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Surgical Techniques

Time of Postoperative Discharge Following Inpatient Tonsillectomy: A Comparison of Two Techniques

Abstract

There are many types of surgical instrumentation and techniques used to perform adenotonsillectomy. The choice of instrument depends on several factors and the benefits of clinical outcomes must outweigh the costs of newer technologies. Our study seeks to compare the discharge times following inpatient adenotonsillectomy using monopolar electrocautery vs. radiofrequency ablation. Participants included thirty children aged 2 to 8 years old who underwent adenotonsillectomy via monopolar electrocautery or radiofrequency ablation and were admitted for inpatient observation. Eighteen patients underwent tonsillectomy with monopolar electrocautery and 10 patients underwent tonsillectomy with radiofrequency ablation. There was no intergroup difference in age, sex, weight, and indication for tonsillectomy. Total hospital length of stay and variance to a goal of discharge before 8 AM on postoperative day #1 was measured. Results demonstrated statistically significant difference in mean length of stay (19.6 vs. 22.4 hours, $p = 0.037$) and variance to discharge time (139.5 vs. 15.6 min, $p = 0.032$) in favor of the radiofrequency ablation group. In this small number of patients, there was significantly earlier discharge times in children undergoing adenotonsillectomy with radiofrequency ablation when compared to monopolar electrocautery. Further cost analysis in a larger sample could determine potential cost benefits to the institution.

Introduction

Adenotonsillectomy is one of the most commonly performed surgical procedures in children worldwide. Epidemiological trends demonstrate a rise in incidence of adenotonsillectomy in recent years as well as a shift for surgical indication from infectious etiologies to sleep-disordered breathing [1,2]. Current clinical practice guidelines recommend overnight monitoring for children with obstructive sleep apnea following tonsillectomy if they are younger than 3 years of age or have severe obstructive sleep apnea [3].

Although various techniques and instruments have evolved to perform standard tonsillectomy, controversy exists over which method provides optimal results. Two commonly used techniques are monopolar electrocautery (MES) dissection and radiofrequency ablation (RFA). Cost, operating time, blood loss, postoperative hemorrhage, pain, and return to normal activity are factors that must be taken into account when choosing surgical instrumentation.

MES dissection has been a standardized technique for tonsillectomy. Voltage is directly applied across tissue, creating localized heating and damage. The intense heat generated by electrical current causes tissue destruction by fulguration and

dessication [4]. The direct heat applied to tissues raises local temperatures to 400 to 600 °C [5].

The RFA device, commercially known as the Coblator (ArthroCare Corporation, Sunnyvale, California), has been used as an alternative surgical tool for tonsillectomy. It operates using radiofrequency which energizes ions in a saline solution. An ionized plasma layer is generated with enough energy to dissociate molecular and chemical bonds. The ablated tissue is cooled by the surrounding saline solution and heat dissipates in the process. This technique allows local temperature of the tissues to remain at 45–85 °C [6].

Because tonsillectomy results in an open wound that heals by second intention, postoperative morbidity is most commonly associated with pain due to the disruption of the mucosa followed by inflammation [7]. RFA requires significantly less heat to ablate tissue when compared to MES, which is theorized to result in decreased postoperative pain. While several studies have reported decreased morbidity with RFA compared to MES dissection tonsillectomy, RFA is a more expensive equipment [5,8–20].

With an increasing emphasis on cost-effective care, the increased equipment cost with the RFA device must be

offset by advantages elsewhere. Based on anecdotal patient experience, our hypothesis is that pediatric patients undergoing adenotonsillectomy with RFA were discharged earlier on postoperative day #1 when compared to patients undergoing conventional MES. Shorter hospital stays, even when measured in hours can result in operational advantages for hospitals, including improved patient throughput. The current study aims to measure the time to discharge on postoperative day #1 following adenotonsillectomy performed by MES or RFA, with specific analysis comparing to a goal discharge time of 0800.

Materials and Methods

This study was a retrospective, non-randomized study enrolling pediatric patients undergoing adenotonsillectomy with planned overnight admission. Surgical technique (MES vs. RFA) and its relation to time to discharge on postoperative day #1 was compared. Protocol was approved by the University of Florida Institutional Review Board (IRB #268-2012). Inclusion criteria included patients 0-18 years of age undergoing elective adenotonsillectomy with a planned overnight admission. Exclusion criteria included patients with significant comorbidities such as underlying neurological disease, Down syndrome, bleeding disorder, or an inability for the child to communicate pain.

Parents and patients of assenting age were consented and enrolled, and basic demographic data was collected preoperatively. Data included age on the day of surgery, sex, indication for adenotonsillectomy, surgical technique, length of stay (time from surgery completion to discharge), time of discharge, variance of discharge time compared to a goal of 0800, and perioperative complications. Choice of surgical instrument was decided upon by the attending surgeon on the case and was not randomized. All patients underwent standard extracapsular tonsillectomy in order to standardize analysis of the two groups. Postoperative pain management was standardized to weight dependent doses of ibuprofen elixir every 8 hours, and acetaminophen elixir every 4-6 hours as needed. Narcotic analgesics were used sparingly in older patients as needed for breakthrough pain. Decisions on postoperative disposition were made by the attending surgeon and followed previously published clinical practice guidelines [21].

Length of stay (LOS) was calculated in hours, using the time for completion of surgery until the time of discharge from the hospital. Variance to discharge time compared to a goal of 0800 was calculated to show what time patients were discharged from the hospital on postoperative day 1 in reference to 0800 hours. This number could range from negative (i.e. discharge earlier than 0800) or positive (i.e. discharge after 0800). The authors felt that this metric was most important as the goal of improving patient throughput is best achieved with early discharge from the hospital on the morning after surgery. All data, except sex, were analyzed by Student's t-test (two-tailed) while sex was analyzed by Chi-square using JMP™ Pro 13.0 (SAS Institute Inc., Cary, NC). A statistical value of $p < 0.05$ was considered significant.

Results

Thirty patients were enrolled in the study; two were subsequently excluded from further analysis because their

respective postoperative conditions allowed safe hospital discharge on the same day as surgery. Thus, 28 patients underwent formal data collection and analysis.

The study patients ranged in age from 2 to 8 years of age (mean = 3.3 years). Fourteen patients were female, and the other 14 were male (Table 1). The primary surgical indications included obstructive sleep apnea/sleep disordered breathing (OSA/SDB) in 27 patients, and recurrent pharyngotonsillitis with periodic fever, aphthous stomatitis, pharyngitis, cervical adenitis (PFAPA) syndrome in 1 patient. The increased ratio of OSA or SDB patients reflects the need for postoperative monitoring in these patients, compared with children undergoing tonsillectomy primarily for recurrent tonsillitis.

Eighteen patients underwent MES adenotonsillectomy and 10 patients underwent RFA adenotonsillectomy. The mean age for the MES group was 3.2 years (range 2 to 8 years), and 2.7 years for the RFA group (range 2 to 4 years) (Table 1).

Data on exact time of surgery completion was unavailable in one patient who underwent MES adenotonsillectomy, and thus excluded from final calculation of mean LOS. The mean LOS was calculated based on 17 patients in the MES group, and the entire group of 10 RFA patients.

Mean LOS was 22.4 hours (range, 17.4 to 27.2 hours) for the MES group vs 19.6 hours (range, 17.1 to 23.5 hours) for the RFA group (2-tailed T-test $p = 0.037$). Mean variance to discharge time was 139.5 minutes (range, 34 to 595 minutes) in the MES group compared to 15.6 minutes (range, 75 to 116 minutes) in the RFA group (2-tailed T-test $p = 0.032$) (Table 1).

One primary postoperative hemorrhage occurred in the RFA group and one clinically significant desaturation was recorded in the MES group. Neither complication resulted in a LOS extending beyond an additional midnight, nor was there any significant long-term sequelae.

Discussion

There are several surgical instruments currently used to perform extracapsular tonsillectomy. While the majority of studies report that RFA technique is associated with a significant decrease in postoperative pain and faster return to normal activity and diet when compared to conventional MES [5,9-20], some studies report no clinical or statistical

Table 1:

	MES (n=18)	RFA (n=10)	p-value
Age	Mean = 3.2 (range: 2 to 8 years)	Mean = 2.7 (range: 2 to 4 years)	0.30
Sex	9 male / 9 female	5 male / 5 female	0.88
OSA Indication	17 patients	10 patients	
Recurrent infection	1 patient	0 patients	0.20
Length of stay (hours)	Mean 22.4 (range: 17.4 to 27.2)	Mean 19.6 (range: 17.1 to 23.5)	0.037
Time of discharge variance (minutes)	Mean 139.5 (range: -34 to 595)	Mean 15.6 (range: -75 to 116)	0.032

MES= Monopolar Electrosurgery; RFA= Radiofrequency Ablation.

difference or benefit [7,22–25]. There is also an inconsistency of results showing benefit of either instrument when assessing intraoperative or postoperative hemorrhage [16,17,23,26]. This discrepancy demands consideration of additional factors that influence the choice of surgical device including ease of use, complication profile, surgeon preference, and cost.

In a hospital-based setting, surgical equipment costs are itemized. Thus, lower equipment costs lead to a more favorable profit margin for the institution. The estimated cost of the RFA hand piece depends on geographic region and individual contracts with vendors, but typically ranges between \$180 to 200. In contrast, a typical MES hand piece costs about \$15 to 20. In order to justify the increased equipment costs of using RFA over MES, benefit to a hospital's balance sheet must be demonstrated beyond good clinical outcomes.

Our study shows significantly earlier discharge on postoperative day #1 in patients who underwent RFA tonsillectomy. According to the National (Nationwide) Inpatient Sample (NIS), the largest publicly available inpatient health care database in the United States, the mean daily cost for hospital stay for pediatric patients was \$2300 in 2009 [27]. The calculated costs represent the expenses incurred for hospital services such as wages, supplies, and utility. MEC patients spent an average of 2.8 hours longer at the hospital which can be extrapolated to an additional \$268.80 in hospital stay cost.

Although difficult to quantify, earlier postoperative discharge may result in other additional benefits. Postoperative patients that occupy a hospital bed longer lead to decreased bed space capacity for additional postoperative patients, emergency department admissions, and ICU-to-floor transfers. The inefficiencies created by longer hospital stays, even when measured in hours, have downstream effects that negatively impact the hospital's bottom line, as well as patient and family satisfaction.

Limitations of the current study include the small study size and lack of standardization in determining choice of surgical instrument. Although the differences in the meantime of discharge variance were vastly different between the two groups, population size allowed achievement of statistical significance ($p=0.032$). Further study with greater patient numbers may enhance this finding. Attending surgeon preference was the primary determinant in instrument choice, and factors such as surgical indication, patient age, and level of training of the resident surgeon all factored into the decision. Although efforts were also made to standardize the postoperative pain management protocol, inconsistencies in pain control necessitated the ethical addition of narcotic analgesics in some patients.

Future avenues of study could include expanding the current study to enroll a greater number of patients, randomization of instrument choice, and also quantification of postoperative oral intake as a metric for safe discharge from the hospital. More precise management of postoperative pain according to a predetermined IRB-approved protocol would also help enhance the statistical analysis and validity of future results.

Conclusion

In this pilot study of pediatric patients undergoing adenotonsillectomy, there were significantly earlier discharge times in children undergoing RFA tonsillectomy as compared to MES tonsillectomy. Further cost analysis in a larger sample would determine potential cost benefits to the institution.

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Data availability

The data used to support the findings of this study are included within the article.

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