

# Evaluation of day-care tonsil surgery in young children

Andrea M. Bruaset<sup>1</sup>, Michael Dahlstrøm<sup>2</sup>, Sören Möller<sup>3,4</sup> & Anette Drøhse Kjeldsen<sup>1</sup>

## ABSTRACT

**INTRODUCTION:** The National Clinical Guideline for Tonsillectomy (Danish Health Authority, 2016) suggests inpatient admission after elective tonsil surgery in patients aged < 4 years at the time of surgery. We aimed to evaluate the safety of tonsil surgery as day surgery in children ≤ 4 years of age.

**METHODS:** The charts of 414 patients aged 2-15 years who underwent elective tonsillectomy, adenotonsillectomy or tonsillotomy at Svendborg Hospital, Denmark, from February 2010 to April 2015 were reviewed in a retrospective cohort. We investigated post-operative complications, defined as post-operative haemorrhage and unplanned contacts or revisits to the hospital.

**RESULTS:** A total of 389 patients were divided into two groups by age (≤ 4/>4 years). In all, 108 patients contacted or revisited the hospital after discharge. Patients aged < 4 years accounted for the majority of contacts unrelated to bleeding and associated with complaints of pain and pain medication. Haemorrhage occurred in 22 (5.7%) patients, 19 of whom were > 4 years. The rates of haemorrhage, readmission and secondary surgery were significantly higher in patients aged > 4 years than in the remaining patients.

**CONCLUSIONS:** Patients ≤ 4 years experienced significantly less haemorrhage but had more unplanned contacts than patients > 4 years. For reassurance of caretakers, easy access to telephone contact with hospital staff in the post-operative period is important.

**FUNDING:** none.

**TRIAL REGISTRATION:** not relevant.

Tonsil surgery is among the most frequently performed procedures by otolaryngologists. More than 7,000 tonsillectomies are performed in Denmark annually [1], and the majority of patients are under the age of 20 years [2]. Frequent complications following tonsil surgery are post-tonsil surgery haemorrhage, pain, nausea/vomiting and insufficient intake of fluid and nutrition. Haemorrhage is potentially life-threatening and recognised as the most severe outcome. International studies report incidences of haemorrhage ranging 2.3-4.8% [3-5]. Day-care surgery is defined as a surgical procedure that does not require overnight hospital stay.

The present clinical guideline on tonsillectomy in

Denmark recommends inpatient admission after elective tonsil surgery in patients who are four years of age or younger at the time of surgery [1].

At Svendborg Hospital in the county of Funen, Denmark, we have experience with day-care tonsil surgery in patients aged 2-15 years, and have not observed an increased risk of post-operative complications in the youngest children. Our main objective was to investigate the prevalence of complications in patients who are four years of age or younger at the time of surgery, compared with patients aged more than four years to determine if day-care tonsil surgery is safe in toddlers.

Most studies agree on a higher risk of haemorrhage in older paediatric patients [6-8], but not many studies have assessed the frequency of complications in toddlers alone. A secondary objective of our study was therefore to provide national data on the complication rates in the youngest paediatric patients following elective tonsil surgery.

## METHODS

### Study design

A retrospective cohort study was carried out on electronic charts, selected using the NOMESCO Classification of Surgical Procedures (NCSP) codes for adenotonsillectomy, tonsillectomy or tonsillotomy (EMB10, EMB20, EMB15) in patients aged 2-15 years.

### Ethical considerations

The study was approved by the Danish Health Authority (Project 3-3013-1820/1) and by the Danish Data Protection Agency (18/61781). No selection besides the eligibility criteria was used. All patients were assigned numerical non-identifying project IDs during the study period.

### Sample

The electronic charts of 414 patients were reviewed. We included all patients aged 2-15 years who had undergone adenotonsillectomy, tonsillectomy or tonsillotomy at Svendborg Hospital between February 2010 and April 2016. The exclusion criteria were acute indication for surgery, unilateral tonsillectomy only and missing chart data. A total of 25 patients were excluded due to cancelled surgery (n = 8), acute indication (ton-

## ORIGINAL ARTICLE

- 1) Department of ENT, Head and Neck Surgery, Odense University Hospital
- 2) Department of ENT, Head and Neck Surgery, Svendborg Hospital
- 3) OPEN - Odense Patient Data Explorative Network, Odense University Hospital
- 4) Department of Clinical Research, University of Southern Denmark, Denmark

Dan Med J  
2019;66(3):A5536

sillectomy à chaud,  $n = 8$ ), missing records ( $n = 7$ ) and unilateral tonsillectomy only (2). A sample of 389 patients was subsequently analysed, producing a representative sample of Danish children undergoing tonsil surgery.

In every case, the procedure was performed under general anaesthesia with oral intubation, using a Boyle-Davis gag.

The surgery was performed by several different surgeons using either cold-steel dissection with bipolar electrocoagulation (diathermy) or coblation technique.

The charts were reviewed according to the following variables: age at the time of surgery, gender, date of surgery, charge of surgeon (specialist or trainee), indication for surgery, extent of surgery (adenotonsillectomy, tonsillectomy or tonsillotomy), surgical technique (coblation or cold-steel dissection), duration of surgery and frequency of complications. The minimum follow-up was one year.

Complications were defined as any unplanned contact or revisit to the hospital after discharge. Considered were the reasons for contact or revisit, the type of contact (telephone, in person directly at hospital or in person through the emergency department) and the outcome of the contact (telephone consultation, treat-and-release, planned follow-up, readmission, secondary surgery for haemostasis).

The indications for surgery were chronic tonsillitis (duration 1-2 years), tonsil hypertrophy causing upper airway obstruction (obstructive sleep apnoea, snoring), persistent foul taste or breath due to chronic tonsillitis that was unresponsive to medical treatment, acute recurrent tonsillitis (3-4 incidences a year for  $> 2$  years), as well as suspected malignancy of the tonsils.

All cases of haemorrhage resulting in hospital contact after discharge were recorded, as were also cases of haemorrhage occurring at the ward before discharge. This included haemorrhage that did not require intervention to stop the bleeding.

### Statistical analysis

Univariate associations with categorical data were analysed using Chi-squared- tests for cross-tabulations. We carried out a multivariate logistic regression to estimate odds ratios (OR) with 95% confidence intervals (CI) for the risk of complications (haemorrhage and unplanned contacts or revisits) with respect to age and weight, adjusted for extent of surgery. In an extended model, we moreover adjusted for surgical technique, indication for surgery and charge of surgeon. We evaluated the fit of the logistic regression models by a specification link test as well as by calculating leverage and Delta-Beta influence statistics [9]. Numerical variables were compared between groups by the two-sample t-test.

We accepted  $p < 0.05$  as statistically significant. Data were processed in SPSS 24.0, STATA 14.2 and Microsoft Excel.

*Trial registration:* not relevant.

## RESULTS

### Subjects

The subjects are presented in **Table 1**. There was a significant gender difference with respect to the age of the patients by gender; the female patients being older (female mean age 7.5 years, standard deviation (SD) =  $\pm 4.0$  years, male mean age 5.8 years, SD =  $\pm 3.4$  years,  $p < 0.01$ ). Mean duration of surgery, defined as the time the patient was under anaesthesia, was 33 min., with 66 patients being operated in 20 min. or less. The mean age for patients who underwent adenotonsillectomy was five years (SD =  $\pm 2.3$  years), and nine years (SD =  $\pm 4.0$  years) for tonsillectomy, with a significant difference of 4.2 years ( $p < 0.01$ ).

The 389 patients were divided into two groups by age at the time of surgery, "age  $\leq 4$  years" ( $n = 187$ ) and "age  $> 4$  years" ( $n = 202$ ). Hypertrophic tonsils was a significantly more likely indication for surgery in patients aged  $\leq 4$  years than in patients aged  $> 4$  years (OR = 3.7 (95% CI: 2.6-5.7),  $p < 0.001$ ). Among all patients with hypertrophic tonsils, 14 had obstructive sleep apnoea, 12 of whom were  $\leq 4$  years of age.

### Direct admission after surgery

The patients could be moved from the recovery room to the ward for observation until the following day if they experienced severe pain, difficulty swallowing or on request from the primary caretakers. Pain was initially managed with non-steroidal anti-inflammatory drugs and paracetamol. In this study, 10.5% ( $n = 41$ ) of all patients were admitted to the ward directly after surgery, of whom 6.7% ( $n = 26$ ) were  $\leq 4$  years of age and 3.9% ( $n = 15$ ) were  $> 4$  years of age. Patients aged  $\leq 4$  years were more likely to be admitted than patients aged  $> 4$  years ( $p < 0.04$ , OR = 2.0 (95% CI: 1.0-3.9)). The average duration of admittance was 20 h for patients  $\leq 4$  years of age and 6 h for patients  $> 4$  years of age.

### Post-operative haemorrhage

A total of 22 (5.7%) patients experienced haemorrhage. The majority were  $> 4$  years of age, so that 9.4% of all patients  $> 4$  years of age and 1.6% of patients  $\leq 4$  years of age experienced haemorrhage. The mean time from surgery to haemorrhage was 7.15 h (range: 1.0-12.0 h, SD =  $\pm 4.92$  h) for haemorrhage occurring within 24 h after surgery. Two haemorrhages occurred in the recovery room. For haemorrhage occurring after 24 h, the mean time was 6.6 days (range: 1.0-16.0 days, SD =  $\pm 3.61$  days).

Out of 389 patients, 16 (4.1%) were readmitted. One was  $\leq 4$  years old (0.5% out of 187), while the remaining 15 were  $> 4$  years old (7.4% out of 202). The difference in re-admittance rate was significant ( $p < 0.001$ , OR = 0.1 (95% CI: 0.0-0.05)). Six patients

(1.5%) underwent secondary surgery for haemostasis, all  $> 4$  years of age. Only one patient  $\leq 4$  years of age was readmitted and did not undergo secondary surgery. The difference in rate of secondary surgery was significant ( $p < 0.05$ , OR = 1.0 (95% CI: 0.1-1.1)).

**TABLE 1**

	All patients (N <sub>tot</sub> = 389)	Age $\leq 4$ yrs (N <sub>1</sub> = 187)	Age $> 4$ yrs (N <sub>2</sub> = 202)	Patient characteristics.
Age, mean ( $\pm$ SD) [range], yrs	6.5 ( $\pm$ 3.8) [2.0-15.9]	3.6 ( $\pm$ 0.8) [2.0-5.0]	9.3 ( $\pm$ 3.3) [5.0-15.9]	
<i>Weight</i>				
Mean, median ( $\pm$ SD) [range], kg	25.7, 20.0 ( $\pm$ 14.6) [10.0-81.0]	16.1, 16.0 ( $\pm$ 3.1) [10.0-28.0]	34.6, 30.0 ( $\pm$ 15.5) [13.0-81.0]	
$\leq 20$ kg, n (%)	207 (53)	173 (93)	34 (17)	
$> 20$ kg, n (%)	179 (46)	13 (7)	166 (82)	
Missing, n	3	1	2	
<i>Gender, n (%)</i>				
Male	213 (55)	116 (62)	97 (48)	
Female	176 (45)	71 (38)	105 (52)	
Missing	0			
<i>Indication, n (%)</i>				
Chronic tonsillitis	170 (44)	56 (30)	114 (56)	
Tonsil hypertrophy	200 (51)	127 (68)	73 (36)	
Persistent foul taste/ breath	4 (1)	0	4 (2)	
Acute recurrent tonsillitis	10 (3)	4 (2)	6 (3)	
Suspected malignancy	4 (1)	0	4 (2)	
PFAPA	1 (0.3)	0	1 (0.5)	
Missing	0			
<i>Surgery, n (%)</i>				
Adenotonsillectomy	213 (55)	133 (71)	80 (40)	
Tonsillectomy	157 (40)	36 (19)	121 (60)	
Tonsillotomy	19 (5)	18 (10)	1 (0.5)	
Missing	0			
<i>Technique, n (%)</i>				
Coblation	330 (85)	153 (82)	177 (88)	
Cold steel dissection	59 (15)	34 (18)	25 (12)	
Missing	0			
<i>Surgeon, n (%)</i>				
Specialista	214 (55)	108 (58)	106 (52)	
Traineeb	174 (45)	79 (42)	95 (47)	
Missing	1	0	1	
<i>Comorbidity, n (%)</i>				
Asthma and asthmatic bronchitis	40	29	11	
Epilepsy and spastic diseases	5	4	1	
Immunodeficiency	4	2	2	
Lymphangioma	1	1	0	
Congenital disorders	3	2	1	
Neurofibromatosis type 1	1	1	0	
Kawasaki's disease	1	1	0	
Recurrent fever syndrome	4	3	1	
<i>Duration of surgery</i>				
Mean, median ( $\pm$ SD) [range], min.	33, 30 ( $\pm$ 16.0) [5-142]	-	-	
Missing data, n	33	-	-	

PFAPA = periodic fever, aphthous stomatitis, pharyngitis, cervical adenitis; SD = standard deviation.

a) Consultant, staff.

b) Resident or senior resident

No patients were readmitted for any other reason than haemorrhage.

The 20 cases of haemorrhage that occurred after discharge produced four contacts by telephone, seven contacts in person directly to the ward and nine in person to the emergency room. The hospital responses were four treat-and-release and 16 readmissions. The duration of readmission ranged 14-42 h.

We excluded the patients who underwent tonsillectomy in an analysis and still found a higher rate of bleeding in patients > 4 years of age ( $p = 0.01$ , OR = 5.8 (95% CI: 1.7-19.9)). The univariate and multivariate analyses (**Table 2** and **Table 3**) consistently concluded that age > 4 years was associated with a higher occurrence of haemorrhage after tonsil surgery than age < 4 years.

#### Unplanned contacts and revisits after discharge

We found that 108 (28%) of all patients had unplanned contacts and revisits to the hospital. Excluding the already assessed cases of haemorrhage, the remaining 88 (23%) unplanned contacts and revisits are included in

univariate and multivariate analysis (**Table 3** and **Table 4**). At age  $\leq 4$  years, adenotonsillectomy and cold-steel dissection were more likely to produce an unplanned contact or revisit to the hospital than tonsillectomy and coblation. We investigated for differences in the frequency of cold-steel dissection technique in adenotonsillectomy and tonsillectomy and found no significant results.

Most contacts and revisits occurred five days after surgery (median = 5.0 days, SD =  $\pm 25.0$  days) with no considerable difference between the two age groups. Among the 88 contacts, enquiries were regarding pain (69%), fever (22%), complaints of nausea and cough, and the reoccurrence of obstructive sleep apnoea in two patients, with no significant difference between the age groups. The type of contact was telephone in 84 of the cases, and four patients  $\leq 4$  years of age presented directly at the ward. The response to contact was a telephone consultation in 57, treat-and-release in eight (six of whom were  $\leq 4$  years), planned follow-up in three and prescription of pain medication in 20 cases.

**TABLE 2**

Results of univariate analysis. Comparison of haemorrhage and no haemorrhage (N = 389).

	Haemorrhage, n	Observations, n	Missing data, n	Haemorrhage, %	p-value	OR (95% CI)
<i>Age</i>	-	-	0	-	< 0.001	0.2 (0.05-0.5)
$\leq 4$ yrs	3	187	-	1.6		
> 4 yrs	19	202	-	9.4		
<i>Gender</i>	-	-	0	-	0.4	1.5 (0.6-3.6)
Female	12	176	-	6.8		
Male	10	213	-	4.7		
<i>Surgeon</i>	-	-	1	-	0.5	1.4 (0.5-3.3)
Specialist	14	214	-	6.5		
Trainee	8	174	-	4.6		
<i>Technique</i>	-	-	0	-	0.6	1.8 (0.4-8.1)
Coblation	20	330	-	6.1		
Cold-steel dissection	2	59	-	3.4		
<i>Surgery I</i>	-	-	0	-	0.2	1.1 (1.0-1.1)
Tonsillectomy	0	19	-	0.0		
Tonsillectomy	14	157	-	9.0		
<i>Surgery II</i>	-	-	0	-	0.04	0.3 (0.2-0.9)
Adenotonsillectomy	8	213	-	3.8		
Tonsillectomy	14	157	-	9.0		
<i>Indication I</i>	-	-	1	-	0.5	1.3 (0.6-3.1)
Chronic tonsillitis	11	170	-	6.5		
Non-chronic tonsillitis	11	218	-	5.0		
<i>Indication II</i>	-	-	1	-	0.7	0.8 (0.3-1.8)
Hypertrophic tonsils	10	200	-	5.0		
Non-hypertrophic tonsils	12	188	-	6.4		
<i>Weight</i>	-	-	3	-	0.01	0.3 (0.1-0.8)
$\leq 20$ kg	6	207	-	2.9		
> 20 kg	16	179	-	8.9		

CI = confidence interval; OR = odds ratio.

## DISCUSSION

This study sought to record the complications, defined as haemorrhage and unplanned contacts and revisits to the hospital, following tonsil surgery in paediatric patients. The obtained information was used to assess the safety of day-care tonsil surgery in toddlers. We found the rates of complications to be significantly different in the two age groups. While patients  $\leq 4$  years of age had a higher number of contacts and revisits after surgery, patients  $> 4$  years of age recorded higher rates of haemorrhage, readmission and secondary surgery.

### Rate of post-tonsillectomy haemorrhage

The overall incidence of haemorrhage in our study (5.7%) is higher than expected compared with previous international (2.3-4.8%) and national (5.2%) results [10]. In patients  $\leq 4$  years of age, the incidence of haemorrhage was low. However, recent Scandinavian lethal cases of post-tonsil surgery haemorrhage underline the relevance of this study [11]. Studies show mor-

tality rates following tonsillectomy with or without adenoidectomy of 1/27,000-1/35,000 [12-14]. A registry-based Swedish study found two fatal adverse events in 82,527 tonsil surgeries; both children aged four years or younger. In both cases, the mechanism of death was bleeding leading to haemodynamic failure. Haemorrhage occurred at day 3 and 6 after surgery.

Higher patient age has consistently been described as a risk factor for post-tonsillectomy haemorrhage [3, 7, 8, 15], but the incidence of haemorrhage in patients  $> 4$  years (9.4%) was especially striking in our study. Literature suggests that the coblation technique is a clinical risk factor for haemorrhage [5, 7, 16]. While we found a non-significant association between coblation and haemorrhage in our statistical analysis, we hope that our results will inspire further research. Tonsillotomy is associated with a lower risk of haemorrhage than tonsillectomy [17]; therefore, the choice of tonsillectomy as tonsil surgery may become more rare in the future.

**TABLE 3**

	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
<i>Haemorrhage</i>				
Age $> 4$ yrs	1 <sup>a</sup>	1 <sup>a</sup>	-	-
Age $\leq 4$ yrs	0.12 (0.03-0.56)**	0.12 (0.03-0.55)**	-	-
Weight $> 20$ kg	-	-	1 <sup>a</sup>	1 <sup>a</sup>
Weight $\leq 20$ kg	-	-	0.31 (0.10-0.92)*	0.30 (0.10-0.90)*
Adenotonsillectomy	1 <sup>a</sup>	1 <sup>a</sup>	1 <sup>a</sup>	1 <sup>a</sup>
Tonsillectomy	1.40 (0.55-3.57)	1.56 (0.59-4.12)	1.61 (0.62-4.23)	1.78 (0.66-4.80)
Tonsillotomy	NA	NA	NA	NA
Coblation	-	1 <sup>a</sup>	-	1 <sup>a</sup>
Cold steel dissection	-	0.68 (0.14-3.25)	-	0.70 (0.15-3.34)
Non-chronic tonsillitis	-	1 <sup>a</sup>	-	1 <sup>a</sup>
Chronic tonsillitis	-	0.74 (0.29-1.89)	-	0.76 (0.30-1.96)
Specialist	-	1 <sup>a</sup>	-	1 <sup>a</sup>
Trainee	-	0.64 (0.25-1.64)	-	0.64 (0.25-1.64)
<i>Unplanned revisits and contacts</i>				
Age $> 4$ yrs	1 <sup>a</sup>	1 <sup>a</sup>	-	-
Age $\leq 4$ yrs	1.92 (1.14-3.23)*	1.84 (1.07-3.16)*	-	-
Weight $> 20$ kg	-	-	1 <sup>a</sup>	1 <sup>a</sup>
Weight $\leq 20$ kg	-	-	2.24 (1.3-3.84)**	2.05 (1.17-3.60)*
Adenotonsillectomy	1 <sup>a</sup>	1 <sup>a</sup>	1 <sup>a</sup>	1 <sup>a</sup>
Tonsillectomy	0.78 (0.46-1.34)	0.69 (0.39-1.22)	0.84 (0.49-1.46)	0.73 (0.41-1.29)
Tonsillotomy	0.48 (0.15-1.53)	0.60 (0.19-1.96)	0.53 (0.17-1.66)	0.65 (0.20-2.10)
Coblation	-	1 <sup>a</sup>	-	1 <sup>a</sup>
Cold steel dissection	-	3.70 (1.93-7.13)***	-	3.53 (1.83-6.82)***
Non-chronic tonsillitis	-	1 <sup>a</sup>	-	1 <sup>a</sup>
Chronic tonsillitis	-	1.37 (0.80-2.32)	-	1.38 (0.81-2.34)
Specialist	-	1 <sup>a</sup>	-	1 <sup>a</sup>
Trainee	-	0.82 (0.49-1.38)	-	0.82 (0.49-1.38)

Results of multivariate logistic regression carried out on post-tonsil surgery haemorrhage and unplanned contacts and revisits, respectively.

CI = confidence interval; NA = not applicable, events are too few for analysis; OR = odds ratio.

\*)  $p < 0.05$  \*\*);  $p < 0.01$  \*\*\*);  $p < 0.001$ .

a) Reference.

*Unplanned contacts and revisits in all patients*

Identifying post-operative complications after tonsillectomy is of interest to hospitals as it has an impact on costs, management, staff and primary caretakers. Our study revealed that most contacts and revisits were enquiries regarding pain. Cold-steel dissection was associated with more unplanned contacts and revisits than coblation. The higher temperature in regular diathermy (400-600 °C) induces more tissue damage [16], and thus more pain than coblation (60-70 °C).

The inclusion of telephone inquiries produced a higher rate of unplanned contacts (28%) than reported in international studies (10.5-15%) [18, 19].

**Limitations**

Reported incidences of haemorrhage vary greatly (0.5-15%) [17, 20]. This is mainly due to the inconsistency in the definition of post-tonsil surgery haemorrhage. We used a broad definition of haemorrhage in our study, which allowed for a comprehensive reporting of haemorrhage in paediatric patients, but we did not investigate the severity of the events.

We included all hospital contacts to our facilities but cannot exclude that some patients may have contacted other healthcare institutions.

The retrospective design of the study offers some disadvantages as it opens the possibility of misclassification bias and confounding. Also, when an outcome is rare, like haemorrhage in this study, a larger cohort is required to obtain precise effect estimates.

**CONCLUSIONS**

We found no evidence that day-care tonsil surgery adds to the inherent risk of tonsil surgery in patients aged ≤ 4 years. We found an overall rate of haemorrhage in children aged > 4 years that was higher than national and international records, while patients aged ≤ 4 years had a higher frequency of unplanned contacts and revisits that were unrelated to bleeding after discharge and a higher direct admittance to ward after surgery than the remaining age groups.

Day-care tonsil surgery is safe, provided direct admission is available when needed, along with easy access to telephone contact with hospital staff in the post-

**TABLE 4**

Results of univariate analysis. Comparison of unplanned contacts and revisits that were unrelated to bleeding, and no contact (N = 389).

	Revisits or contacts, n	Observations, n	Missing data, n	Revisits, %	p-value	OR (95% CI)
<i>Age</i>	-	-	0	-	0.001	2.3 (1.4-3.7)
≤ 4 yrs	56	187	-	29.9		
> 4 yrs	32	202	-	15.8		
<i>Gender</i>	-	-	0	-	0.017	0.5 (0.3-0.9)
Female	30	176	-	17.0		
Male	58	213	-	27.2		
<i>Surgeon</i>	-	-	1	-	0.177	0.7 (0.5-1.2)
Specialist	43	214	-	20.1		
Trainee	45	174	-	25.9		
<i>Technique</i>	-	-	0	-	< 0.001	0.321 (0.2-0.6)
Coblation	63	330	-	19.1		
Cold-steel dissection	25	59	-	41.7		
<i>Surgery I</i>	-	-	0	-	0.315	0.3 (0.04-2.2)
Tonsillotomy	1	19	-	5.3		
Tonsillectomy	26	157	-	16.6		
<i>Surgery II</i>	-	-	0	-	0.007	2 (1.2-3.4)
Adenotonsillectomy	61	213	-	28.6		
Tonsillectomy	26	157	-	16.6		
<i>Indication I</i>	-	-	1	-	0.266	0.8 (0.5-1.2)
Chronic tonsillitis	34	170	-	20.0		
Non-chronic tonsillitis	54	218	-	24.8		
<i>Indication II</i>	-	-	1	-	0.184	1.4 (0.9-2.3)
Hypertrophic tonsils	51	200	-	25.5		
Non-hypertrophic tonsils	37	188	-	19.7		
<i>Weight</i>	-	-	3	-	< 0.001	2.4 (1.4-3.9)
≤ 20 kg	61	207	-	29.5		
> 20 kg	27	179	-	15.1		

CI = confidence interval; OR = odds ratio.

operative week, and thorough education of patients and caretakers before surgery.

**CORRESPONDENCE:** Anette Drøhse Kjeldsen.

E-mail: anette.kjeldsen@rsyd.dk

**ACCEPTED:** 18 January 2019

**CONFLICTS OF INTEREST:** none. Disclosure forms provided by the authors are available with the full text of this article at Ugeskriftet.dk/dmj

#### LITERATURE

1. Danish Health Authority. National klinisk retningslinje for fjernelse af mandler (tonsillektomi). 2016. <https://www.sst.dk/da/udgivelse/2016/~media/E9A0CDD19A7E461C8A6C061504FE0355.ashx> (23 May 2017).
2. Vestergaard H, Wohlfahrt J, Westergaard T et al. Incidence of tonsillectomy in Denmark, 1980 to 2001. *Pediatr Infect Dis J* 2007;26:1117-21.
3. Windfuhr JP, Chen YS. Hemorrhage following pediatric tonsillectomy before puberty. *Int J Pediatr Otorhinolaryngol* 2001;58:197-204.
4. Harounian JA, Schaefer E, Schubart J et al. Pediatric adenotonsillectomy and postoperative hemorrhage: Demographic and geographic variation in the US. *Int J Pediatr Otorhinolaryngol* 2016;87:50-4.
5. Lowe D, van der Meulen J, Cromwell D et al. Key messages from the National Prospective Tonsillectomy Audit. *Laryngoscope* 2007;117:717-24.
6. Söderman A-CH, Odhagen E, Ericsson E et al. Post-tonsillectomy haemorrhage rates are related to technique for dissection and for haemostasis. An analysis of 15734 patients in the National Tonsil Surgery Register in Sweden. *Clin Otolaryngol* 2015;40:248-54.
7. Lane JC, Dworkin-Valenti J, Chiodo L et al. Postoperative tonsillectomy bleeding complications in children: a comparison of three surgical techniques. *Int J Pediatr Otorhinolaryngol* 2016;88:184-8.
8. Windfuhr JP. Specified data for tonsil surgery in Germany. *GMS Curr Top Otorhinolaryngol Head Neck Surg* 2016;15:Doc08.
9. Pregibon D. *Annals of Statistics* 1981;9:705-24.
10. Klug TE, Ovesen T. Blødning efter tonsillektomi: hyppighed og risikofaktorer. *Ugeskr Læger* 2006;168:2559-62.
11. Norwegian Board of Health Supervision. Endelig rapport: alvorlige blødninger hos to barn etter mandeloperasjon- fikk ikke forsvarlig helsehjelp. 2017. <https://www.helsetilsynet.no/presse/nyhet-sarkiv/2017/alvorlige-blodninger-hos-to-barn-etter-mandeloperasjon-fikk-ikke-forsvarlig-helsehjelp/> (09 Mar 2017).
12. Goldman JL, Baugh RF, Davies L et al. Mortality and major morbidity after tonsillectomy. *Laryngoscope* 2013;123:2544-53.
13. Isaacson G. Pediatric tonsillectomy: an evidence-based approach. *Otolaryngol Clin North Am* 2014;47:673-90.
14. Østvoll E, Sunnergren O, Ericsson E. Mortality after tonsil surgery, a population study, covering eight years and 82,527 operations in Sweden. *Eur Arch Otorhinolaryngol* 2015;737-43.
15. Windfuhr JP. Serious complications following tonsillectomy: how frequent are they really? *ORL Otorhinolaryngol Relat Spec* 2013;75:166-73.
16. Heidemann CH, Wallén M, Aakesson M et al. Post-tonsillectomy hemorrhage: assessment of risk factors with special attention to introduction of coblation technique. *Eur Arch Otorhinolaryngol* 2009;266:1011-5.
17. Sarny S, Ossimitz G, Habermann W et al. Hemorrhage following tonsil surgery: a multicenter prospective study. *Laryngoscope* 2011;121:2553-60.
18. Tumin D, Walia H, Raman VT et al. Acute care revisits after adenotonsillectomy in a pediatric Medicaid population in Ohio. *Int J Pediatr Otorhinolaryngol* 2017;94:17-22.
19. Edmonson MB, Eickhoff JC, Zhang C. A population-based study of acute care revisits following tonsillectomy. *J Pediatr* 2015;166:607-12.
20. Kværner KJ. Benchmarking surgery: secondary post-tonsillectomy hemorrhage 1999-2005. *Acta Otolaryngol* 2009;129:195-8.