The effects of an antistick phospholipid solution on pediatric electrocautery adenoidectomy

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Abstract

We conducted a study to determine if coating a suction cautery tip with an antistick phospholipid solution would decrease the amount of time required to complete primary pediatric adenoidectomies. The aim of the study was focused on two main criteria: the amount of surgical time required to complete each procedure and the number of times an operation had to be interrupted because the suction cautery tip needed to be cleaned (each interruption was called a "handback"). We obtained data prospectively during 61 pediatric adenoidectomies performed at our institution from February through June 2009. These patients were randomized to undergo surgery either with (n = 31) or without (n = 30) the use of the antistick phospholipid solution (Electro Lube; Mectra Labs; Bloomfield, Ind.). The overall mean amount of time needed to complete an adenoidectomy was 6 minutes and 39 seconds (6:39); use of the antistick solution shortened the amount of surgical time by 1:45—a decrease of 23.2% (p = 0.0360). Likewise, surgeries performed with Electro Lube required an average of 3.0 fewer handbacks for cleaning during the operation (p < 0.0001). The benefits of the antistick solution were even more pronounced in patients with larger adenoids than in those with smaller adenoids.

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Introduction

Since it was first described nearly 2,000 years ago, adenoidectomy has become one of the most common pediatric surgical procedures. Over the past 20 to 30 years, newer techniques and instrumentation have largely replaced traditional cold adenoid dissection performed with curettes and adenotomes. Several electrosurgical options are available for removing adenoid tissue, including suction electrocautery, microdebriders, lasers, and Coblation.[1,2]

Suction electrocautery was introduced during the 1980s largely to control bleeding after curettage. This procedure quickly gained popularity because of its precision and its ability to control bleeding. Eventually, entire adenoidectomies were completed with electrocautery alone.[1,3] A 2007 survey of pediatric otolaryngologists found that monopolar electrocautery alone was the most common procedure used for adenoidectomy; electrocautery was used to some extent by 70% of the surveyed surgeons.[2] The findings of a recent meta-analysis confirmed that electrocautery adenoidectomy has significant advantages over cold techniques in terms of reducing blood loss, as well as in shortening surgical times.[4]

Electro Lube (Mectra Labs; Bloomfield, Ind.) is an antistick solution designed to prevent sticking and char buildup during electrocautery surgery. It is a lecithin-based phospholipid mixture derived from soybean oil; it is nonsynthetic, nonflammable, and nonallergenic. It has been approved by the Food and Drug Administration and is used mainly during robotic surgery, as well as with some urology, gynecology, neurosurgery, and general surgery instruments.[5-7] To date, there have been no reports of Electro Lube being used with suction electrocautery in adenoidectomy.

We conducted a study to determine if coating a suction cautery tip with this antistick phospholipid solution would shorten the amount of time required to complete a primary pediatric adenoidectomy. A secondary objective was to evaluate the effects of this solution on changes in cautery temperature and the depth of cauterization. While neither higher cautery settings nor the amount of cautery time is associated with an increase in postoperative adenoidectomy complications,[8] we felt it necessary to evaluate temperature and cauterization depth outcomes because an increase in either of these measures could theoretically influence the length of surgery.

Patients and methods

For this prospective study, we collected data on consecutively presenting pediatric patients who were undergoing adenoidectomy for any indication at West Virginia University Hospitals from February through June 2009. All patients between the ages of 1 and 12 years were considered for study inclusion. In addition to demographic data, we collected information on each patient's weight and indication for surgery. Exclusion criteria included a previous adenoidectomy, the presence of a cleft palate, or the discovery of a small adenoid pad during surgery. Institutional Review Board approval was obtained.

On the day of surgery, each patient was randomized to undergo adenoidectomy either with or without the use of Electro Lube. Randomization into each group was sequential in that placement alternated with the presentation of each new patient. The two groups were further subdivided on the basis of adenoid size. Prior to each procedure, adenoid size was measured and classified into four groups based on the estimated degree of posterior choanal obstruction caused by the adenoid tissue (<25%, 25 to 49%, 50 to 75%, and >75%). Patients with an obstruction of less than 25% were excluded from the study. The remaining adenoids were classified as either *smaller* (25 to 49%) or *larger* (≥50%).

A standard adenoidectomy was performed with the suction electrocautery set at 35 W. Setup and exposure were consistent for each procedure. When adenoidectomy was combined with tonsillectomy, the adenoidectomy was performed first. A single surgeon performed all of the procedures. When Electro Lube was used, the tip of the suction cautery handpiece was submerged in a sterile bottle of the solution, and the entire tip was coated. Additional applications were added as needed throughout the procedure.

Final results were based on two main criteria: the amount of surgical time required for each operation and the number of times an operation had to be interrupted because the suction cautery tip needed to be cleaned (each interruption was called a "handback"). Surgical time was measured from the moment before the first cut until the adenoid pad was flat, the choanae were 100% patent, and hemostasis was achieved; the amount of time required for setup and anesthesia emergence was not included. Handbacks were counted each time the suction cautery device was given to the surgical assistant for cleaning. Cleaning was deemed necessary when the tip became clogged and visualization of the surgical field was hindered by fog and smoke accumulation within the nasopharynx.

Differences between the two groups were determined by *t* tests for the amount of surgical time and the number of handbacks. Multivariate analysis was performed with analysis of variance (ANOVA) to determine the differences in surgical time between the two groups. Multivariate analysis was also used in comparing age, weight, adenoid size, the number of handbacks, and the use or nonuse of Electro Lube.

To determine the effects of the phospholipid solution on temperature and cauterization depth, bovine kidneys were used as a tissue medium. A calibrated meat thermometer (model 806E4L; Taylor Precision Products; Oak Brook, Ill.) was inserted into the tissue 1 cm directly below the area of planned cauterization. A 2-cm^2 area was cauterized with a suction coagulator (model E2505-10FR; Valleylab; Boulder, Colo.) set at 35 W for a total of 6 minutes. The choice of a 2-cm^2 area was based on reported adenoid tissue volumes.[9-11] Temperatures were recorded at 0 seconds, 3 minutes, and 6 minutes. The tissue was then sectioned, and the depth of coagulation char was measured.

This entire procedure was performed three times with the Electro Lube added to the suction electrocautery tip and three times without. Additionally, we cauterized renal tissue both with and without the solution for 30 and 60 seconds without moving the cautery tip, and we photographically documented the differences (figure).

Results

A total of 61 patients—37 boys and 24 girls, aged 14 months to 11 years (mean: 4.4 yr)—met the criteria for study inclusion (table 1). There were 31 patients in the Electro Lube group and 30 in the control group. The most common indications for surgery were airway obstruction (n = 18; 29.5%) and adenotonsillitis (n = 15; 24.6%); other indications included otitis media and otitis media with rhinosinusitis (n = 9; 14.8% each), airway obstruction with otitis media (n = 6; 9.8%), and rhinosinusitis alone (n = 4; 6.6%). Adenoidectomy was

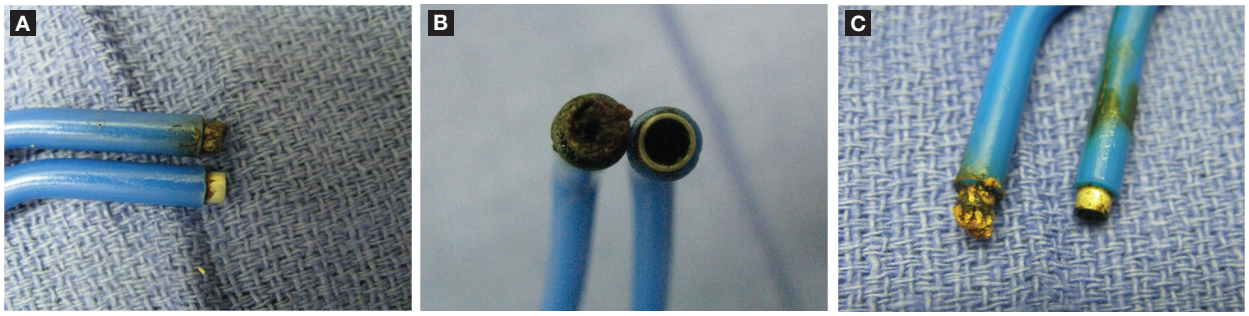

Figure. ***A:*** *Photo shows two suction cautery tips after 30 seconds of cauterizing bovine renal tissue. The instrument on the bottom is coated with Electro Lube.* ***B:*** *Another photo shows two other tips after 30 seconds. The coated tip is on the right.* ***C:*** *Tips are seen after 60 seconds of cauterizing. The coated instrument is on the right.*

combined with tonsillectomy in 30 cases (49.2%), with tympanostomy tube placement in 17 cases (27.9%), and with both tonsillectomy and tube placement in 9 cases (14.8%); the remaining 5 cases (8.2%) involved adenoidectomy alone.

Statistically significant differences were found between the two groups with respect to both the amount of surgical time and the number of handbacks.

Surgical time. Overall, the average amount of time required to complete an adenoidectomy was 6 minutes and 39 seconds (6:39) (table 1). Mean operating time was significantly shorter in the Electro Lube group than in the control group—5:47 vs. 7:32, respectively, a difference of 23.2% ($p = 0.0360$) (table 2). When controlled for adenoid size, surgical time remained shorter in the antistick group for both smaller ($p = 0.0011$) and larger ($p = 0.0426$) adenoids.

Handbacks. Overall, the number of handbacks per operation ranged from 0 to 11 (mean: 1.9) (table 1). The average number of handbacks was 0.4 in the Electro Lube group and 3.4 in the control group ($p < 0.0001$) (table 2). Again, when adenoid size was taken into account, the significant differences between the two groups in favor of the antistick solution persisted; patients with smaller adenoids required an average of 2.0 fewer handbacks per operation, and those with larger adenoids required 3.9 fewer handbacks ($p = 0.0006$ and $p < 0.0001$, respectively).

Other variables. For multivariate analysis, we considered the effects of age, weight, adenoid size, the number of handbacks, and Electro Lube status on the amount of surgical time. Those variables that were associated with a decrease in operating time were adenoid size ($p = 0.0005$), handbacks ($p < 0.0001$), and the use of Electro Lube ($p = 0.0010$); age and weight had no bearing on the amount of surgical time.

Table 1. Summary of patient characteristics (N = 61)

Variable	Value
Sex distribution (ratio)	37 boys, 24 girls (3:2)
Age	14 mo to 11 yr (mean: 4.4 yr)
Weight	9.4 to 50.2 kg (mean: 20.1)
Surgical time (min:sec)	3:04 to 19:20 (mean: 6:39)
No. handbacks	0 to 11 (mean: 1.9)

Although our study design precluded a detailed statistical analysis of temperature changes and cauterization depth in the surgical bed, it appears that the addition of the antistick solution to the tip of the suction cautery handpiece had no effect on either. The average temperature at 1 cm of depth after 6 minutes of cauterization was 45.3°C with Electro Lube and 47.3°C without it. The amount of temperature change from 0 to 6 minutes was 22.0°C in the Electro Lube group and 23.6°C in the control group. The maximum depth of coagulation char was 7 mm below the surface in all specimens.

Discussion

The number of pediatric adenoidectomies performed annually in the United States alone reaches levels in the hundreds of thousands.[12] Advancements in adenoidectomy technique and instrumentation continue, providing multiple options for individual surgeons. Yet despite these advancements, suction electrocautery remains a useful tool for most surgeons.[2]

A commonly encountered problem in our experience is the tendency of adenoid tissue to stick to the tip of the suction electrocautery handpiece. This obstructs the suction mechanism, which leads to smoke accumulation and decreased visualization of the operative field. This obstacle can be overcome by cleaning the instrument until the lumen is patent and suction returns. Cleaning often becomes necessary several times during a single procedure, causing significant delay in finishing the operation. This problem seems to be exaggerated in patients with bulkier adenoids.

The results of our study confirmed our anecdotal experience that coating the suction cautery tip with the antistick solution decreases how often the instrument requires cleaning. We hypothesized that the shorter amount of operative time seen in the Electro Lube group was the direct result of the reduction in time spent cleaning the instrument.

We considered it possible that the antistick solution also increased the level of heat conduction from the cautery tip, thereby dissipating adenoid tissue more rapidly. However, our soft-tissue experiments with bovine kidney failed to demonstrate that Electro Lube had any effect on temperature or cautery depth. Therefore, the decrease in surgical time was almost certainly attributable to fewer interruptions for cleaning.

As expected, larger adenoids were associated with longer surgical times and more handbacks in this series. Electro Lube appeared to convey a greater benefit in patients with larger adenoids than in those with smaller adenoids. Patients with larger adenoids experienced a greater decrease in surgical time with use of the antistick solution than did the patients with smaller adenoids—2:27 and 1:46, respectively. Likewise, the Electro Lube patients with larger adenoids required an average of 3.9 fewer handbacks than the controls, compared with 2.0 fewer among the patients with smaller adenoids.

Although the differences in surgical times and the number of handbacks reached statistical significance in our series, we acknowledge that our sample size was relatively small and might not have been representative of the entire pediatric population undergoing adenoidectomy. Also, while we randomized patients in a sequential manner, we recognize that this method is not completely random. Finally, because our study was not blinded, it was subject to individual bias; the fact that a single surgeon completed all of the procedures might have contributed to further individual bias. On the other hand, the use of a single surgeon conferred a good level of consistency in surgical technique and assessment of adenoid size, a consistency that would be difficult to replicate in a multiple-surgeon study.

We have not identified any adverse effects of using Electro Lube during electrocautery adenoidectomy.

Table 2. Comparison of the amount of surgical time and the number of handbacks according to Electro Lube status and adenoid size

	Electro Lube group	Control group	Difference	*p* Value
Time (min:sec)				
All	5:47 (n = 31)	7:32 (n = 30)	1:45	0.0360
Smaller adenoids	3:56 (n = 10)	5:43 (n = 14)	1:47	0.0011
Larger adenoids	6:41 (n = 21)	9:08 (n = 16)	2:27	0.0426
Mean no. handbacks				
All	0.4 (n = 31)	3.4 (n = 30)	3.0	<0.0001
Smaller adenoids	0.2 (n = 10)	2.2 (n = 14)	2.0	0.0006
Larger adenoids	0.5 (n = 21)	4.4 (n = 16)	3.9	<0.0001

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