International Journal of Otolaryngology and Head & Neck Surgery, 2015, 4, 350-355
Published Online September 2015 in SciRes. http://www.scirp.org/journal/ijohns
http://dx.doi.org/10.4236/ijohns.2015.45059

Coblation Intracapsular Tonsillectomy and Coblation Complete Tonsillectomy for Obstructive Sleep Apnea

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Received 20 July 2015; accepted 8 September 2015; published 11 September 2015

Abstract

Objective: Total tonsillectomy and intracapsular tonsillectomy are common procedures for the treatment of obstructive sleep apnea (OSA) in children. The objective of this study was to compare the effectiveness of coblation intracapsular tonsillectomy (ICT) and coblation complete tonsillectomy (CT) as treatments for OSA. Study design: A retrospective study of all the children ages 2 - 18 years with OSA who underwent coblation intracapsular tonsillectomy (ICT) or coblation complete tonsillectomy (CT) from January 2007 to August 2010 by the same surgeons at one institution. Methods: Data were retrieved from children's charts and from telephone interviews with children's parents, regarding pre and postoperative OSA-18 scores, postoperative pain, postoperative complications, use of analgesic drugs, and time to return to a solid food diet. Results: All 43 children who underwent ICT and 37 children who underwent CT suffered from OSA before surgery, and none did postoperatively. There were no minor complications in the ICT group, compared to 13.5% in the CT group ($p = 0.01$). According to parental report, 72% and 21% suffered a low level of postoperative pain, and 9% and 33% severe pain in the ICT and CT groups, respectively. For these respective groups, 49% and 73% needed analgesic drugs ($p < 0.05$); and 65% and 35% ate solid food during the first 3 days post surgery. Conclusions: Both ICT and CT were safe, with few complications; however recovery was faster in the ICT group, as demonstrated by less pain, and more rapid return to a solid food diet.

Keywords

Obstructive Sleep Apnea, Tonsillectomy, Coblation, Intracapsular Tonsillectomy, Pain, Adenotonsillectomy, Tonsillotomy

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How to cite this paper: Braverman, I., Nemirovsky, A., Klein, A., Sarid, M. and Avior, G. (2015) Coblation Intracapsular Tonsillectomy and CoblationComplete Tonsillectomy for Obstructive Sleep Apnea. *International Journal of Otolaryngology and Head & Neck Surgery*, **4**, 350-355. http://dx.doi.org/10.4236/ijohns.2015.45059

1. Introduction

Obstructive sleep apnea (OSA) in children is characterized by a decrease or complete halt in airflow despite an ongoing effort to breath, and by upper airway collapse that disrupts normal respiratory gas exchange or causes sleep fragmentation. A systematic review concluded that 4% to 11% of children suffer from sleep-disordered breathing, ranging in severity from snoring to OSA, as assessed by parent report [1]. Consequences of untreated OSA include: failure to thrive, enuresis, attention-deficit disorder, behavior problems, poor academic performance, and cardiopulmonary disease [2] [3]. The most common etiology of OSA is adenotonsillar hypertrophy.

Tonsillar surgery is the treatment of choice for most children with OSA. Moreover, OSA, rather than chronic infection, has become the primary indication for pediatric tonsillectomy, especially in younger children [4] [5]. A large recently published randomized trial supports the beneficial effects of early adenotonsillectomy, compared with a strategy of watchful waiting, for school-age children with OSA [6]. Nevertheless, pain is a common postoperative morbidity of tonsillectomy; the degree is usually severe, and often leads to poor oral intake and dehydration.

Tonsillotomy (also known as partial tonsillectomy and as intracapsular tonsillectomy) was the most commonly performed tonsillar surgery until the 1930s, when the broad introduction and safety of general anesthesia led to a preference for tonsillectomy (also known as total or traditional tonsillectomy and as subcapsular tonsillectomy) [7]. However, tonsillectomy is associated with considerable postoperative morbidity, including long recovery, characterized by dysphagia and odinophagia due to pain, bleeding, and loss of school days. Recent years have witnessed renewed interest in tonsillotomy as treatment of OSA, by means of a variety of techniques and with positive outcomes on morbidity and postoperative pain. The advantage of tonsillotomy over conventional tonsillectomy is that it leaves a residual tonsillar tissue and capsule which protects the underlying musculature with its vessels and nerves. Microdebrider partial tonsillectomy, first described by Koltai *et al*. in 2002 [8], and coblation were two techniques employed in tonsillotomy.

Coblation technology uses the combination of radiofrequency energy with a saline solution for gently and precisely removing tonsils, preserving the capsule, and precluding damage from surrounding healthy tissue. In prospective trials comparing the two techniques, coblation and steel cold dissection, for total tonsillectomy [9] and for adenotonsillectomy [10], fewer intraoperative and postoperative complications and less postoperative pain were observed with coblation. Numerous studies and two recent reviews [11] [12] have compared recovery-related outcomes of tonsillectomy and tonsillotomy by a variety of techniques. Less pain and more rapid recovery were reported for tonsillotomy, both by microdebrider and by coblation [11] [12]; however, since different techniques were used for tonsillectomy and tonsillotomy, it was not clear if the findings were due to the technique (microdebrider, coblation) or to the intracapsular rather than subcapsular procedure. Few studies and neither of these reviews compared the effectiveness of treating OSA between the two procedures using the same technique.

The purpose of this study was to compare recovery-related outcomes and effectiveness of tonsillectomy and tonsillotomy for the treatment of OSA in children, using the same technique, namely coblation: coblation intracapsular adenotonsillectomy (ICT) and coblation subcapsular adenotonsillectomy (CT).

2. Material and Methods

This is a retrospective study of children aged 2 - 18 years old who underwent coblation intracapsular adenotonsillectomy (ICT) or coblation subcapsular adenotonsillectomy (CT) for treatment of OSA at one institution, with the same surgeons, during a five year period (2007 to 2010). The indication for ICT was OSA; and for CT, OSA together with chronic tonsillitis. OSA was clinically determined in all children before surgery. Exclusion criteria were the presence of other diseases, such as cardiac, lung or metabolic and medical treatment that influences sleep.

Data retrieved from patient charts included intraoperative complications and the number of hours postoperative that the patients consumed a fluid diet. Parents were called by telephone and asked to respond to the Obstructive Sleep Apnea Syndrome Quality of Life Survey (OSA-18) [13] regarding the period before and after surgery.

The pediatric OSA-18 questionnaire is an18-item survey that comprises 5 categories (sleep disturbance, physical symptoms, emotional distress, daytime function, caregiver concerns). Questions are scored 1 (never) to 7 (persistently) based on the frequency of symptoms. The maximum score is 126. Scores of less than 60 suggest

a small impact on health-related quality of life (HRQL); scores between 60 and 80 suggest a moderate impact; and scores greater than 80 suggest a large impact.

In addition to the OSA-18 questionnaire, parents were asked to assess their children's pain for the 7 days postoperative as mild, moderate, or severe; their degree of satisfaction with the surgery, according to the visual analogue scale; the duration of time of recovery from tonsillectomy; postoperative complications; the use and frequency of analgesic drugs; and the time lapse, in days, until the start of solid food. Postoperative pain was also evaluated by the use of analgesic drugs and the timing of eating solid food, according to patients' charts.

The surgical procedure was performed as described previously [14], except for differences in the coblate settings of the surgical wand: 7 instead of 9 during ablation of the tonsils from the surface, and 7 instead of 6 during dissection.

Statistical analysis: The Chi-square test was used to compare data between the intracapsular and subcapsular groups.

3. Results

Table 1 presents demographic and clinical data according to study procedure. During the study period, 43 children, 28 boys and 15 girls, underwent ICT; and 37 children, 22 boys and 15 girls, CT. Mean OSA18 scores were 82.6 and 73.0 before surgery, in the ICT and CT groups respectively; and 25.5 and 24.6, respectively, postoperative. All the children who underwent ICT or CT with adenoidectomy were free from OSA symptoms postoperatively. Altogether, only 9% of the children were snoring post surgery, 13.5% following CT and 5% following ICT.

No intraoperative or postoperative complications were observed in the ICT group, compared to 13.5% minor complications in the CT group, most of them dehydration ($p = 0.01$).

During the first 24 hours postoperative, 67.4% in the ICT group, and 94.6% in the CT group suffered pain, according to parents' report ($p < 0.001$). Mild pain complaints during the first 3 postoperative days were 64.5% in the ICT and 28.3% in the CT group. In the ICT group, 72% of the parents rated their children's 7 days postoperative pain as mild, compared with 21% in the CT group; 9% and 33% reported severe pain following ICT and CT respectively (**Figure 1**). Fewer than half (49%) of children in the ICT group needed analgesics, compared with 73% in the CT group ($p < 0.05$). Of those who used analgesics, a higher proportion in the CT group received 3 or more doses (**Figure 2**).

In the ICT group 65% ate solid food during the first 3 days post-surgery, compared to only 35% in the CT group, despite the recommendation to eat soft food during the first week. The proportion of children who only consumed fluids for 8 or more hours postoperative was lower in the ICT group (**Figure 3**) ($p < 0.01$).

Table 1. Characteristics and outcomes of children who underwent coblation intracapsular adenotonsillectomy (ICT) and coblation subcapsular adenotonsillectomy (CT).

Characteristic	ICT	CT
Number of children	43	37
Boys	28	22
Girls	15	15
Age (years)	range 2 - 8, median 4	range 2 - 17, median 5
Mean OSA18 scores		
Before surgery	82.6	73.0
After surgery	25.5	24.6
Snoring postoperative	2 (4.7%)	5 (13.5%)
Postoperative complications	0	5 (13.5%)
Reported pain		
During 24 hours postoperative	29 (67.4%)	35 (94.6%)

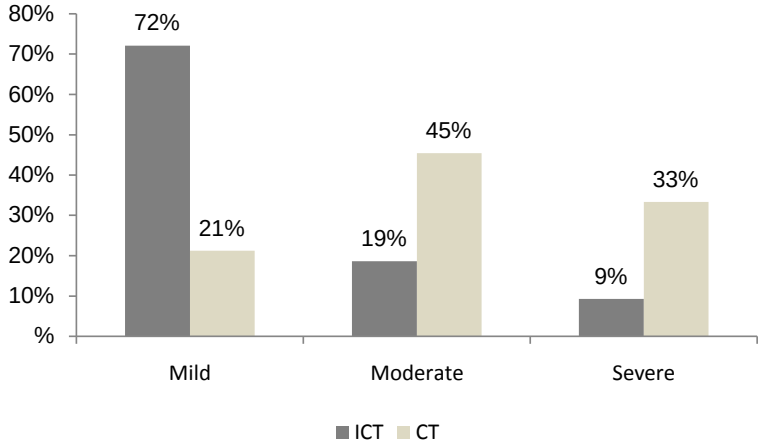

Figure 1. Pain level 7 days post surgery.

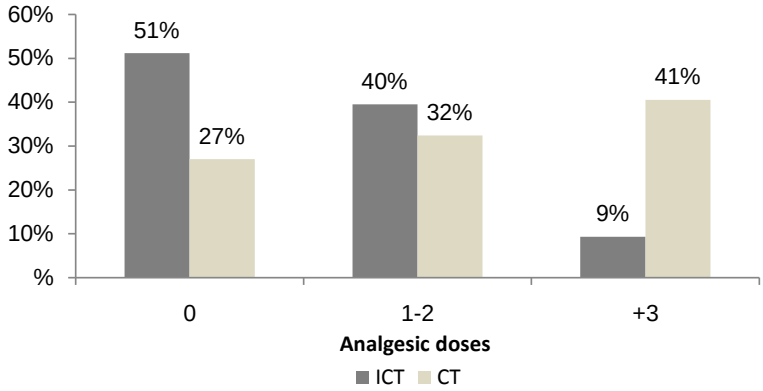

Figure 2. The number of analgesic dosages after each surgery.

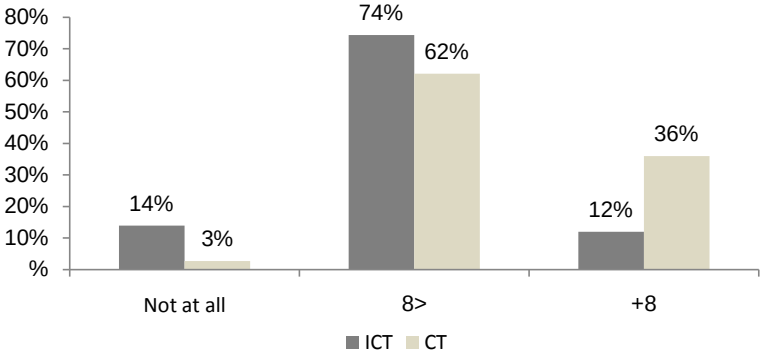

Figure 3. The number of "fluid only hours" after each surgery.

4. Discussion

This study compared subcapsular (total) (CT) and intracapsular adenotonsillectomy (ICT), both employing coblation. The two procedures demonstrated effectiveness as treatment for OSA, according to parent report, as well as safety, as assessed by few complications. The low thermal effect of coblation, 45˚C - 85˚C, reduces the risk of thermal injury to surrounding tissues, reducing pain and promoting healing.

Recovery from ICT was faster than from the subcapsular procedure, as demonstrated by fewer days with pain, less use of analgesic drugs, and earlier resumption of solid food ingestion. These findings support Acevedo *et al.*'s [11] subanalysis of coblation procedures, which showed a more rapid return to a regular diet and fewer

days of analgesic use for tonsillotomy than tonsillectomy. However, that review included studies in which only tonsillotomies were performed by coblation, contrasting with the current study in which all tonsillectomies and tonsillotomies were performed using coblation.

The less pain experienced in the first 24 hours among children who underwent ICT compared to CT suggests less tissue injury in the former. Since the procedures were performed by the same two surgeons, such difference seems to be due to differences in the surgical techniques, and not to differences in the surgeons' skills. This is an important point since dissection skills of the surgeon has been suggested as a main factor determining the degree of tissue injury, and thus explains differences in the postoperative outcomes of different procedures [14].

In the current study, the lower level of pain reported by the ICT group after seven postoperative days is likely due to the protective effect of sparing the capsule. Similarly, in a randomized trial, significantly less pain was reported 5 and 6 days postoperative following intracapsular coblation tonsillectomy than following total coblation, despite comparable levels of pain between the groups on the first two postoperative days [14]. Likewise, in a prospective study in which coblation was used in a subcapsular approach on one side and intracapsular on the other side of the same patients, no difference in pain was reported within the first 24 hours [15].

Few studies have compared the effectiveness of tonsillar procedures for the treatment of OSA. The OSA-18 is a well-accepted questionnaire. Nevertheless, the use of parent report, and the time lapse from the surgery to the interviews, which was sometimes considerable, raises the possibility of reporting bias. To mitigate such bias, data were collected and correlated from patients' charts.

Despite the benefits of ICT, this procedure is not appropriate for patients suffering from tonsillitis in addition to OSA, due to the possible risk of infection in the tonsillar remnant and of regrowth of tonsillar tissue. Consequently, in the current study, CT, and not ICT, was performed in patients suffering from chronic tonsillitis. However, this raises the possibility of an indication bias, *i.e.* different indications for the two procedures (although all the children had OSA). In contrast, if indications were identical for the two procedures, as in randomized trials, such as those included in Walton *et al.*'s review [12], then some patients would evidently be over or undertreated. If, on the one hand, the indication for surgery was OSA without tonsillitis, then patients randomized to CT would be overtreated. If, on the other hand, the indication was tonsillitis, then those randomized to ICT would be undertreated. Thus, in contrast with the bias arising from the "real life" design of the current study, randomized trials comparing CT and ICT raise clinical and ethical questions.

Assessment of the effectiveness of CT for the treatment of chronic tonsillitis is beyond the scope of the current study. However, the fact that children who underwent CT suffered from chronic infection, in addition to OSA, is a limitation of this study, as well as of other such comparative studies [16]. Of note, greater postoperative bleeding was reported following operations in which recurrent tonsillitis, rather than non-infectious pathologies including sleep apnea, was the indication [17].

An explanation for the lower level of pain and complications in the ICT group is the sparing of the tonsillar capsule and the presence of remnant tonsillar tissue, which generates a protective effect that may achieve safer distance from vessels and nerves in the tonsillar bed. This mechanism is the major pathogenesis, in our opinion, for less morbidity in the ICT group and similar improvement in OSA. The benefits demonstrated herein of ICT in postoperative recovery and in relief from OSA are important, since OSA is currently the main indication for tonsillar surgery [4] [5]. Still, long term evaluation is necessary to assess the degree of tonsil regrowth following ICT, and the possible effect of such on OSA.

5. Conclusion

The two techniques, ICT and CT, demonstrated safety, yet there were fewer complications in the ICT group. Recovery from ICT was faster than from CT, as assessed by number of days with pain, the use of analgesic drugs and the timing to solid food ingestion. After 5 days all children in the ICT group ate solid food, while in the CT group, it took longer. In the ICT group, pain duration was shorter than in the CT group. Still, there was no significant difference in pain level between the two groups, and severe pain was not reported in either. Two thirds of the children in both groups had mild pain. The overall satisfaction from the operation and OSA symptoms was high in both groups. ICT is an effective and recommended technique for children with OSA.

Acknowledgements

The author wants to thank Ms. Cindy Cohen for her help in preparing this manuscript.

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