scalpel, microdebrider, and coblation-assisted adenotonsillectomy (CAA). Many of these new technologies seek to provide operative speed and hemostasis without the thermal injury to the surrounding tissues imparted by cautery techniques. Coblation technology has recently surfaced as a potentially appealing technology for adenotonsillectomy. Operating at much lower surface temperatures (40–70°C) than electrocautery, it provides both ablation and dissection of tissue as well as hemostasis. Recent studies have compared coblation tonsillectomy with both electrocautery and ultrasonic scalpel technique.[2–5] In contrast, to our knowledge, no study has compared

From the Division of Head and Neck Surgery (N.L.S.), David Geffen UCLA School of Medicine, Los Angeles, California, U.S.A.; and the Department of Otology and Laryngology (N.B.), Division of Otolaryngology, Brigham and Women's Hospital, Boston, Harvard Medical School, Boston, Massachusetts, U.S.A.

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Send correspondence to Dr. Nina L. Shapiro, 62-158 CHS, 10833 LeConte Ave, Los Angeles, CA 90095. E-mail: nshapiro@ucla.edu

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coblation adenotonsillectomy with cold technique. We report a prospective, randomized, single-blind, single-surgeon study comparing the intraoperative and postoperative courses of children undergoing CDA and CAA.

METHODS

This study protocol was approved by the UCLA Institutional Review Board before subject recruitment. Children ages 2 to 16 years undergoing outpatient adenotonsillectomy were offered participation in this prospective trial. Patients with significant comorbidities such as systemic disease, known bleeding diathesis, craniofacial disorders, chromosomal abnormalities, or motor/developmental delays were excluded. Informed consent from the parent (and informed assent for children >7 yr old) regarding randomization of technique and agreement to complete a 14 day daily caregiver questionnaire form regarding the child's recovery were obtained. Patients and families were blinded as to technique. Randomization occurred when the surgeon opened a preprinted, sealed, randomized envelope, revealing the technique to be used for each consecutive study patient. Recovery room staff was also blinded to the surgical technique used for each study patient.

The coblation-assisted tonsillectomy was performed with the EVAC T&A (ArthroCare ENT, Sunnyvale, CA) handpiece using subcapsular dissection along the tonsillar pillar mucosa, leaving muscle intact. Dissection was carried out on the coblate 7 setting, and hemostasis was obtained on the coagulate 3 setting. CAA was performed using the coblate 9 setting to ablate the adenoid pad and the coagulate 3 setting for hemostasis.

Cold-dissection tonsillectomy was performed using curved Metzenbaum scissors to enter the peritonsillar space, blunt dissection to remove the tonsil from superior to inferior, and a wire snare to divide the inferior pole. Hemostasis was obtained with a bipolar cautery at a setting of 30. CDA was performed with an adenoid curette, and hemostasis was achieved with a suction Bovie cautery at a setting of 35. Anesthesia and recovery room techniques were standardized for all patients.

Measured operative data included duration of the tonsillectomy portion, duration of the adenoidectomy portion, and duration of the entire surgery for each technique as well as total operating room time, intraoperative blood loss, and amount of time in the recovery room before discharge. Postoperative data were obtained from a 14 day diary completed daily by a parent or caregiver. Instructions were given to have the same parent or caregiver fill out the diary entry at the same time each day. Postoperative outcome measures included postoperative pain, as assessed using the Wong-Baker FACES pain scale and daily use of narcotic and non-narcotic analgesia. The Wong-Baker FACES pain scale is a reliable, valid pain assessment tool for children ages 3 to 18 years. It is based on the child pointing to one of five drawn faces with the facial expression that best describes their pain, ranging from "happy, smiling" (equivalent to a score of 0, or no pain) to frowning with tears (equivalent to a score of 5, or worst pain ever).[6] Additional measures included number of days until the patient was able to eat solid food, number of days until his/her return to normal preoperative diet, number of days until his/her return to normal activities, and number of days until the child's caregiver returned to his/her normal routines. Any postoperative complications, including phone calls or visits to physicians, dehydration, or bleeding, were recorded.

Demographic characteristics for the two groups were compared using Student's t test and chi-square test, as appropriate. Intraoperative data for surgery duration, intraoperative blood loss for adenoidectomy, and intraoperative blood loss for tonsillectomy were compared between groups using Student's t test. Mean pain scores were computed for each reported postoperative day for each group and compared using a repeated-measures analysis of variance (ANOVA) model. Power analysis was conducted to determine the equivalency of pain scores between CDA and CAA at postoperative day 3 and postoperative day 5, assuming that a difference of 1.0 in mean pain scores (i.e., 1 unit on the Wong-Baker FACES pain scale) was clinically significant with alpha set at .05. Finally, number of days required for return to a normal diet, cessation of narcotic pain medication use, and days required for the caregiver to return to a normal routine were compared using the Mann-Whitney U test. Statistical significance was set at $P < .05$, two tailed.

RESULTS

Forty-seven children were enrolled in the study over a 12-month period. Twenty-four underwent CAA, and 23 underwent CDA. One patient in the CAA group had incomplete postoperative data and was subsequently excluded, leaving 23 patients in each group. Mean age for the entire cohort was 6.7 (range, 2–16) years. Mean age for CAA patients was 7.39 years, and mean age for CDA patients was 6.1 years ($P = .236$). There were 28 males (13 CAA and 15 CDA) and 18 females (10 CAA and 8 CDA, $P = .763$). Mean tonsillectomy time, including completion of hemostasis, was 7.8 (95% CI, ±1.1) minutes in the CDA group versus 5.0 (±0.97) minutes in the CAA group ($P < .001$). Mean adenoidectomy time, including achieving complete hemostasis, was 4.1 (±0.5) minutes in the CDA group and 2.6 (±0.6) minutes in the CAA group ($P = .001$). Total adenotonsillectomy time was 17.0 (±1.3) minutes for the CDA group and 11.2 (±1.2) minutes in the CAA group ($P < .001$). Figures 1 and 2 display the intraoperative blood loss for the tonsillectomy portion and adenoidectomy portion of the procedure according to surgical method. Intraoperative blood loss was statistically significantly higher in the CDA than the CAA patients for both adenoidectomy and tonsillectomy portions ($P < .001$ and $P < .001$, Kendall's tau statistic, respectively).

Figure 3 depicts postoperative pain scores for each surgical group. There was no statistically significant difference identified between groups in daily pain scores ($P = .296$, repeated-measures ANOVA), although CDA patients did tend report slightly lower pain scores in the middle of the first postoperative week. For the sample size study, power analysis revealed that our study exhibited a power of 0.56 to show that the mean pain score for CAA was at least as low as the mean pain score for CDA at postoperative

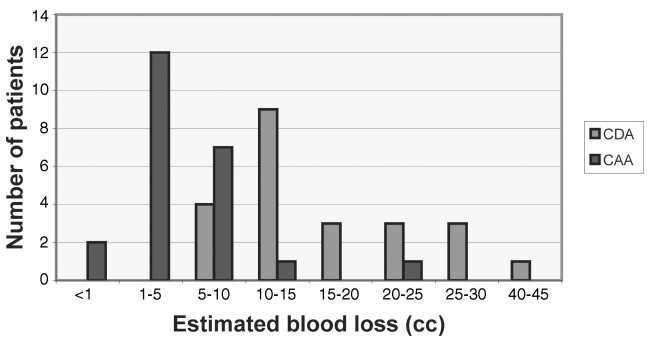

Fig. 1. Blood loss for tonsillectomy: Cold dissection adenotonsillectomy versus coblation-assisted adenotonsillectomy.

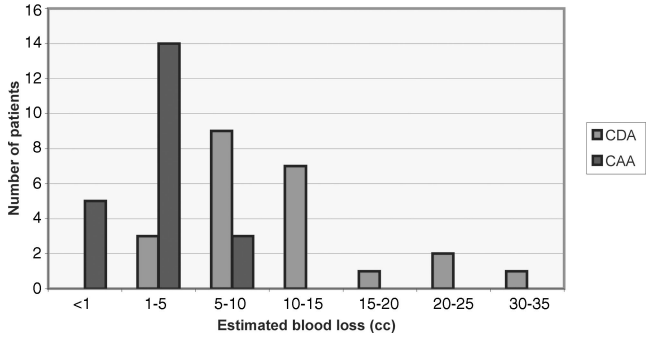

Fig. 2. Blood loss for adenoidectomy: Cold dissection adenotonsillectomy versus coblation-assisted adenotonsillectomy.

day 3. The same was true for postoperative day 5. Figure 4 depicts postoperative narcotic pain medication use in terms of daily dosing for patients in each group. There was no statistically significant difference identified between groups according to narcotic pain medication dosing (P = .910, repeated-measures ANOVA). Patients in the CDA group returned to a normal diet on average at the third postoperative day, whereas patients in the CAA group returned to normal diet on average at the fourth postoperative day; this difference was not statistically significant (P = .982, Mann-Whitney U test). Furthermore, caregivers for the CDA patients typically reported a return to their normal routine in the first postoperative day, whereas caregivers for patients in the CAA group reported a return to their normal routine between the second and third postoperative day (P = .631). There were no unscheduled telephone calls, physician office visits, or dehydration admissions recorded for either group. There was one postoperative hemorrhage in a CAA patient on postoperative day 6. This patient was treated with operative control of the bleeding, without blood transfusion.

DISCUSSION

Tonsillectomy and adenoidectomy have proven to be effective surgical treatment options for disorders associated with adenotonsillar hypertrophy. Traditional cold dissection tonsillectomy using sharp dissection with snare, followed by adenoidectomy with sharp curette or adenotome, has yielded excellent results and was the standard technique for adenotonsillectomy until the late 20th century. Once introduced, electrocautery (electrosurgical) dissection was widely espoused because it allowed the surgeon to concomitantly achieve dissection and hemostasis. Several investigators have explored alternative methods with novel surgical instrumentation and techniques to maintain intraoperative surgical advantages without sacrificing the patients' postoperative recovery. Some of these newer techniques include harmonic scalpel dissection, laser-assisted dissection, and the technique under current study, CAA.

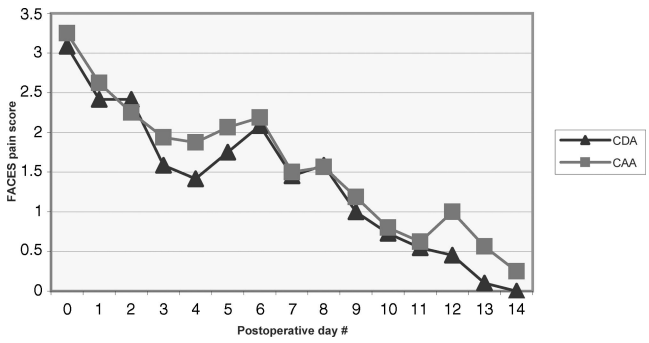

Fig. 3. Postoperative pain scores after adenotonsillectomy.

Coblation instrumentation uses bipolar radiofrequency waves transmitted by a conductive solution (i.e., isotonic saline) between the device and the target tissue to ablate the target tissue. The transmitted energy converts the conductive medium into an ionized particle field, which contains sufficient energy to break molecular bonds within the target tissue. Surface temperatures range from 40 to 70°C, and the ablation effect is primarily localized to the contact area, thereby theoretically resulting in less adjacent tissue damage. In the head and neck, coblation technology has been used to perform adenotonsillectomy, inferior turbinate reduction, and soft tissue volume reduction for obstructive sleep apnea.[2–5,7–9]

In 2004, Stoker et al.[2] performed a prospective, controlled, single-blind study comparing coblation with electrocautery adenotonsillectomy in children. The investigators found no difference in postoperative return to diet, normal activity levels, absence of pain, or use of nonnarcotic pain medications between these two methods. However, coblation patients stopped narcotic pain medication sooner than electrocautery patients, with a trend toward significance (P = .07). There was one postoperative hemorrhage in each treatment group. Chang[3] performed a randomized, prospective, double-blind study comparing children undergoing coblation tonsillectomy with children undergoing electrocautery tonsillectomy. Postoperative pain scores, using the Wong-Baker FACES pain scale, were found to be better on each postoperative day from days 1 through 6 in the coblation patients ($P < .005$). Similarly, coblation patients also resumed normal diet sooner than the electrocautery patients ($P < .005$) and resumed normal activities sooner as well by postoperative day 5 ($P < .005$).

Coblation adenotonsillectomy has also been compared with techniques other than monopolar electrocautery. Parsons et al.[5] compared coblation with both electrocautery and ultrasonic scalpel in a prospective, three-armed randomized trial of tonsillectomy patients. Postoperative pain scores were better for coblation versus electrocautery (P = .02) and for coblation versus ultrasonic harmonic scalpel (P = .003), and coblation patients demonstrated a trend toward earlier return to normal diet than the other techniques (P = .08). There was no significant difference in postoperative pain between the cautery and ultrasonic scalpel patients. Temple and Timms[10] compared coblation tonsillectomy with bipolar electrocautery tonsillectomy in a prospective, randomized study. Postoperative pain scores were rated using the Wong-Baker FACES pain during 9 days postoperatively. The mean pain score for each day was significantly lower in the coblation patients than in the bipolar cautery patients ($P < .0001$). Return to normal diet was also earlier for the coblation patients versus the bipolar cautery patients ($P < .0001$).

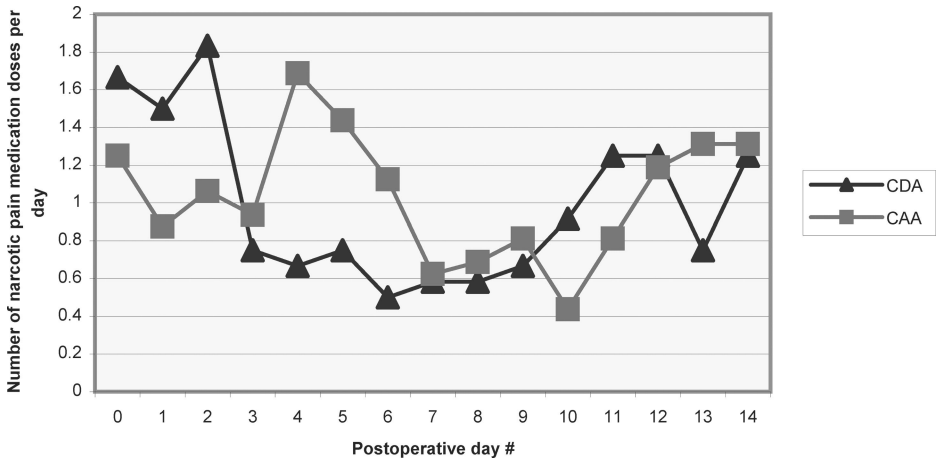

Fig. 4. Postoperative narcotic pain medication use after adenotonsillectomy.

Although there is strong evidence and literature indicating that CAA improves postoperative recovery as compared with other electrosurgical techniques, no study has reported on differences in postoperative recovery between CAA and cold dissection techniques. If CAA patients experience postoperative pain score similar to CDA while maintaining the intraoperative efficiency and hemostasis provided by coblation technology, this may then suggest that coblation offers a more favorable balance between intraoperative advantages and postoperative recovery outcomes and adenotonsillectomy.

We found that CAA offered significant intraoperative advantages over CDA. In particular, CAA offered significantly faster operative times in the performance of adenotonsillectomy. In addition, despite this increase in speed, intraoperative blood loss was also statistically significantly lower with CAA than with cold dissection technique. Thus, similar to electrosurgical techniques, CAA enhances operator control and surgical efficiency with adenotonsillectomy. Although it could be argued that a 6 minute difference is not clinically significant for surgical time, for those surgeons who perform multiple adenotonsillectomy procedures, this could potentially allow for one to three more surgeries in a day's operative schedule. The majority of CAA patients had intraoperative blood loss of less than 10 mL, and the majority of CDA patients had an intraoperative blood loss of more than 10 mL. Although it could be argued that the clinical significance of this difference is negligible (the majority of CDA patients had an intraoperative blood loss of <30 mL), offering a nearly "bloodless" surgery, without significantly increased risk of postoperative hemorrhage, is oftentimes appealing to parents whose children are undergoing surgery.

On the other side of the equation, in examining postoperative recovery, we found that CAA afforded patients a similar postoperative recovery in terms of pain scores as can be expected with conventional cold dissection technique. Similarly, both CAA and CDA patients returned to normal diet and normal routine for the caregiver at similar intervals postoperatively. One possible explanation for this is that thermal injury and localized tissue trauma may in fact be minimized by coblation technology during adenotonsillectomy, accounting for similar postoperative outcomes between CDA and CAA techniques. Because patients were blinded to surgical technique and self-reported their pain scores, this assertion is meaningful. Although the sample size was somewhat limited, postoperative complications appeared similar between the two groups. Several prior studies have examined issues of postoperative hemorrhage with coblation versus other adenotonsillectomy techniques. In general, the literature reports a delayed postoperative hemorrhage rate for coblation tonsillectomy (range, 0.95–5.4%), which is at or below levels reported for cold dissection techniques.[11,12]

A notable limitation of this study was the small sample size. In consideration of the small sample size, our study was hampered by a limited power to demonstrate equivalency between pain scores between CAA and CDA. Although data were neither reviewed nor analyzed until study completion, patient recruitment was constrained because of a strong bias of parental requests for CAA, limiting randomization. In this millennium, health care recipients have become increasingly aware of data available on the internet and in the lay press. New technologies are frequently presented as a lure for a "better" method, even before definitive data are available. Although prior data regarding CAA has been favorable, there had, to date, been no data comparing CAA with CDA. Nonetheless, patients were eager to choose CAA, thus significantly limiting the ultimate number of patients in this cohort.

CONCLUSIONS

Compared with CDA, CAA offers a significant reduction in surgical time and blood loss, with similar recovery results as measured by return to diet, return to activity, and postoperative pain scores. Thus, CAA offers a more efficient intraoperative adenotonsillectomy without compromising patients' postoperative recoveries. Further study of CAA with respect to cost analysis and larger scale comparisons with other tonsillectomy methods is warranted.

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BIBLIOGRAPHY

1. *Vital and Health Statistics: Ambulatory and Inpatient Procedures in the United States, 1996*, Series 13, No. 139. Hyattsville, MD: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics, November 1998.
2. Stoker KE, Don DM, Kang DR, et al. Pediatric total tonsillectomy using coblation compared to conventional electrosurgery: a prospective, controlled, single-blind study. *Otolaryngol Head Neck Surg* 2004;130:666–675.
3. Chang KW. Randomized controlled trial of coblation versus electrocautery tonsillectomy. *Otolaryngol Head Neck Surg* 2005;132:273–280.
4. Chan KH, Friedman NR, Allen GC, et al. Randomized, controlled, multisite study of intracapsular tonsillectomy using low-temperature plasma excision. *Arch Otolaryngol Head Neck Surg* 2004;130:1303–1307.
5. Parsons SP, Cordes SR, Comer B. Comparison of posttonsillectomy pain using the ultrasonic scalpel, coblator, and electrocautery. *Otolaryngol Head Neck Surg* 2006;134:106–113.
6. Wong D, Baker C. Pain in children: comparison of assessment scales. Pediatr Nurs 1988;14:9–17.
7. Bhattacharyya N, Kepnes LJ. Clinical effectiveness of coblation inferior turbinate reduction. *Otolaryngol Head Neck Surg* 2003;129:365–371.
8. Maturo SC, Mair EA. Submucosal minimally invasive lingual excision: an effective, novel surgery for pediatric tongue base reduction. *Ann Otol Rhinol Laryngol* 2006;115:624–630.
9. Belloso A, Morar P, Tahery J, et al. Randomized-controlled study comparing post-operative pain between coblation palatoplasty and laser palatoplasty. *Clin Otolaryngol* 2006;31:138–143.
10. Temple RH, Timms MS. Paediatric coblation tonsillectomy. *Int J Pediatr Otorhinolaryngol* 2001;61:195–198.
11. Divi V, Benninger M. Postoperative tonsillectomy bleed: coblation versus noncoblation. *Laryngoscope* 2005;115:31–33.
12. Belloso A, Chidambaram A, Morar P, Timms MS. Coblation tonsillectomy versus dissection tonsillectomy: postoperative hemorrhage. *Laryngoscope* 2003;113:2010–2013.