Adenoidectomy Technique in the United Kingdom and Postoperative Hemorrhage

David Lowe, MD, FRCS¹, Peter Brown, FRCS², and Matthew Yung, PhD, FRCS³

Abstract

Objective. To investigate the incidence of postoperative hemorrhage and its risk factors after adenotonsillectomy.

Study Design. A prospective cohort study as part of the National Prospective Tonsillectomy Audit.

Setting. National Health Service and private hospitals in England and Northern Ireland.

Subjects and Methods. National Prospective Tonsillectomy Audit methodology was followed with a nonrandomized prospective observational cohort methodology and data collection.

Results. A total of 33,921 patients underwent tonsillectomy; of these, 9900 underwent adenoidectomy. Traditional curette adenoidectomy (without any diathermy use at all) was performed in 6871 patients. Suction diathermy technique was used in 1489 patients. Hemorrhage rates were calculated for these main adenoidectomy technique groups and compared by calculation of risk ratios. Both early and late hemorrhage rates for suction diathermy were found to be 0.07% (n = 1 in each case). In the traditional curette group, these rates were 0.3% (n = 19) and 0.2% (n = 14), respectively. The risk ratio for hemorrhage overall was 3.6 for curette adenoidectomy compared with suction diathermy (95% confidence interval, 0.86-14.9; \( P = .06 \)). The data suggest comparable hemorrhage rates in both adenoidectomy technique groups and fail to demonstrate diathermy usage as a risk factor for hemorrhage following adenoidectomy despite a clear interaction between diathermy usage and subsequent hemorrhage in tonsillectomy.

Conclusion. Use of suction diathermy in adenoidectomy appears to have a similar safety profile to conventional techniques and may offer additional benefits over traditional adenoid curettage. Further clinical and laboratory-based research into the complex interaction between diathermy usage and both adenoid and tonsillar tissue is warranted.

Keywords
adenoidectomy, hemorrhage, diathermy, complication

1Department of ENT, James Cook University Hospital, Middlesbrough, UK
2The Saxon Clinic, Milton Keynes, UK
3Department of ENT, Ipswich Hospital NHS Trust, Suffolk, UK

Corresponding Author:
David Lowe, MD, FRCS, James Cook University Hospital, Middlesbrough, Cleveland TS4 3BW, UK
Email: tonsils@gmail.com

Received September 9, 2010; revised February 4, 2011; accepted February 16, 2011.
reactionary. Here, adenoidectomy hemorrhage is classified as early (during initial stay including reactionary and the following hours of initial recovery) or late (delayed bleeding necessitating hospital readmission).

Very few previous studies of adenoidectomy have considered such primary outcomes, particularly in comparison with surgical techniques. Most consider adenoidal regrowth as a main outcome. Alternative outcomes studied include operative time and intraoperative blood loss. This mainly reflects the rarity of postoperative complications such as hemorrhage.

Wright et al² first described the suction diathermy technique in 1997. Their prospective study concluded that intraoperative blood loss and operative time were reduced with a low incidence of postoperative infection and hemorrhage.

Jonas et al³ produced a small randomized single-blind study comparing electrocautery adenoidectomy to traditional curettage and concluded that suction diathermy was better at reducing adenoidal regrowth at 6 months.

Clemens et al⁴ described reduced intraoperative blood loss in suction diathermy adenoidectomy compared with traditional curette technique. A retrospective study of near 2000 patients by Glade et al⁵ did not reveal any significant difference in hemorrhage among various technique groups.

An audit of adenoidectomy technique and impact on day case rates and complications reported by Hunt et al⁶ showed a high hemorrhage rate of 9.7% for curette adenoidectomy, but this reduced to zero after adopting a suction diathermy technique.

Elluru et al⁷ performed a comparative review of adenoidectomy techniques and found suction diathermy minimized operating time and reduced intraoperative blood loss compared with curettage.

Importantly, in 2009, Reed et al⁸ reported a meta-analysis of 9 studies considering suction electrocautery adenoidectomy. They concluded that long-term outcome and complication data were scarce but that electrocautery adenoidectomy resulted in both decreased intraoperative hemorrhage and surgical time.

Method

The NPTA methodology was followed for the study.¹⁰ This study sought primarily to investigate complications of tonsillectomy, and all adenoidectomy cases included in this study underwent simultaneous tonsillectomy. Data on patient characteristics including age, sex, and indication for surgery were collected as well as details of surgical technique. Data were collected prospectively using a novel secure online electronic data transfer system from handwritten operation and complication tick-box sheets completed by each surgeon. Ethical approval was granted nationally by COREC. The study methods were of an observational cohort design without randomization. All cases operated at participating centers during the study period in England and Northern Ireland were aimed to be included subject to fulfillment of inclusion criteria.

Rates of early hemorrhage (during initial stay and causing delayed discharge) and late hemorrhage (requiring readmission after discharge) were calculated for all patients undergoing adenoidectomy. Comparison was undertaken for different adenoidectomy techniques. To maintain clinical relevance, comparison was mainly limited to the suction diathermy group and a “pure” curette group. This group included all adenoidectomies performed with traditional curette techniques in which hemostasis was achieved only by plain or adrenaline-soaked packs but without any use of diathermy whatsoever. Cases involving any use of diathermy hemostasis were therefore excluded from both the curette and suction diathermy groups. As an observational study, the decision as to which surgical technique was adopted was dependent on each surgeon’s preference.

Traditionally, adenoidectomy hemorrhage is thought to be a reactionary phenomenon, occurring shortly after surgery. The data collected allowed estimation of the timing of the more severe hemorrhages (where there was a return to theatre). Source of hemorrhage was confirmed by clinical examination by the attending physician, and complication recording allowed notification of specific sites including the adenoid bed, tonsil bed, and tongue base. These data were used to investigate the timing of hemorrhage and enabled evaluation of the proportion of patients deemed to have late hemorrhage in which bleeding led to readmission within 24 hours of surgery.

Statistical analysis was conducted with Stata software (release 8) throughout (www.stata.com). Complication rates were expressed as percentages, with relative risks for adenoidectomy techniques calculated as ratios of the complication rates. All P values lower than .05 were considered to indicate a statistically significant result.

Results

Table 1 describes the age distribution for the included patients undergoing adenoidectomy in conjunction with their tonsillectomy. This contrasts with the far older age distribution for tonsillectomy alone (where no adenoidectomy occurred). Almost 99% of adenoidectomy patients were younger than 16 years age, and 41% were less than 5 years of age.

Indication for surgery was not given detailed consideration as all adenoidectomy patients also received tonsillectomy, and indication for surgery was based mainly around that stated for the tonsillectomy.

No appreciable difference was noted for any patient characteristics between technique groups. A total of 410 curette procedures (5%) were excluded on the basis of additional use of bipolar diathermy for hemostasis. Traditional curette technique

<table>
<thead>
<tr>
<th>Age Group, y</th>
<th>Tonsillectomy</th>
<th>Adenotonsillectomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;5</td>
<td>1322</td>
<td>3745</td>
</tr>
<tr>
<td>5-16</td>
<td>10,470</td>
<td>5309</td>
</tr>
<tr>
<td>≥16</td>
<td>12,388</td>
<td>109</td>
</tr>
<tr>
<td>Total</td>
<td>24,180</td>
<td>9163</td>
</tr>
</tbody>
</table>
without any diathermy whatsoever was recorded for 6861 patients (75%). Suction diathermy was used for 1489 patients (16%). Early, late, and overall hemorrhage rates were calculated for the 2 main technique groups and are shown in Table 2. The overall hemorrhage rate was 0.13% in the suction diathermy group and 0.48% in the curette group (relative risk, 3.6; 95% confidence interval, 0.9-14.9; \( P = .06 \)). This suggests that the safety profile of the 2 techniques is comparable. As expected, early hemorrhages occurred more frequently than delayed bleeding. Bleeding in excess of 6 to 8 hours after surgery is rare, and in the United Kingdom, a day-case admission policy for adenotonsillectomy is common. Surprisingly, in the cold steel group, the number of late hemorrhages was also high at 0.2%.

The greatest number of late hemorrhages actually occurred within 24 hours of surgery in those returning after discharge as day cases. A small number of patients were readmitted with particularly late hemorrhage (up to 14 days after surgery). Within the initial recovery period, most reported hemorrhages occurred in the immediate postoperative period (less than 1 hour).

The calculated adenoidectomy hemorrhage rates appear low overall, particularly compared with those for tonsillectomy. The distribution of hemorrhages between the early and late groups is somewhat different for adenoidectomy and tonsillectomy. In this study, early hemorrhage infers bleeding that occurred during the initial hospital stay. This can be as either day case or overnight stay, and the latter remains most comparable with other studies’ definition of primary hemorrhage (bleeding in the first 24 hours after surgery). Again, in this study, late hemorrhage was defined as bleeding giving rise to readmission. Many studies define secondary hemorrhage following adenoidectomy only if this occurred more than 24 hours after surgery. While such late hemorrhage occurring days after adenoidectomy is generally considered exceptionally rare, given these definitions, it was possible for bleeding occurring later the same day as surgery to be classified as a late hemorrhage if the patient was discharged as a day case and later readmitted. Late hemorrhage from the adenoid bed is considered extremely rare, and therefore, the relatively high number of events in the curette group remains largely unexpected. Hemorrhage of any sort was, however, seen to be exceptionally rare in suction diathermy adenoidectomy.

### Table 2. Table of Adenoidectomy Hemorrhage Rates in Adenoidectomy Technique Subgroups

<table>
<thead>
<tr>
<th>No. of Hemorrhages</th>
<th>No. of Procedures</th>
<th>Hemorrhage Rate (%)</th>
<th>Relative Risk</th>
<th>Confidence Interval</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early adenoidectomy hemorrhage (during initial stay/delaying discharge)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suction diathermy</td>
<td>1</td>
<td>1489</td>
<td>0.07</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Curette</td>
<td>19</td>
<td>6861</td>
<td>0.3</td>
<td>4.1</td>
<td>0.6-30.8</td>
</tr>
<tr>
<td>Late adenoidectomy hemorrhage (causing readmission)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suction diathermy</td>
<td>1</td>
<td>1489</td>
<td>0.07</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Curette</td>
<td>14</td>
<td>6861</td>
<td>0.2</td>
<td>3.0</td>
<td>0.4-23.1</td>
</tr>
<tr>
<td>Overall adenoidectomy hemorrhage (total early + late hemorrhage)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suction diathermy</td>
<td>2</td>
<td>1489</td>
<td>0.13</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Curette</td>
<td>33</td>
<td>6861</td>
<td>0.48</td>
<td>3.6</td>
<td>0.9-14.9</td>
</tr>
</tbody>
</table>

### Discussion

The calculated adenoidectomy hemorrhage rates appear low overall, particularly compared with those for tonsillectomy. The distribution of hemorrhages between the early and late groups is somewhat different for adenoidectomy and tonsillectomy. In this study, early hemorrhage infers bleeding that occurred during the initial hospital stay. This can be as either day case or overnight stay, and the latter remains most comparable with other studies’ definition of primary hemorrhage (bleeding in the first 24 hours after surgery). Again, in this study, late hemorrhage was defined as bleeding giving rise to readmission. Many studies define secondary hemorrhage following adenoidectomy only if this occurred more than 24 hours after surgery. While such late hemorrhage occurring days after adenoidectomy is generally considered exceptionally rare, given these definitions, it was possible for bleeding occurring later the same day as surgery to be classified as a late hemorrhage if the patient was discharged as a day case and later readmitted. Late hemorrhage from the adenoid bed is considered extremely rare, and therefore, the relatively high number of events in the curette group remains largely unexpected. Hemorrhage of any sort was, however, seen to be exceptionally rare in suction diathermy adenoidectomy.
The distribution over time of early hemorrhage (Figure 1) was felt to be in keeping with existing knowledge with the vast majority in the first 6 hours. Late or secondary hemorrhage (Figure 2) is scarcely reported following adenoidectomy, and little remains known as to the cause of this rare complication.

Of particular interest is the different relationship between the use of diathermy in the adenoid bed and the tonsil in terms of subsequent hemorrhage. The NPTA data on diathermy usage in tonsillectomy and adenoidectomy suggest a strong relationship between the use of diathermy (particularly as a dissection tool) and hemorrhage.11,12 For example, bipolar diathermy tonsillectomy (in which both dissection and hemostasis were achieved by diathermy) was found to have about 3 times the rate of hemorrhage of that seen in a cold-steel group in which traditional instruments were used without diathermy.10 By this logic, it might be expected that suction diathermy adenoidectomy (which employs generally high levels of diathermy energy) might carry substantially higher rates of hemorrhage than that seen with traditional cold-steel curette adenoidectomy, but this is not the case.

There are notable differences between diathermy tonsillectomy and suction diathermy adenoidectomy, which may possibly influence the opposing effects of diathermy energy in different settings and the resultant rates of postoperative hemorrhage, especially some days after the procedure. While it is acknowledged that the following points require confirmation in further clinical and laboratory-based research, they are included here as suggested possible factors.

First, anatomical and functional differences in the operative site (postnasal space compared with tonsillar fossa) may play a role in the increased risk of hemorrhage for the tonsil only when high-power diathermy is used at surgery. The tonsillar fossa may be more widely colonized with commensal and/or pathogenic bacteria than the nasopharynx, and this might play a part in the etiology of tonsillar hemorrhage. The patient has to swallow past the healing tonsillar fossae, and this is not the case for adenoidectomy alone. This may have implications for speed of healing in the 2 different areas. Postoperative pain is also considered to be more widespread and problematic in tonsillectomy compared with adenoidectomy alone. Resumption of a normal diet in adenoidectomy patients is normally expected far quicker than in tonsillectomy.

Differences in the effect of diathermy usage in tonsillectomy and adenoidectomy may at least partly reflect the differences in the age group of the patients. The NPTA demonstrated that for tonsillectomy hemorrhage, young age was a protective factor. Given that most adenoidectomy patients are young children, the overall low risk of hemorrhage for adenoidectomy may reflect the young age distribution of patients irrespective of surgical technique.

Another important difference between diathermy usage in tonsillectomy and adenoidectomy is that diathermy in tonsillectomy is implemented for dissection and/or hemostasis, whereas in adenoidectomy, it is used for ablation or vaporization of tissue. In itself, such usage requires high diathermy power settings for effective ablation, not so in tonsillectomy.

Limitations of the Study

While the aims of the NPTA were primarily to investigate complications of tonsillectomy surgery, it is felt that those patients who underwent adjunctive adenoidectomy offered an ideal opportunity to investigate its complications. Overall, for investigation of hemorrhage rates in the different described technique groups, the study was slightly underpowered, and it is likely that an additional 1000 patients would produce a study of sufficient power, albeit a massive one. This will of course have direct implications for future studies in this area, and only the largest studies will be of sufficient power to investigate rare outcomes such as hemorrhage.

Underreporting of complications may have slightly diminished the power of the study to detect small differences in the rate of adenoidectomy hemorrhage between different technique groups. To maximize the detection of hemorrhages associated with the adenoid bed, such complications were identified in a number of different ways from the data. No other risk factors for adenoid hemorrhage were identified from the data, and the age and sex distribution within the 2 technique groups were found to be very similar indeed.

Constraints on the amount of data recorded on individual cases meant that no data on diathermy power settings were recorded for adenoidectomy. Such data were collected for tonsillectomy, and a direct relationship between high settings and hemorrhage was demonstrated for tonsillectomy.11,12 In diathermy tonsillectomy, a great deal of variation in diathermy settings used was demonstrated; such a spread would not be anticipated for suction diathermy adenoidectomy, where generally high settings are employed for tissue ablation.

It is likely that most of the included adenoidectomy cases included were performed for pharyngeal obstruction or obstructive sleep apnea. The primary indication for tonsillectomy, not adenoidectomy, was recorded in each case. As a result, those cases in which glue ear was an additional indication for adenoidectomy surgery remain unknown. It is, however, felt that the indication for surgery is unlikely an important factor in postadenoidectomy hemorrhage.

An additional minor limitation may be the difficulty of distinguishing between self-limiting bleeding from tonsils or...
adenoids. It is felt that clinical doubt over the source of bleeding is likely to arise in only a very small proportion of cases, and surgeons specifically recorded the site of bleeding.

During planning of the study, power calculations were made on the basis of tonsillectomy complications data only. All adenoidectomy patients included here underwent adenotonsillectomy. While operative time was recorded for all cases, these data did not directly reflect adenoidectomy surgery alone given that tonsillectomy (and in some cases grommet insertion) were also carried out.

An additional limitation of the study was the need to exclude cases in which diathermy was used for hemostasis from the pure curette group. Because of the particularly small size of this excluded group, it was felt that calculation of hemorrhage rates for these cases alone would not prove meaningful. While their exclusion might slightly reduce the complication rate in the curette group, it was felt untenable to have diathermy usage within both technique groups given that this was the focus of the comparison. A pure curette group was therefore analyzed in the same way that pure cold-steel tonsillectomy was considered previously in other NPTA publications.10-12

Finally, it is possible that the use of vasoconstrictor agents in either group may have affected results in terms of hemorrhage rates. It is felt that such usage in either group was likely to have the most influence on intraoperative rather than the studied postoperative hemorrhage and particularly on timing of intraoperative bleeding. Use of packing with or without vasoconstrictors did not lead to exclusion of cases from either technique group.

Conclusion

Overall, the results support adenoidectomy as a safe surgical procedure with low rates of postoperative hemorrhage and comparable complication rates for both traditional curette and suction diathermy/electrocautery adenoidectomy.

We feel that the data support the use of suction diathermy adenoidectomy as a valid, safe, and probably improved alternative to traditional curette adenoidectomy. Given the recent evidence on favorable intraoperative blood loss and operative time,8,9 suction diathermy adenoidectomy may be preferable. This technique also confers improved controllability and visibility over traditional techniques, with the added benefit of the option for partial or selective adenoidectomy where indicated. Contrary to that seen in tonsillectomy,11,12 use of diathermy in adenoidectomy does not appear to give rise to subsequent hemorrhage. Detailed future research on the interaction between diathermy energy and the tissues of the tonsillar fossa and nasopharynx remains desirable.

Author Contributions

David Lowe, corresponding author, project managed study, first author of article; Peter Brown, chair of research group, coauthor; Matthew Yung, chair of research group, coauthor.

Disclosures

Competing interests: None.

Sponsorships: UK Department of Health. The UK Department of Health had no role in conducting the study, although a representative from the Department of Health sat on the steering group.

Funding sources: Department of Health. Funded study through a grant that paid for a research fellow and research team and other costs incurred.

References