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Intraoperative Use of QuikClot During Adenotonsillectomy: A Prospective Pediatric Trial

Craig S. Derkay, MD, FACS[1], Hind A. Baydoun, PhD[2], and Laura Stone, RN, BSN[3]

Abstract

Background: Achieving hemostatic control after intracapsular adenotonsillectomy with minimal cauterization may potentially lead to improved outcomes with respect to return to normal diet, normal activity, and less use of narcotic pain medications.

Methods: A prospective, nonrandomized, consecutive series of children with obstructive tonsils and adenoids at a tertiary children's hospital was undertaken.

Results: One hundred consecutive children (52 boys/48 girls) ages 0-16 (mean = 4.8, SD = 3.7, median = 4.0) years were recruited with complete data available on all 100. Mean total procedure time was 19.8 (SD = 4.3, median = 19.5) minutes, including mean total cauterization time of 155.3 (SD = 59.7 seconds, median = 143.0) (adenoids: mean = 60.9, SD = 31.5, median = 53.0; tonsils: mean = 94.5, SD = 41.9, median = 82.0) minutes. Mean estimated blood loss was 29.4 (SD = 40.9, median = 25.0) ml. There were no major complications (0/100 episodes of bleeding or dehydration after surgery). Mean return to normal diet was 3.4 (SD = 2.2, median = 3.0) days; mean return to normal activity was 2.8 (SD = 2.1, median = 3.0) days, and mean days to no further narcotics was 3.0 (SD = 2.3, median = 2.0) days. Mean days to complete recovery (normal diet, normal activity, and no narcotics) was 4.5 (SD = 2.1, median = 4.0, range: 1-10). Total cautery time was significantly correlated with time to complete recovery ($P < .05$).

Conclusions: Intracapsular microdebrider tonsillectomy with adenoidectomy utilizing QuikClot to enhance the hemostasis results in recovery times better than previously reported for this common operation in children.

Keywords

otolaryngology, clinical trials, otology, otolaryngology, pediatric, otology, otolaryngology, adenoiditis, rhinology, otolaryngology, experimental, rhinology, otolaryngology

Tonsillectomy and adenoidectomy remains among the most commonly performed major surgeries in the United States with more than 530 000 procedures performed annually in children younger than 15 years in the United States.[1-3]

The current tonsillectomy "rate" is estimated to be 0.53 per thousand children and 1.46 per thousand children for combined tonsillectomy and adenoidectomy.[4] These procedures, when performed for the proper indications, unquestionably improve the quality of life[5] and occasionally may be life-saving. The past few decades have also seen a greater awareness of the role of the tonsil and the adenoid hyperplasia in upper airway obstruction resulting in sleep-related breathing disorders (SRBD). In such cases, the removal of the offending lymphoid tissue is often curative. As a result, incidence rates of tonsillectomy in the United States have significantly increased in the past 35 years, with SRBD being the primary indication for surgery.[6]

Advances in technology have resulted in the introduction of new instruments and adjuvant measures that can be used to perform these procedures, while investigators continue to debate the superiority of 1 technique versus another. Common tools employed to remove tonsils and adenoids

[1]Department of Otolaryngology-Head and Neck Surgery, Eastern Virginia Medical School, Children's Hospital of the King's Daughters, Norfolk, Virginia, USA
[2]Department of Distance Learning, Eastern Virginia Medical School, Norfolk, Virginia, USA
[3]Department of Otolaryngology-Head and Neck Surgery, Eastern Virginia Medical School, Norfolk, Virginia, USA

Corresponding Author:
Craig S. Derkay, MD, FACS, Eastern Virginia Medical School, Children's Hospital of the King's Daughters, Department of Otolaryngology-Head and Neck Surgery, 601 Children's Ln, 2nd Fl, Norfolk, VA 23507, USA.
Email: Craig.derkay@chkd.org

include cold dissection instruments, electrocautery, thermal coblation, and powered instrumentation (ie, microdebrider). Both intracapsular and total tonsillectomy techniques can be utilized. Risks of adenotonsillectomy have been well described in the literature to include postoperative dehydration, hemorrhage and anesthetic risks, among others.[7]

Intracapsular microdebrider tonsillectomy, when compared to electrocautery extra-capsular tonsillectomy, has been shown to be associated with shorter recovery times[8] and lower rates of postoperative dehydration and bleeding.[9] Koltai postulated that these improved outcomes were the result of the formation of a "biological dressing" via leaving the connective tissue capsule surrounding the tonsil in place. Histologic confirmation of this concept has been demonstrated.[10]

Reducing intraoperative blood loss is a goal of all surgeons. The hemostatic agent QuikClot, originally developed and used throughout the military, is known for its hemostatic properties. QuikClot products are now in their third generation and are composed of rayon/polyester gauze that has been impregnated with kaolin, a white aluminosilicate. The gauze does not contain botanicals or materials from animal or human sources. Kaolin is a naturally occurring inorganic mineral that has been clinically shown to accelerate the body's natural coagulation cascade, while not causing any exothermic reaction or vascular complications. QuikClot has been shown to reduce hemorrhage through activation of factor XII in the coagulation cascade.[11,12]

In October 2009, QuikClot was deemed safe for use in the hospital setting with current use in trauma surgery, orthopedics, dermatology, gynecology, and interventional radiology. QuikClot was first introduced as a powder. This was found to be effective, but had a tendency to burn exposed skin and blow away in the wind. Improvements and continued innovation demonstrated the efficacy of gauze bandage designs with hemostatic agents embedded within them. Combat experience during the Iraq war served as a validation of the efficacy of QuikClot for "junctional bleeding" (bleeding that is in areas of the body such that it cannot be stopped with a tourniquet).[13,14]

In 2006 we performed a randomized, blinded comparison of low wattage electrocautery to use of the microdebrider for adenotonsillectomy in a cohort of 300 children with obstructive sleep disorders. We reported favorable findings in the microdebrider group with a median of 3 days until return to normal diet, 4 days until return to normal activity, and 4 days until no longer taking narcotic pain medications. Unfortunately, we did not record cauterization times, size of the tonsils and adenoids, BMI, or results of PSG testing as parameters. Given our favorable results, we sought to mimic the design of this study with respect to the controversial areas of antibiotic, narcotics, dexamethasone and bupivicaine administration and enhance the data collection to include parameters that might help us understand further improvements in recovery. Although it will not be possible to use the original study's microdebrider group as a control group, we hope that broad comparisons can be gleaned to provide enough data to suggest the need for a larger, side-by-side, randomized, controlled study to verify the benefits of using QuikClot in adenotonsillectomies.

After an initial piloted use of this technology in an effort to reduce bleeding associated with adenotonsillectomy, the investigators observed that placement of the product against the tonsil fossa raw surfaces created during intracapsular tonsillectomy minimized blood loss, without increase operating room and anesthetic times for the patient. Although effective in achieving hemostasis, standard use of cautery to the adenoid bed and the tonsillar fossa is thought to be a contributing factor toward development of postoperative pain. Despite favorable results in clinical trials, more universal adoption of microdebrider techniques for adenotonsillectomy is hindered by dissatisfaction with intraoperative hemostasis and the potential risk of regrowth of tissue requiring a second operation. Use of QuikClot may alleviate these concerns by minimizing bleeding, decreasing the amount of cauterization, and allowing the surgeon to better visualize residual tonsil tissue and desiccate it effectively. This may provide better outcomes for children undergoing this procedure.

Methods

Inclusion Criteria

One hundred consecutive ASA 1 or 2 children, ages 0-18, undergoing adenotonsillectomy by the senior author for symptoms of upper airway obstruction carrying a clinical diagnosis of adenotonsillar hypertrophy as the cause of the sleep obstructive breathing were eligible for enrollment. Diagnosis was made with a combination of history, physical examination, sleep video, nasopharyngoscopy, lateral neck X-ray, and polysomnography.

Exclusion Criteria

Patients with signs or symptoms of obstructed breathing, but also carrying a diagnosis of recurrent pharyngitis were excluded from the study as were children ASA 3 and above and those with a history of a bleeding dyscrasia or history of prior adenotonsillectomy.

Procedures

IRB approval was obtained before embarking on this study. An unrestricted educational grant was provided by Z-Medica to fund the study. Consistent with the IRB policies at our institution, the unrestricted grant allowed the investigators to design the study, collect the data and

Figure 1. QuikClot with radiopaque thread.

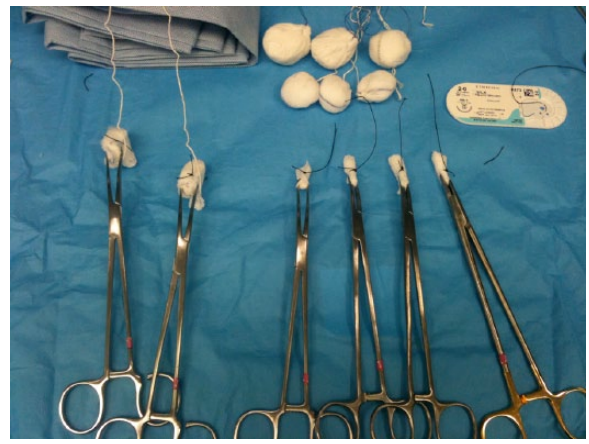

Figure 2. QuikClot sponges rolled into 4 tonsillar packs and 2 adenoid packs.

analyze the results without input from the funding source. Informed consent was obtained from the legal guardian and assent from all children 7 years of age or older. A patient diary was given to the caregivers along with detailed instructions on the use of the Wong Faces pain scale. A stamped, self-addressed envelope was also provided. Caregivers were given the option of returning the postoperative diaries at their children's postoperative visit or to mail the diary back to the research coordinator. One to 2 phone calls were made in the postoperative first week by the research coordinator to the households to remind them to fill out their diaries. As an incentive to fill out the daily diary, a $25 gift card to Target was provided to the family upon receipt of the completed form.

QuikClot 4 × 4 gauze sponges with radiographic thread sewn into them were prepared by the surgical scrub technician (Figures 1 and 2). The gauze sponge was cut in half. One of the halves was then cut in half again and these segments were tightly wrapped around medium size tonsil sponges with a 2-0 silk suture securing it in place. These were used in the nasopharynx after performance of the adenoidectomy. The remaining half was cut into 4 rectangular strips and rolled tightly like a "tootsie roll" to create the tonsillar packs. A 2 cm length of 2-0 silk suture was secured to the end to facilitate removal and aid in accounting for all packing at the conclusion of the procedure. Preparation time generally required 2-4 minutes and was accomplished during anesthesia induction. The remaining tonsillar sponges were also utilized during the procedure—applying pressure against the QuikClot tonsillar packs for 1 minute after initial placement.

All children received an intraoperative dose of dexamethasone (0.4 mg/kg, max dose 20 mg) and antibiotics (20 mg/kg Ampicillin if not penicillin-allergic) prior to incision. Marcaine with epinephrine, 0.25% was injected preincision along the anterior tonsillar pillars and at Passavant's ridge in the nasopharynx. The adenoids were removed using the microdebrider at a setting of 2000 rpm. The first adenoid pack (wrapped tightly in the QuikClot) was placed in the nasopharynx. Intracapsular tonsillectomy was then performed starting with the left tonsil (for right-handed surgeons) from superior pole to inferior pole. A QuikClot tonsil roll was then placed in the tonsil fossa with pressure applied using a medium-size tonsil sponge for 1 minute. The right tonsil was then addressed in a similar fashion. The adenoid pack was then removed and any residual adenoidal bleeding or tufts of residual adenoid tissue were addressed with the suction electrocautery set at 35 watt/second. The amount of time for this cauterization was recorded and the second QuikClot adenoid pack applied. The left tonsil QuikClot roll was then removed and the suction electrocautery at 25 watts/second was used to address any tonsil fossa bleeding or to desiccate any residual tonsil tissue left behind after the intracapsular tonsillectomy. A second tonsil QuikClot pack was then placed. The right tonsil fossa was addressed in an identical fashion. A second round of observation with touch-up cautery was then performed with removal of the packs. Timing of each of these stages was then recorded as well as surgical blood loss, total surgical procedure time (mouth gag in to mouth gag out), and total time in the room. Additional 0.25% Marcaine with epinephrine was placed at the end of the procedure in the anterior and posterior tonsillar pillars to a final volume of approximately 10 ml.

Additional data collected included basic demographics (age, sex, ethnicity), height, weight, body mass index

Table 1. Demographic and Clinical Characteristics of Study Sample (N = 100).

	Mean ± SD	Median (Range)	n (%)
Age (years)	4.8 ± 3.7	4.0 (0-16)	
Sex			
Male			52 (52.0)
Female			48 (48.0)
Race			
White			48 (49.5)
Black			44 (45.4)
Other			5 (5.2)
BMI (kg/m^2)	20.8 ± 14.5	17.3 (9.7-150)	
Tonsil size (1-4)	3.3 ± 0.6	3.0 (2-4)	
Adenoid size (0-2)	1.6 ± 0.6	2.0 (0-2)	
Procedure time (min)	19.8 ± 4.3	19.5 (14-45)	
Cauterization time (seconds)	155.3 ± 59.7	143 (61-400)	
Total blood loss (ml)	29.4 ± 40.9	25 (10-402)	
Time until no narcotics (days)	3.0 ± 2.3	2 (0-10)	
Time until return to normal diet (days)	3.4 ± 2.2	3 (0-10)	
Time until return to normal activity (days)	2.8 ± 2.1	3 (0-8)	
Time until normal recovery (days)	4.5 ± 2.1	4 (1-10)	

(BMI), BMI % for age, AHI, and comorbidities. An assessment of tonsil and adenoid size was recorded intraoperatively. Any adjunctive procedures (ie, placement of ventilation tubes) were also recorded. In these few instances, the total surgical time in the room was not included in the analysis (only the mouth gag in to mouth gag out adenotonsillectomy procedure time).

Families were provided with a postoperative prescription for Lortab (acetaminophen/hydrocodone) dosed at 0.2 cc/kg every 4-6 hours. They were instructed to use this for break-through pain not controlled with either acetaminophen (10 mg/kg every 4 hours) or ibuprofen (10 mg/kg every 6 hours) taking care not to "double-dose" the acetaminophen. Amoxicillin (80 mg/kg/d divided TID) was provided for a 7-day postoperative course (azithromycin was substituted for 5 days if penicillin-allergic). These measures were instituted as part of the protocol prior to the publication of the AAO-HNS tonsillectomy guidelines and the CDC black box warning concerning use of codeine after tonsillectomy in pediatric patients.

Statistical Analysis

Descriptive, bivariate, and multivariate analyses were performed using SAS version 9.3. Summary statistics included mean, standard deviation, median, and range for continuous variables as well as frequencies and percentages for categorical variables. Bivariate associations were examined using Student's *t* test and Pearson's correlation coefficient. Multivariate linear regression models were constructed for the best predictors of selected outcomes (days to no narcotics, days to normal diet, days to normal activity, adenoid total time), including age (in years), sex (male or female), race (white, black, other), BMI (continuous), tonsil size (continuous), and adenoid size (continuous). Two-sided statistical tests were conducted at an alpha level of .05.

Results

One hundred consecutive children (52 boys/48 girls), ages 0-16 (mean = 4.8, SD = 3.7, median = 4.0) years, were recruited, with complete data available on all 100. Mean total procedure time was 19.8 (SD = 4.3, median = 19.5) minutes including mean total cauterization time of 155.3 (SD = 59.7 seconds, median = 143.0) (adenoids: mean = 60.9, SD = 31.5, median = 53.0; tonsils: mean = 94.5, SD = 41.9, median = 82.0) minutes. Mean estimated blood loss was 29.4 (SD = 40.9, median = 25.0) ml. There were no major complications (0/100 episodes of bleeding or dehydration after surgery). Mean return to normal diet was 3.4 (SD = 2.2, median = 3.0) days; mean return to normal activity was 2.8 (SD = 2.1, median = 3.0) days, and mean days to no further narcotics was 3.0 (SD = 2.3, median = 2.0) days. Mean days to complete recovery (normal diet, normal activity, and no narcotics) was 4.5 (SD = 2.1, median = 4.0, range: 1-10) (Table 1).

Total cautery time was significantly correlated with time to complete recovery ($P < .05$). Multiple linear regression models show best predictors of days to normal activity to be age, race, and BMI. Whereas age and race were the best predictors of days until full recovery, BMI was the best predictor for cauterization and adenoid total time (Table 2).

Table 2. Multiple Linear Regression Models for Selected Study Outcomes.

	Days to No Narcotics	Days to Normal Diet	Days to Normal Activity	Days to Full Recovery
	β (SEM), *P*	β (SEM), *P*	β (SEM), *P*	β (SEM), *P*
Age (years)	0.06 (0.07), .4	0.01 (0.07), .9	0.2 (0.05), .01	0.1 (0.06), .02
Sex				
Female vs male	0.2 (0.5), .7	0.4 (0.5), .3	0.4 (0.4), .3	0.3 (0.4), .5
Race				
White	0.5 (1.2), .7	1.7 (1.1), .1	2.2 (0.9), .02	2.1 (0.9), .03
Black	0.9 (1.1), .4	1.1 (1.0), .3	1.4 (0.9), .1	
Other	Ref.	Ref.	Ref.	Ref.
BMI (kg/m^2)	0.02 (0.04), .6	0.04 (0.04), .3	0.07 (0.03), .03	0.06 (0.04), .07
Tonsil size (1-4)	−0.002 (0.4), .9	−0.5 (0.4), .1	0.02 (0.3), .9	−0.3 (0.34), .44
Adenoid size (0-2)	−0.09 (0.4), .8	0.2 (0.4), .6	−0.05 (0.3), .9	0.2 (0.4), .5
R^2	.04	.07	.2	.2

	Cauterization Time	Adenoid Total Time
	β (SEM), *P*	β (SEM), *P*
Age (years)	1.6 (1.6), .3	1.2 (0.9), .2
Sex		
Female vs male	−0.9 (11.3), .9	1.1 (6.6), .9
Race		
White	45.5 (25.5), .08	17.8 (14.8), .2
Black	28.2 (25.4), .3	13.6 (14.8), .4
Other	Ref.	Ref.
BMI (kg/m^2)	3.8 (0.9), < 0.0001	1.2 (0.5), .03
Tonsil size (1-4)	9.9 (8.9), .3	−2.8 (5.2), .6
Adenoid size (0-2)	−17.3 (9.5), .07	−3.8 (5.5), .5
R^2	.3	.1

Discussion

The third generation of QuikClot products are composed of rayon/polyester gauze that has been impregnated with kaolin, a white aluminosilicate. QuikClot gauze has been subjected to safety and efficacy studies that were performed by the US Army Institute of Surgical Research (USAISR) and the Naval Medical Research Center. QuikClot has been accepted by all branches of the US military and is part of the "go pack" for Medics and EMTs. The Tactical Combat Casualty Care committee considers QuikClot as the first line of treatment for life-threatening hemorrhage on external wounds that are not amendable to tourniquet placement. QuikClot has successfully been used in the operating room by colleagues in general surgery,[15] obstetrics/gynecology,[16] orthopedics,[17] and other surgical specialties.

Kaolin is an inert mineral that promotes clotting by 2 main modes of action: Kaolin promotes the activation of factor XII (FXII) in the presence of kallikrein and high molecular weight kininogen.[18] Activated FXII initiates the intrinsic clotting pathway via the activation of Factor XI (FXI). Activated FXI continues the coagulation pathway that ends with the formation of a fibrin clot. Kaolin also promotes the activation of platelet-associated FXI. It is a distinct and separate molecule from plasma FXI.[19] Activated platelet-associated FXI initiates the intrinsic clotting pathway in normal and FXII deficient patients.[20] Although the manufacturer provided the QuikClot for this investigation, the off-the-shelf cost for the version we utilized is approximately $20 per package.

The decision to perform a partial intracapsular tonsillectomy (PIT) as opposed to a total extracapsular tonsillectomy is surgeon-dependent. Tonsillectomy performed prior to the 20th century was a less than complete removal of the pharyngeal lymphoid tissues. However, concerns that residual tissue served as a source for further infection and secondary complications suggested a need to alter the surgical technique.[21] With improved anatomical understanding and surgical precision, surgeons began to advocate for complete tonsil removal, performing the procedure along the tonsil capsule.[22]

Regardless of the instrumentation used, total tonsillectomy leaves the musculature of the pharynx exposed to heal by secondary intention. In PIT, the removal of tissue is near

complete, leaving a rim of tonsil tissue overlying the capsule. Once the tonsil tissue has been removed, suction electrocautery can be used to control any residual bleeding.

The cauterized tissue heals as a "natural biological dressing," theorized to speed the healing process by reducing the exposure and inflammation of the pharyngeal musculature.[10] Proponents of the partial procedure believe their patients experience less pain and a lower risk of post-tonsillectomy bleeding by protecting the underlying muscle with its vasculature and nerves.[23]

Negative comments regarding this technique fall into 2 general categories: potential regrowth of tonsillar tissue from incomplete removal that might require a secondary procedure (with the increased cost and risks of a second operation) and surgeon concerns regarding managing intraoperative hemostasis. The introduction of QuikClot into this procedure addresses both concerns. Utilizing this material after microdebrider resection results in a reduced need to suction-cauterize the tonsil bed and allows the surgeon to address residual nests of lymphoid tissue along the connective tissue capsule with desiccating cautery minimizing the risk of regrowth. We demonstrated through the multiregression analysis that recovery after this procedure correlated with the amount of tonsillar cautery time with a mean total recovery (return to normal diet, normal activity and no longer requiring any narcotic pain medication) of 4.5 days and a median recovery of 4 days.

Studies have found that PIT, performed either with the microdebrider or with the coblator results in a moderate reduction in postoperative pain, a more rapid return to normal activity and diet, and perhaps fewer delayed complications.[8,9,23-28] It has been suggested that the intracapsular procedure, more so than the instrument used to perform it, may be the most important determinant of a good outcome.[28-30] Quality of life surveys also demonstrate a greater decrease in emotional distress in children undergoing microdebrider PIT.[8]

Large retrospective case series have suggested that tonsillar regrowth occurs in about 0.5%-6% of patients, with a much smaller percentage requiring completion tonsillectomy, though follow-up in these studies was brief and captured only a subset of enrolled subjects.[26,31]

Peritonsillar abscess and recurrent tonsillitis are potentially possible after PIT,[31] necessitating a return trip to the operating room. For this reason, while some clinicians suggest a possible role for PIT in the management of children with recurrent tonsillitis,[32,33] others limit their use of PIT to patients with obstructive tonsils and adenoids only.[8,23,34] In the present study, we only enrolled children with obstructive adenotonsillar hypertrophy (mean AHI 10.5, mean REM AHI 24.5) and purposefully excluded children with a history of recurrent tonsillitis.

Ultimately, the decision regarding which technique to use comes down to whether the decrease in pain with PIT justifies the risk of tonsil regrowth and potential for future infection. Adding to the thought process is the recognition that the risk of a post-tonsillectomy bleed (requiring either a visit to the emergency room or a second trip to the operating room) and the risk of postoperative dehydration resulting in a visit to the emergency department has been shown to be markedly lower with use of the microdebrider,[9] counteracting the economic argument used against PIT. Granted that our study included only 100 consecutive children; however, none exhibited a post-tonsillectomy bleed or postoperative dehydration, and the follow-up is too brief to make any judgments regarding regrowth in this cohort.

The microdebrider is also an ideal instrument for adenoid removal. The device is efficient and precise, allowing for the complete, but not excessive, removal of tissue from the nasopharynx. Bleeding is reduced compared to curette procedures since there is less risk of dissection in the fascial plane. Murray and Koltai[35-37] have demonstrated the benefits of using the microdebrider for adenoid removal with shorter operating times, higher surgeon satisfaction, more complete removal of tissue and less bleeding. The use of the QuikClot as an adjuvant to microdebrider adenoidectomy facilitated hemostasis in our patients and resulted in cautery time in the nasopharynx that averaged only 1 minute. Adding this to the mean of 95 seconds of cautery time to achieve hemostasis in both tonsillar fossas resulted in a total procedure time of less than 20 minutes.

The use of intraoperative and postoperative antibiotics have been proposed as adjuvant medical therapies to reduce pain, minimize foul breath and provide a more rapid return to a normal diet.[38,39]

We chose to utilize intraoperative and postoperative antibiotics in our study for 2 reasons: (1) we wished to generally compare the results of this investigation with a prior double-blind, prospective comparison between microdebrider and electrocautery tonsillectomy we had performed that included the use of antibiotics, dexamethasone, intralesional bupivicaine and postoperative narcotics;[8] and (2) the AAO-HNS Clinical Practice Guideline[1] had not yet been published at the time that we initiated this investigation.

The intraoperative administration of dexamethasone has been advocated to reduce postadenotonsillectomy nausea and vomiting and inflammation. Postoperative nausea and vomiting occur in over 70% of children who do not receive prophylactic antiemetics.[40] Consistent with our prior investigation,[8] we administered an intraoperative dose of dexamethasone at 0.4 mg/kg/IV (maximum dose 20 mg) to all of our subjects.

Local anesthetics have been evaluated in numerous studies for their ability to reduce postoperative pain and morbidity after tonsillectomy.[41-45] Although there are many studies in literature, results vary as tonsillectomy surgical techniques and the protocol for administration of local

anesthesia were not standardized. The AAO-HNS Tonsillectomy Guidelines do not support the routine use of topical anesthetics[1] but the articles reviewed to support this recommendation did not include its use for intracapsular tonsillectomy. Consistent with our desire to replicate the design of our prior randomized, blinded study,[8] we included a pre- and postincisional administration of 0.25% bupivicaine with epinephrine into our protocol.

Our prior investigation of tonsillectomy technique comparing the use of the microdebrider to low-wattage electrocautery in children with obstructive tonsils and adenoids is helpful in viewing the results of this study in context.[8] We designed the present study to mirror some of the criteria in the original study for this purpose. The additional use of QuikClot appeared to result in several improvements over those achieved in the microdebrider arm of the original study. The median number of days to return to normal diet remained the same at 3 days. The median days to return to normal activity decreased from 4 to 3 days while the median days until no longer taking narcotic pain medications declined from 4 to 2 days. Although we did not measure the amount of cautery time in the prior investigation, our multivariate regression analysis in the present study identified this as the most significant factor in determining total recovery ($P < .05$). The adjuvant use of QuikClot in reducing this cautery time appears to explain these improvements. A true side-by-side, randomized, controlled, prospective comparison study will be needed to verify these preliminary observations.

Conclusions

Intracapsular microdebrider tonsillectomy with adenoidectomy utilizing QuikClot to enhance the hemostasis results in recovery times significantly better than previously reported for this common operation in children. Utilizing this relatively inexpensive adjuvant to our existing regimen, our children with obstructive adenotonsillar hypertrophy achieved a median complete recovery (normal diet, normal activity and no longer requiring narcotics) after adenotonsillectomy of 4.0 days.

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Declaration of Conflicting Interests

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