Increasing Readmission Rates for Hemorrhage after Tonsil Surgery: A Longitudinal (26 Years) National Study

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Sponsorships or competing interests that may be relevant to content are disclosed at the end of this article.

Abstract

Objective. To investigate the readmission rates due to postoperative hemorrhage in relation to tonsil surgery clinical practice in a national population.

Study Design. Retrospective longitudinal population-based cohort study.

Setting. Based on register data from the Swedish National Patient Register (NPR).

Subjects and Methods. All benign tonsil operations (256 053) performed in Sweden from 1987 to 2013 were identified through a search in the NPR. For all identified cases, data on gender, age, date of surgery, indication, type of surgery, level of care, length of stay (LOS) for inpatient surgery, readmission and reoperation because of postoperative bleeding (within 31 days) were collected.

Results. Overall frequency of readmission for hemorrhage was 2.61%, and the reoperation rate for hemostasis was 0.84%. The longitudinal analysis showed an increase from 1% (1987) to 5% (2013) in readmissions caused by hemorrhage. Tonsillectomies, surgery performed for infectious disease, and surgery on adult patients (age >18 years) showed readmission rates approaching 10% (2013). Male gender, increasing age, tonsillectomy, infectious indication, and recent year of surgery were identified as risk factors for readmission and reoperation due to hemorrhage. An increasing share of patients readmitted for hemorrhage underwent reoperation for hemostasis: 18% (1987) versus 43% (2013).

Conclusion. Readmissions for hemorrhage have increased by a factor of 5 in Sweden from 1987 to 2013. The design of the study and the data in NPR do not allow determination of the true reasons behind the alarming results.

Keywords
tonsillectomy, adenotonsillectomy, tonsillotomy, tonsil surgery, postoperative hemorrhage, posttonsillectomy hemorrhage

Tonsil surgery is one of the most commonly performed surgical procedures, with reported incidence rates of 1.9 to 11.8 per 100 000 per year.1 The most common indications are upper airway obstruction caused by tonsillar hypertrophy and recurrent infections in the tonsils.2 Several studies report effective relief in symptoms following surgery, although evidence with respect to indication limits is unsatisfactory.2-5

Postoperative hemorrhage, the most significant complication of tonsil surgery, often results in hospital readmission, sometimes in return to the operating theatre and in isolated cases death.6-10 Reported hemorrhage rates vary between 0% and 30%; the difference has been attributed to age, gender, indication, surgical method, surgical technique (warm vs cold dissection), and the surgeon’s level of experience.9,11-16

The clinical practice of tonsil surgery has seen major changes in the past century with respect to indications, methods, and techniques.17 Originally, only cold steel instruments were used for dissection, but in recent decades, several instruments have been introduced, with the common characteristic of delivering thermal energy to the tissue with the aim of improving dissection and achieving a more effective hemostasis.2,17 Partial removal of the tonsils, tonsillotomy (or intracapsular tonsillectomy), was the dominating surgical method before 1950, when the introduction of general anesthesia made the dissection needed for tonsillectomy possible. In the past
In many countries, consistent with an increased focus on cost-effective use of health care resources,20-22 optimally, changes in clinical practice should be based on well-designed randomized controlled trials. In reality, the introduction of new techniques and methods is not as anchored in evidence as desired. Retrospective studies based on national health care registers, with large cohorts of patients and high coverage, make it possible to monitor trends and study the effect of changes in clinical practice.

The aim of this study was to perform a retrospective longitudinal evaluation of the rates of postoperative hemorrhage in relation to changes in tonsil surgery clinical practice in a national population.

**Methods**

The Swedish National Patient Register (NPR) run by the National Board of Health and Welfare contains individual-based information on all surgical events and all in- and outpatient visits to medical care facilities nationwide in Sweden. The register was founded in 1964 and is considered complete with respect to inpatient care as of 1987.23 Outpatient surgical procedures were included in the register from 1997.23

The initial search in the NPR, identifying all tonsil operations performed in Sweden from 1987 to 2013, was based on surgical codes for both total and partial tonsillectomy (tonsillotomy) with or without adenoidectomy. The classification of surgical procedures in the NPR from 1963 until 1996 was based on 6 modified versions of the American system: The International Classification of Diseases, Adapted for Indexing of Hospital Records and Operation Classification.24 Since 1997, a new coding system, the Nordic Medico-Statistical Committees Classification of Surgical Procedures (NOMESCO), has been used. For all identified cases of tonsil surgery data on gender, age, date of surgery, indication, type of surgery, level of care (from 1998), length of stay for (LOS) inpatient surgery (number of days between date of surgery and discharge date), readmission to hospital, the indication for readmission to hospital, and reoperation to control postoperative bleeding (within 31 days) were collected.

All cases in the NPR are registered with 1 or more diagnostic codes according to the International Classification of Diseases (ICD) standard. From 1987 to 2013, 2 versions of the system were in use, ICD9 (1987-1997) and ICD10 (1997-). From a thorough workup of ICD codes, 4 indication groups were formed: “obstruction,” “infection,” “obstruction and infection,” and “other indications.” The group “obstruction and infection” contains all cases in which both obstruction- and infection-related codes appeared and where more precise classification was impossible. All codes that did not fit into any of the first 3 groups were classified as “other indications.” All operations related to malignant disease and lymphomas were excluded.

Hemorrhage after tonsillectomy (secondary hemorrhage) was defined as readmission to the hospital within 31 days of tonsil surgery with an ICD code indicating that the readmission was the result of bleeding from the head and neck region or unspecified bleeding. Primary hemorrhage, occurring before discharge, is not reported to the NPR and therefore not included in the definition of hemorrhage used in this study.

Reoperation for hemorrhage after tonsillectomy was defined as all events of return to theatre (RTT) in patients readmitted for hemorrhage within 31 days of surgery.

Univariate logistic regression was used to identify tentative predictors of readmission and reoperation for hemorrhage. Significant independent predictors were entered into a forward stepwise multivariable logistic regression analysis to select independent predictors of readmission and reoperation for hemorrhage. Performing longitudinal analyses, calendar year was used as a continuous variable. Trends in proportions were tested using logistic regression, correlation between counts and calendar year using Spearman’s rank correlation test, and differences in proportions between time periods using Fisher’s exact test and continuity-adjusted χ² test. A binominal test was used for testing proportions against predefined proportions at a defined time period. The results are presented as graphs and unadjusted and adjusted odds ratio (OR) with 95% confidence intervals and P values. All significance tests were 2 sided and conducted at the 5% significance level.

This study was approved by the Central Ethical Review Board in Gothenburg, Sweden (Dnr. 257-14).

**Results**

The search in the NPR identified 264 667 tonsil operations performed between 1987 and 2013. A total of 5891 cases were excluded because the diagnostic codes indicated malignant disease or lymphoma, and 2723 cases were excluded because of errors in coding or incomplete coding in the NPR. In total, 256 053 patients were included in the statistical analyses.

The general characteristics of the study population are presented in Table 1. The data demonstrate a larger proportion of females undergoing tonsillectomy; for all other types of surgery, the male gender is most prevalent. A lower mean age is seen in patients where adenoidectomy complements surgery on the tonsils. Tonsillectomy alone was performed in 60.4% of the cases, and “obstruction” was the most prevalent indication (50.3%). When quantified by type of surgery, “infection” was the most common indication for tonsillectomy, and “obstruction” was the most common indication for tonsillotomy and procedures including adenoidectomy.

In Figure 1a-f, the general trends from 1987 to 2013 are presented. The number of tonsil operations has increased...
(Figure 1a; \(P < .0001\)), and “obstruction” has gained predominance over “infection” as the main indication (Figure 1c; \(P < .0001\)), resulting in a falling mean age at the time of surgery (Figure 1b; \(P < .0001\)). Adenotonsillotomy has increased significantly since 2006 (Figure 1d; \(P < .0001\)), consistent with increased utilization of the obstructive indication. Outpatient surgery became the most prevalent level of care from 2010 (Figure 1e; \(P < .0001\)). Gender distribution was stable for the general population, with an overall greater proportion of the female gender (Figure 1b; \(P < .0001\)). LOS for inpatient surgery has decreased from a mean average of 4 days (3 nights) in 1987 to 2 days (1 night) in 2013 (Figure 1f; \(P < .0001\)).

The rates of readmission and reoperation resulting from hemorrhage following tonsil surgery in 1987 to 2013 are shown in Table 2. The overall frequency of readmission for hemorrhage was 2.61% (2.54%-2.67%), and the reoperation rate was 0.84% (0.81%-0.88%), with approximately one-third of the readmissions leading to reoperation. Overall, the reoperation rate for hemorrhage was higher for outpatient compared with inpatient surgery (3.94% vs 3.52%).

A longitudinal analysis shows that the readmission rate for postoperative hemorrhage has increased from 1% in 1987 to 5% in 2013 (Figure 2a; \(P < .0001\)). The share of readmissions because of hemorrhage, from all readmissions, has gone up from <50% to close to 70% (Figure 2a; \(P < .0001\)). The increase in readmissions is most prominent in the adult population, for tonsillectomies and for the indication “infection,” where the rate approached 10% in 2013 (Figure 2b, 2d, and 2e; \(P < .0001\)). Since outpatient care became the most prevalent level of care in 2010 (Figure 1e), inpatient surgery has had a higher risk of readmission for hemorrhage (Figure 2f; \(P < .0001\)). The reoperation rate for hemorrhage increased from 0.2% (1987) to 2.0% (2013; \(P < .0001\)), and 18% of the patients readmitted for hemorrhage underwent reoperation for hemostasis in 1987 compared with 43% in 2013 (\(P < .0001\)).

The univariate logistic regression analysis identified the following risk factors for readmission because of hemorrhage (Figure 3): male gender (OR 1.19), increasing age (OR 1.31), type of tonsil surgery–tonsillectomy (OR 3.34), indication–infection (OR 2.33), level of care–outpatient surgery (OR 1.12), and year of index operation–recent surgery higher risk (OR 1.08). The multivariate analysis identified the same risk factors except for level of care. Repeating both the univariate and multivariate analyses for reoperation identified identical risk factors but with slightly different OR values and wider confidence intervals (Figure 4). Unexpected opposite risk of readmission for hemorrhage was seen for tonsillectomy compared with adenotonsillectomy.

Days to first readmission for hemorrhage are presented in Figure 5. Most patients were readmitted on day 5 to 7 after surgery with a median of 6 days. Less than 1% of the readmissions occurred after 3 weeks. Two separate readmissions caused by hemorrhage were identified in 8.3% of the patients, and <1% were readmitted more than 2 times. In addition, 10% of all readmissions occurred within the first 4 days after surgery in 1987 compared with 25% in 2013 (not shown graphically).

**Discussion**

The readmission rate for hemorrhage after benign tonsil surgery in Sweden has increased by a factor of 5 from 1987 to 2013, with rates approaching 10% (2013) for tonsillectomies, “infection” as indication, and in patients ≥18 years of age. Univariate and multivariate analyses identified male gender, increasing age, tonsillectomy, the indication “infection,” and recent year of surgery as

**Table 1. General Characteristics (All Benign Tonsil Operations in Sweden 1987-2013).**

<table>
<thead>
<tr>
<th>Variable</th>
<th>All Patients</th>
<th>Adenotonsillectomy</th>
<th>Tonsillectomy</th>
<th>Adenotonsillotomy</th>
<th>Tonsillotomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>All patients</td>
<td>256 053</td>
<td>73 877 (28.9%)</td>
<td>154 569 (60.4%)</td>
<td>21 296 (8.3%)</td>
<td>6311 (2.5%)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>124 580 (48.7%)</td>
<td>40 307 (54.6%)</td>
<td>68 711 (44.5%)</td>
<td>12 172 (57.2%)</td>
<td>3 390 (53.7%)</td>
</tr>
<tr>
<td>Female</td>
<td>131 473 (51.3%)</td>
<td>33 570 (45.4%)</td>
<td>85 858 (55.5%)</td>
<td>9 124 (42.8%)</td>
<td>2 921 (46.3%)</td>
</tr>
<tr>
<td>Age, y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All patients</td>
<td>15.3 (13.2)</td>
<td>6.26 (5.05)</td>
<td>21.3 (13.3)</td>
<td>4.78 (3.03)</td>
<td>10.6 (11.4)</td>
</tr>
<tr>
<td>Male</td>
<td>14.4 (13.7)</td>
<td>5 (3.7)</td>
<td>19 (13.8)</td>
<td>4 (3.6)</td>
<td>6 (4.13)</td>
</tr>
<tr>
<td>Female</td>
<td>16.2 (12.6)</td>
<td>15 (6.22)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indication</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obstruction</td>
<td>128 898 (50.3%)</td>
<td>62 316 (84.4%)</td>
<td>39 940 (25.8%)</td>
<td>21 048 (98.8%)</td>
<td>5 594 (88.6%)</td>
</tr>
<tr>
<td>Infection</td>
<td>109 322 (42.7%)</td>
<td>4 553 (6.2%)</td>
<td>104 267 (67.5%)</td>
<td>71 (0.3%)</td>
<td>431 (6.8%)</td>
</tr>
<tr>
<td>Obstruction and infection</td>
<td>10 063 (3.9%)</td>
<td>5 879 (8.0%)</td>
<td>3 993 (2.6%)</td>
<td>94 (0.4%)</td>
<td>97 (1.5%)</td>
</tr>
<tr>
<td>Other indications</td>
<td>7 770 (3.0%)</td>
<td>1 129 (1.5%)</td>
<td>6 369 (4.1%)</td>
<td>83 (0.4%)</td>
<td>189 (3.0%)</td>
</tr>
</tbody>
</table>

*For categorical variables, n (%) is presented. For continuous variables, values are presented as mean (SD)/median (Q1; Q3).
significant risk factors for both readmission and reoperation because of hemorrhage. An increasing share of all readmissions is caused by postoperative hemorrhage, and a larger share of bleeding patients are returned to the theater for hemostatic procedures. Markedly lower readmission rates for hemorrhage were seen in younger children, in patients with obstructive indication for surgery, and when adenotonsillectomy or tonsillectomy ± adenoidectomy was performed. This is in accordance with previous publications, except the finding that adenotonsillectomy showed lower readmission rates compared with tonsillectomy after removing the contribution from the variables indication and age in the multivariate analysis. To our knowledge, this has not previously been reported.

Figure 1. General characteristics (all benign tonsil operations in Sweden 1987-2013) The x axis displays the year of surgery in all graphics. The y axis displays percentage (if not else specified).
Unfortunately, the data in the NPR do not allow further investigation of this finding.

Great variation exists in the definition and reported rates of postoperative hemorrhage following tonsil surgery. The postoperative hemorrhage rate of 10% (2013) following tonsillectomy presented in this study is comparable to the results from the Austrian audit reported by Sarny (15% including primary hemorrhage) and the secondary hemorrhage rates of 10% and 13.2% published by Ikoma (Japan) and Tolska (Finland), respectively. These rates are considerably higher than numbers reported from the British National Prospective Tonsillectomy Audit (3.0%) and a multicenter study in Wales described by Tomkinson (1.8%), and recent German numbers. The NPR does not contain information about the skills or the level of experience of the surgeons performing the operations, or the volume of tonsil surgery, which could influence surgical skills. However, despite the increasing number of tonsil surgeries performed yearly according to the NPR, the number of tonsillectomies performed is stable, as is the number of specialists and surgeons undergoing training in otolaryngology according to the Swedish Association for Otorhinolaryngology and Head and Neck Surgery. This fact should leave an unchanged volume of tonsillectomies available to each surgeon on average and does not imply a decrease in surgical skills based on volume. Interestingly, the Swedish ear, nose, and throat (ENT) community has seen large reorganizations in the past 2 decades with increased privatization of health care and establishment of high-output facilities performing large volumes of tonsillectomies, changes that may have influenced both specialty training and maintenance of surgical skills for specialists.

### Table 2. Readmission and Reoperation for Hemorrhage (1987-2013).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number of Operations</th>
<th>Readmission for Hemorrhage, n (%)</th>
<th>Reoperations/Rate (of All Operations), n (%)</th>
<th>Reoperation Rate (when Readmitted for Hemorrhage), %</th>
</tr>
</thead>
<tbody>
<tr>
<td>All patients</td>
<td>256 053</td>
<td>6671 (2.61)</td>
<td>2160 (0.84)</td>
<td>32.4</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>131 473</td>
<td>3147 (2.39)</td>
<td>992 (0.75)</td>
<td>31.5</td>
</tr>
<tr>
<td>Male</td>
<td>124 580</td>
<td>3524 (2.83)</td>
<td>1168 (0.94)</td>
<td>33.1</td>
</tr>
<tr>
<td>Age, y</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 to &lt;18</td>
<td>166 053</td>
<td>2562 (1.54)</td>
<td>785 (0.47)</td>
<td>30.6</td>
</tr>
<tr>
<td>≥18</td>
<td>90 000</td>
<td>4109 (4.57)</td>
<td>1375 (1.53)</td>
<td>33.5</td>
</tr>
<tr>
<td>Type of surgery</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tonsillectomy</td>
<td>154 569</td>
<td>5551 (3.59)</td>
<td>1827 (1.18)</td>
<td>32.9</td>
</tr>
<tr>
<td>Adenotonsillectomy</td>
<td>73 877</td>
<td>910 (1.23)</td>
<td>271 (0.37)</td>
<td>29.8</td>
</tr>
<tr>
<td>Tonsillotomy</td>
<td>6311</td>
<td>100 (1.58)</td>
<td>37 (0.59)</td>
<td>37.0</td>
</tr>
<tr>
<td>Adenotonsillotomy</td>
<td>21 296</td>
<td>110 (0.52)</td>
<td>25 (0.12)</td>
<td>22.7</td>
</tr>
<tr>
<td>Indication</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infection</td>
<td>109 322</td>
<td>4196 (3.84)</td>
<td>1395 (1.28)</td>
<td>33.2</td>
</tr>
<tr>
<td>Obstruction</td>
<td>128 898</td>
<td>1990 (1.54)</td>
<td>595 (0.46)</td>
<td>29.9</td>
</tr>
<tr>
<td>Obstruction and infection</td>
<td>10 063</td>
<td>345 (3.43)</td>
<td>125 (1.24)</td>
<td>36.2</td>
</tr>
<tr>
<td>Other indication</td>
<td>7770</td>
<td>140 (1.80)</td>
<td>45 (0.58)</td>
<td>32.1</td>
</tr>
<tr>
<td>Level of care</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inpatient</td>
<td>103 194</td>
<td>3634 (3.52)</td>
<td>1152 (1.12)</td>
<td>31.7</td>
</tr>
<tr>
<td>Outpatient</td>
<td>46 683</td>
<td>1837 (3.94)</td>
<td>763 (1.63)</td>
<td>41.4</td>
</tr>
</tbody>
</table>

*From 1998 to 2013, since outpatient care was first included in the National Patient Register (NPR) in 1997.*
Surgical Technique

In Sweden, cold dissection is (and has been) the predominant dissection technique for tonsillectomy. During 2009 to 2013, cold dissection was used in 72.7% of all tonsillectomies. Other techniques used for dissection are diathermy scissors, coblation, ultracision, and laser, all hot techniques. During recent decades, after its introduction in the late 20th century, bipolar diathermy has increasingly been used for hemostasis, and according to data from the National Tonsil Surgery Register in Sweden, it was used...
Figure 3. Odds ratio diagram readmission for hemorrhage: univariate and multivariate analyses.

Figure 4. Odds ratio diagram reoperation for hemorrhage: univariate and multivariate analyses.
alone or in combination with other techniques for hemostasis in 55.9% of all tonsil surgeries in 2012. Several studies have shown an increased rate of secondary postoperative hemorrhage for hot versus cold techniques for both dissection and/or hemostasis. It is possible that the increased use of warm techniques for both dissection and hemostasis has contributed to the increased hemorrhage rates seen in Sweden.

Patients and Indication for Surgery

Comparing the general characteristics of our study population with the readmission rates for hemorrhage, it is evident that the variables found to be risk factors for hemorrhage are decreasing over time, except for gender. In Sweden, fewer tonsillectomies are being performed for infectious disease. Patients were typically younger in 2013 compared with 1987. The readmission rate for hemorrhage is highest and increased the most for tonsillectomies, for surgeries with “infection” as indication, and for adult patients. Reducing the number of surgeries with higher-risk characteristics (Figure 3) should have had a positive opposite effect on postoperative hemorrhage rates.

Surprisingly, outpatient surgery showed higher readmission rates compared with inpatient surgery from 1998 to 2013. The opposite trend was evident from 2010 when outpatient care became the most common care form in Sweden. This discrepancy is most likely explained by a bias created by comparing a large group of inpatient operations that were performed early in the study period, when readmission rates for hemorrhage were low, to a smaller group of outpatient surgeries performed more recently, when readmission rates were generally higher. Level of care was identified as a risk factor in the univariate but not in the multivariate analysis. A possible explanation could be that level of care is too closely linked to LOS, with all outpatient procedures having LOS = 1 per definition. Based on NPR data, outpatient surgery should not be considered a risk factor for readmission for hemorrhage.

Nonsteroidal anti-inflammatory drugs (NSAIDs) are given routinely after tonsil surgery in Sweden, in combination with paracetamol and, if needed, clonidine (children) or opioids. Controversy exists about the NSAID effect on hemorrhage rates after tonsil surgery. Information about analgesics is not reported to the NPR. No major change has been made in the practice of administering NSAIDs after tonsil surgery in Sweden from 1987 to 2013.

Practice Regarding Postoperative Complications

In recent years, there has been an increasing focus on patient safety, including complications after surgery. One example is the National Tonsil Surgery Registry (NTSRS) in Sweden, which follows trends, practice, and outcomes of tonsil surgery, including postoperative complications, such as bleeding and RTT. Increased knowledge and awareness could have influenced the Swedish ENT community to change their approach to postoperative bleeding. Today, patients are thoroughly informed of the risks of surgery, and they are given detailed instructions on how to act if postoperative bleeding occurs. The common practice is to readmit and observe all patients for a minimum of 24 hours if they report even minor postoperative bleeding after tonsil surgery. The percentage of patients reoperated for hemorrhage is increasing, a fact that could reflect a more cautious attitude toward postoperative hemorrhage. It is possible that a larger share of the bleeding patients was handled in outpatient level of care decades ago, contributing to the increasing proportion of readmissions for hemorrhage seen in recent years.

The LOS in inpatient surgery has decreased from a mean average of 4 days (1987) to 2 days (2013), leaving 2 more days on average for patients to be readmitted for hemorrhage following surgery. This fact could potentially explain the increasing readmission rates for hemorrhage. In the multivariate analyses, the OR for LOS was 0.96 (0.94-0.98), and when quantifying readmission rates for hemorrhage by LOS/year, it became evident that the same increase in readmission rates (from 1% to 5%) was seen independent of LOS; thus, changes in LOS do not explain the increase in readmission rates.

Validity of Data

The NPR has been validated in 2011 and is considered complete (99%-100%) for inpatient somatic care from 1987. Surgical day care procedures were included in the NPR in 1997, and the coverage of hospital-based outpatient care was considered to be approximately 80% in 2011. With these statistics, the NPR should be considered a reliable source of information, and the data presented in this study should be considered valid and representative of tonsil surgery practice in Sweden for the past 3 decades.

A pronounced decrease (>30%) in the number of registered tonsil surgeries was seen between 1996 and 2008 (Figure 1a). Together with a representative from the NPR, the data extract was reanalyzed to ensure the correctness of the data collection; although no specific errors were found, it seems plausible that a weakness in reporting and/or data

![Figure 5](image-url)
collection contributed to the observed decrease in numbers. Both implementing outpatient care into the register and lack of reporting from a fast-growing sector of private health care providers are 2 possible explanations. This obvious weakness is problematic, but with the magnitude of the decrease, we believe that a bias in data collection alone cannot explain the large decrease in registered operations and that, in fact, a true decrease in surgical procedures performed is likely.

Conclusions

The readmission rate because of postoperative hemorrhage following benign tonsil surgery in Sweden increased from 1987 to 2013. We proposed and discussed at least 4 perspectives that potentially contribute: skills and experience of the surgeon, surgical technique, patient/indication/level of care for surgery, and practice regarding postoperative complications. The design of this study and the data in the NPR do not allow further in-depth evaluation of the true reasons behind the increasing readmission rates for hemorrhage. Our results indicate an alarming evolution regarding the most important complication of tonsil surgery: postoperative hemorrhage. Further studies are needed to address the hypotheses proposed in the discussion.

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Author Contributions

Eirik Østvoll, design of the study, data analysis and interpretation, drafting and revision of draft, final approval before submission; Ola Sunnergren, data analysis and interpretation, revision of draft, intellectual input, final approval before submission; Joacim Stalfors, design of the study, data analysis and interpretation, revision of draft, intellectual input, final approval before submission.

Disclosures

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References


