Tonsillotomy in children with sleep-disordered breathing is safe and results in high parent satisfaction

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ABSTRACT

INTRODUCTION: Sleep-disordered breathing in children is often associated with tonsillar hypertrophy. For many years, total tonsillectomy (TE) was the treatment of choice, but performing an intracapsular tonsillotomy (TT) is becoming increasingly widespread. In this Danish study, we have investigated the long-term results on efficacy and parent satisfaction after TT performed on children.

METHODS: This was a retrospective study based on a questionnaire that was sent to the parents of 335 children who underwent TT due to sleep-related obstructive symptoms.

RESULTS: A total of seven children had unilateral re-TT due to tonsillar regrowth, leaving a total of 342 operations performed. The response rate was 71% and the median follow-up was 90 months. None of the patients in this study experienced post-operative bleeding requiring medical assistance. A total of 97% of parents reported total or partial relief of all symptoms, whereas 3% experienced no effect of treatment on preoperative symptoms. A total of 5% of the children later underwent tonsillectomy after their primary TT. The majority of parents (89%) would choose the operation again in a similar situation.

CONCLUSIONS: TT has previously been shown to have a lower morbidity and risk of post-operative bleeding and a better recovery than TE. In this study, we found it to be a long-term efficient and safe treatment for children with obstructive symptoms during sleep and it was associated with a high degree of parent satisfaction.

FUNDING: none.

TRIAL REGISTRATION: This was a retrospective study.

Tonsillotomy (TT) (also partial tonsillectomy, intracapsular tonsillectomy or subtotal tonsillectomy) is partial removal of the tonsils. The procedure was common until the 1930s when it was largely replaced by complete tonsillectomy (TE) due to concerns about possible regrowth and disease due to retained tonsillar tissue. Since the late 1980s, the method has been reintroduced by several ear, nose and throat (ENT) surgeons, based on studies showing a lower morbidity and easier recovery after TT compared with TE [1, 2]. A reported lower risk of serious post-operative bleeding [3, 4] has increased interest in performing TT, especially in small children with sleep-disordered breathing (SDB) due to tonsillar hypertrophy. The symptoms of SDB range from mild snoring to obstructive sleep apnoea (OSA). They also include oral breathing, restless sleep with frequent awakenings, failure to thrive and behavioural disturbances [5-8].

In this Danish retrospective study, we wanted to investigate the long-term effects of TT as treatment for children with SDB measured by parent reports on long-term efficacy. In a private ENT practice, TT was performed in 335 small children suffering from SDB due to tonsillar hypertrophy with a median follow-up of 90 months.

METHODS

During the period from 1 January 2001 to 31 March 2011, TT was performed 342 times in a private ENT practice in Slagelse, Denmark, by two surgeons. A total of seven patients had a second unilateral operation performed due to unilateral regrowth of one tonsil, leaving a total patient number of 335.

This is a retrospective cohort study of children operated with TT alone or in combination with adenoidectomy and/or insertion of ventilation tubes. Children under the age of 15 were included in the study. They were elected for surgery based on the objective finding of tonsillar hypertrophy combined with parent-reported SDB and/or obstructive symptoms during eating. Children with a history of tonsillitis were not excluded.

Informed consent for surgery was obtained from all individual participants included in the study. The information to the parents also included the risk of post-operative bleeding and tonsillar regrowth causing recurrence of symptoms.

A total of four kinds (A-D) of surgical procedures (**Table 1**) were performed in general anaesthesia (Sevoflurane) with an oral endotracheal tube in situ.

Patients were observed for bleeding and general health in the clinic after surgery, and all patients left the clinic within two hours post-operatively. All parents were contacted by phone later on the day of surgery, and all had a direct phone number to the surgeon and instructions to call if they experienced bleeding during the post-operative period. Children were advised to stay at home for five days before returning to day-care or school. All patients had a post-operative clinical control within one month after surgery.

ORIGINAL ARTICLE

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A questionnaire (**Figure 1**) was sent out to all the parents of the 335 patients during weeks 39-40 in 2011. In cases where the questionnaire had not been returned after four weeks, a reminder letter was sent out.

The files of all 335 patients were evaluated for information about complications during surgery or in the post-operative period.

The study was not reported to the Ethics Committee since it did not involve further surgery, removal of tissue samples or direct patient contact. Answering the questionnaire was voluntary and all the parents had previously given verbal permission for them to be contacted for follow-up studies. Data retention was made in accordance with the guidelines for private practices.

Statistics

Descriptive statistics were calculated using the Excel 2013 (Microsoft) software.

Trial registration: This was a retrospective study.

RESULTS

A total of 244 questionnaires were returned and included in the analysis, corresponding to a 71% response rate. In the responder group, five patients underwent surgery twice and returned two questionnaires, one for each operation. Patient characteristics of both responders and non-responders are shown in Table 1. The majority of the children were under six years of age at the time of surgery (85%) and 95% were under eight years of age. The median follow-up time was 90 months (9-130 months). According to the patient files, no complications occurred during surgery, and all patients left the clinic within two hours after surgery.

A total of six parents did not answer question 2 (Q2) since they did not recall the preoperative symptoms. For the 238 parents who did answer this question, results are as presented in **Table 2**. According to the parents, most children suffered from more than one of the symptoms listed. In Q4, a total of six parents reported that bleeding occurred in the post-operative period. These six cases were investigated by a follow-up telephone call. This revealed that parents had answered "yes" because there had been a contact to the family doctor or the ENT surgeon, but in no cases was the reason bleeding; instead the causes were pain and eating problems. Thus, no events of bleeding requiring hospital admission or other kinds of medical intervention were observed among the patients, confirming the data from the patient files.

The majority of the parents recalled their child's post-operative pain as moderate or limited. Only 9% of the parents reported that the child had experienced severe pain post-operatively. Of the 244 responding parents, three did not recall the degree of post-operative pain.

Figure 2 shows to which degree the parents reported symptom relief after surgery (Q7). A total of six parents did not answer this question, leaving 238 responders. A total of 63% of these parents reported that after surgery their child was "completely" relieved from symptoms, whereas only 3% of the parents did "not at all" observe any relief.

The vast majority of the responding parents (89%) would again, in a similar situation, choose the same op-

TABLE 1

Characteristics of responders and non-responders. There was no difference in age distribution between the two groups with regards to the age at the time of surgery or the median period of follow-up. The distribution of the different surgical procedures was also comparable between the two groups.

	Total population (N = 342)	Responders (N = 244)
Sex, n		
Females	140	102
Males	202	142
Age at surgery, median (range), months	50 (12-195)	50 (18-180)
Follow-up period, median (range), months	94 (9-130)	90 (9-130)
Type of surgery, n (%)		
A: tonsillotomy[a]	12 (3.5)	9 (3.7)
B: adenotonsillotomy[b]	229 (67.0)	166 (68.0)
C: tonsillotomy and tubulation[c]	3 (0.9)	3 (1.2)
D: adenotonsillotomy and tubulation[d]	98 (28.7)	66 (27.0)

AE = adenoidectomy; TT = tonsillotomy; TU = tubulation.
a) The hypertrophic tonsils were reduced by ⅓-½, but no further than the level of the tonsillar pillars. An ERBE mono-polar bent-knife-electrode connected to an ERBE-ICC 30 Electro-surgical system was used.
A Davis Mouth Gag with a Teflon-coated blade and a Teflon-coated Blohmke Tonsil Grasping Forceps were also used during the operation in order to prevent burns on the tongue.
b) TT and in addition conventional AE were performed using a ring knife.
c) TT and in addition insertion of Beveled Bobbin ventilation TU in the eardrums in cases of chronic secretory otitis media.
d) TT + AE + TU.

TABLE 2

The answers to the question regarding the symptoms prior to surgery (question 2 in the questionnaire). Six parents among the responders did not answer this question. The main complaints prior to surgery were snoring with breathing pauses and recurrent tonsillitis with almost half of the parents reporting these two complaints. The least frequent complaint was asthma or bronchitis.

Preoperative symptoms	Parent reports, n (%)
Impaired sleep with frequent awakenings	85 (36)
Snoring with breathing pauses	102 (43)
Snoring without breathing pauses	67 (28)
Reduced appetite and/or difficulties with feeding	69 (29)
≥ 1 occurrences of acute tonsillitis	101 (42)
Asthma or bronchitis	58 (24)

eration for their child (Q8), whereas 3% would not again choose the operation, 9% would be in doubt and one parent did not answer this question.

To the question (Q9) of whether their child had tonsillitis requiring treatment with antibiotics after the operation, 73 parents (30%) reported "yes", 170 parents (70%) reported "no", whereas one parent did not remember.

Of the responding parents, 13 reported that their child had subsequently undergone TE (Q10), 228 parents answered "no" to this question, whereas three parents did not answer the question. With these reports, 5% of the TT children subsequently underwent TE within the follow-up period.

DISCUSSION

Our study is retrospective in nature and unfortunately as such it has some limitations. The questionnaire was sent out to all the parents at the same time, resulting in some of the parents receiving the questionnaire many years after surgery. This, of course, challenges the parent's ability to recall the preoperative and immediate post-operative symptoms. However, in all cases the indications for TT were symptoms of SDB and objective tonsillar hypertrophy. The results concerning post-operative pain scores and analgesic treatment are again somewhat uncertain since they depend upon the parents' long-term recollection. That being said, our results do correlate with those of other studies on this subject [2, 5, 6]. The fact that the questionnaire was sent out at the same time to all the parents results in a long median observation period, which illustrates the duration of the effect of the surgery.

The main purpose of this study was to evaluate safety and long-term parent-reported efficacy and satisfaction with TT in small children.

Among the 244 parents who returned the questionnaire, no cases of serious bleeding were reported, and revision of all the files of 335 patients revealed that no bleedings occurred at all. Low rates of post-operative haemorrhage have also been found in other studies. Mueller et al conducted a study of 431 patients who underwent TT and found post-operative haemorrhage in 0.7% with 0.2% needing additional surgery [9]. Koltai et al found post-operative haemorrhage in 1.7% of 243 children after TT [2]. Similar results were reported in several other studies including the Swedish "National Tonsil Surgery Register" where the report from 2009-2012 found post-operative haemorrhage in 1.6% of 7,860 children following TT [4, 6, 10]. This confirms that TT seems to be a safe procedure in regards to post-operative bleeding.

In a Danish study from 2006 based on 918 patients, Klug & Ovesen found a 2.8% rate of post-operative bleeding needing surgical intervention following TE [11]. Similar rates were found in a more recent Danish study from 2012 were Akin et al reported a rate of 3.4% in 1,365 patients after TE [12].

FIGURE 1

The questionnaire in English translation.

Questionnaire regarding your child´s former tonsil surgery

Q1: The child's birthweight: _____g

Q2: Which of the following symptoms did your child suffer from prior to the surgery? Please mark the categories that match your child, you can mark as many as you like.

- ☐ Impaired sleep with frequent awakenings
- ☐ Snoring with breathing pauses during sleep
- ☐ Snoring without breathing pauses during sleep
- ☐ Reduced appetite with eating difficulties
- ☐ One or more occurrences of tonsillitis
- ☐ Asthma or bronchitis

Q3: How was the level of information you received prior to the surgery?

- ☐ Very satisfactory
- ☐ Satisfactory
- ☐ Not satisfactory

Q4: Did bleeding from the throat occur after the surgery that required contact to a doctor?

- ☐ Yes
- ☐ No

Q5: How do you recall your child´s pain after the surgery?

1 2 3 4 5

Score 1-5 where 1 is "severe pain" and 5 denotes" little or no pain."

Q6: How many days after surgery did your child receive analgesic medication?

_____ days

Q7: To what extend did the operation cause a relief of symptoms?

1 2 3 4 5

Score 1-5 where 1 is "completely" and 5 denotes "not at all".

Q8: In a similar situation, would you then again choose the operation?

- ☐ Yes
- ☐ No
- ☐ I would be in doubt

Q9: Has your child had events of tonsillitis that required treatment with antibiotics (penicillin etc.) after the surgery?

- ☐ Yes
- ☐ No

If yes, how many times has your child had an infection, and when was the last time?

_____ times Date of latest infection: _____

Q10: Has your child subsequently undergone total tonsillectomy?

- ☐ Yes
- ☐ No

If yes, then where and when?

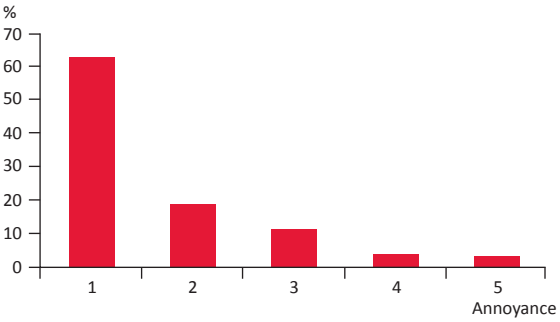
Date and location of surgery: _____

Q11: May we contact you later in case of further questions?

- ☐ Yes
- ☐ No

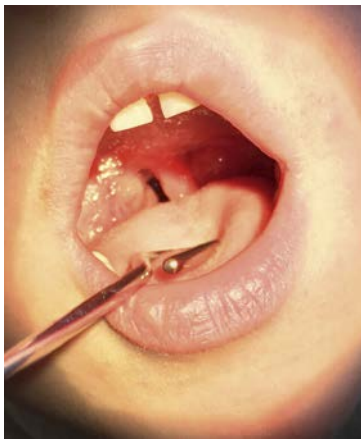
FIGURE 2

The parent-reported relieve of symptoms after surgery based on answers to question 7 in the questionnaire: "Did the operation relieve the symptoms?" The answers rank from 1 = complete absence from symptoms to 5 = no effect of surgery at all. Only 3% noted no effect at all.



In 2014, Østvoll et al conducted a retrospective cohort study in 82,527 patients in Sweden who underwent tonsil surgery in 2004-2011 and found two cases of fatal bleeding. One patient died after TE and the other after extensive TT [13]. Though the risk of fatal bleeding after tonsil surgery is low (1/41,263), it nevertheless needs to be kept in mind when deciding on surgery for children.

The bleedings after TE originate from the tonsillar bed which is not injured during TT. This is, in our opinion, of outmost importance when deciding the safest type of surgery for small children since post-operative bleedings are potentially more dangerous in children. In this study, only a third to half of the tonsil was removed, which is a small proportion of tissue compared with many other studies; this ensures that a good distance is maintained to the large vessels in the tonsillar capsule. This may be a reason for the very low rate of post-operative bleeding in this study.



Child with tonsillar hypertrophy and sleep-disordered breathing.

In our study, the parents reported a degree of symptom relief similar to that reported in other studies [2, 3, 5, 6]. While 63% of the parents reported that the operation completely relieved the symptoms, only 3% observed no kind of relief from symptoms in their children after the operation. Furthermore, the long median follow-up period of 90 months indicates that the effect of the operation is long lasting, even though following TT – in contrast to a well-performed TE – there is a risk of regrowth of the tonsils. In our study, 3% of the children needed an additional unilateral TT due to regrowth of one tonsil, and only in 13 of 241 cases (5%) was a TE later performed. We do not have data on the background for these later total tonsillectomies; hence, we cannot distinguish between whether the indication was hypertrophy of tonsils or recurrent tonsillitis.

Different TT techniques have different reports on the degree of tonsillar regrowth. In a study of radio frequency-assisted TT, Celenk et al [8] found a higher rate of regrowth (16.6%) than in most other studies. In a systematic review of 86 studies, Windfuhr et al found a 6% rate of regrowth and tonsillitis after TT, but only a third of these underwent additional surgery [14]. Other authors have compared the effect of TT with that of TE, reporting that results are comparable with respect to effect on obstruction and in favour of TT when considering post-operative pain and duration of the recovery period [3-5, 15]. Koltai et al [2] investigated 243 patients who underwent TT and compared them with 107 patients who had TE performed by the same surgeons. They found that the efficacy of TT was equal to that of TE, but TT was associated with less pain and fewer days were needed to return to normal activity. In a meta-analysis, Wang et al found that TT and TE were equal in terms of quality of life and in resolving obstructive symptoms, but after an average follow-up of 31 months, the risk ratio of SDB recurrence was 3.33 favouring TE [16]. Bitar & Rameh [15] found no symptom recurrence at 20 months after TT, but less post-operative pain and a higher short-term parental satisfaction than in the TE group. Ericsson et al [5] reported less post-operative pain in 35 children who underwent TT when compared with children subjected to TE in a randomised study. Improvement in symptoms, frequency of recurrent infections and improvement in phonology did not differ between the two groups.

In our study, the parents reported a high degree of satisfaction with the treatment since almost 90% would again choose TT under similar conditions. These results are equal to what Eisfeld et al found in a similar study [6]. In a Cochrane Review, Venekamp et al compared tonsil surgery with non-surgical management of SDB in children [17]. In the largest trial studied, they found that surgery was superior in regards to quality-of-life and

symptom relief compared with watchful waiting in children with OSA verified by a sleep study. Surprisingly, they found that the sleep study had normalised in almost half of the children in the non-surgical group after seven months, indicating that the condition may in some cases recover over time. The trial included children aged 5-9 years, and in our study 85% of the children were under six years of age at the time of surgery. The poor quality of life based on SDB may call for intervention years before any spontaneous recovery, but the possibility of spontaneous recovery must be kept in mind when deciding on the best treatment for the child.

CONCLUSIONS

TT seems to be a safe alternative to TE in small children with obstructive symptoms due to tonsillar hypertrophy, also when performed in a private ENT practice. In this study, we found no post-operative bleedings and a high degree of parent-reported relief of symptoms combined with a low degree of need for subsequent TE even in cases with a history of tonsillitis, thus supporting the long-term efficacy of TT.

Despite recent research on this subject, the surgery of choice for American children with SDB remains TE in 73% of the cases [18]. In Denmark, TT is becoming increasingly widespread as treatment for SDB in children also in a hospital setting, but is still not the treatment of choice in all ENT departments despite the numerous good results from TT. This proves that there is a continuing need for studies in different settings, like our non-hospital specialised practice setting, to explore the safety and long-term efficacy of TT for children with SDB.

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LITERATURE

1. Ericsson E, Wadsby M, Hultcrantz E. Pre-surgical child behavior ratings and pain management after two different techniques of tonsil surgery. Int J Pediatr Otorhinolaryngol 2006;70:1749-58.
2. Koltai PJ, Solares CA, Koempel JA et al. Intracapsular tonsillar reduction (partial tonsillectomy): reviving a historical procedure for obstructive sleep disordered breathing in children. Otolaryngol Head Neck Surg 2003;129: 532-38.
3. Reichel O, Mayr D, Winterhoff J et al. Tonsillotomy or tonsillectomy? A prospective study comparing histological and immunological findings in recurrent tonsillitis and tonsillar hyperplasia. Eur Arch Otorhinolaryngol 2007;264:277-84.
4. Gjensidige. Årsrapport 2012. Sweden: Nationellt kvalitetsregister, Öron-, Näs- och Halssjukvård, 2012.
5. Ericsson E, Lundeborg I, Hultcrantz E. Child behavior and quality of life before and after tonsillotomy versus tonsillectomy. Int J Pediatr Otorhinolaryngol 2009;73:1254-62.
6. Eisfeld W, Amler S, Deitmer T. Langzeitergebnisse nach Tonsillotomie im Kindesalter. Laryngorhinootologie 2010;89:466-72.
7. Wireklint S, Ericsson E. Health-related quality of life after tonsillotomy versus tonsillectomy in young adults: 6 years postsurgery follow-up. Eur Arch Otorhinolaryngol 2012;269:1951-8.
8. Celenk F, Bayazit YA, Yilmaz M et al. Tonsillar regrowth following partial tonsillectomy with radiofrequency. Int J Pediatr Otorhinolaryngol 2008; 72:19-22.
9. Mueller J, Boeger D, Buentzel J et al. Population-based analysis of tonsil surgery and postoperative hemorrhage. Eur Arch Oto-Rhino-Laryngology 2014;272:3769-77.
10. Eviatar E, Kessler A, Shlamkovitch N et al. Tonsillectomy vs. partial tonsillectomy for OSAS in children – 10 years post-surgery follow-up. Int J Pediatr Otorhinolaryngol 2009;73:637-40.
11. Klug TE, Ovesen T. Blødning efter tonsillektomi: hyppighed og risikofaktorer. Ugeskr Læger 2006;168:2559-62.
12. Akin RC, Holst R, Schousboe LP. Risk factors for post-tonsillectomy haemorrhage. Acta Otolaryngol 2012;132:773-7.
13. Østvoll E, Sunnergren O, Ericsson E et al. Mortality after tonsil surgery, a population study, covering eight years and 82,527 operations in Sweden. Eur Arch Oto-Rhino-Laryngology 2015;272:737-43.
14. Windfuhr JP, Savva K, Dahm JD et al. Tonsillotomy: facts and fiction. Eur Arch Oto-Rhino-Laryngology 2015;272:949-69.
15. Bitar MA, Rameh C. Microdebrider-assisted partial tonsillectomy: short- and long-term outcomes. Eur Arch Otorhinolaryngol 2008;265:459-63.
16. Wang H, Fu Y, Feng Y et al. Tonsillectomy versus tonsillotomy for sleep-disordered breathing in children: a meta analysis. PLoS One 2015;10: e0121500.
17. Venekamp RP, Hearne BJ, Chandrasekharan D et al. Tonsillectomy or adenotonsillectomy versus non-surgical management for obstructive sleep-disordered breathing in children. Cochrane Database Syst Rev 2015;10:CD011165.
18. Isaacson G. Pediatric tonsillectomy: an evidence-based approach. Otolaryngol Clin North Am 2014;47:673-90.