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MAIN ARTICLE

Bleeding following coblation tonsillectomy: a 10-year, single-surgeon audit and modified grading system

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Abstract

Objective: Coblation tonsillectomy can be controversial. This study assessed post-tonsillectomy haemorrhage outcomes for patients operated on by a single experienced coblation-trained ENT surgeon.

Study design: A retrospective audit of coblation tonsillectomies was performed using the Flinders modification of Stammberger criteria for post-tonsillectomy haemorrhage.

Method: Case note review, interview and database interrogation were utilised to obtain the dataset. Haemorrhage results were compared to reports in the current literature.

Results: Of those who underwent coblation tonsillectomy, 3.4 per cent were readmitted to hospital with haemorrhage and 1.3 per cent returned to the operating theatre (0.4 per cent primary haemorrhage and 0.9 per cent secondary haemorrhage). Younger children had a lower risk of returning to the operating theatre than older children or adults (0.3 per cent under the age of 12 years *vs* 2.0 per cent aged 12 years or older).

Conclusion: Coblation can be a safe method for tonsillectomy with low complication rates when performed by an experienced ENT surgeon. The Flinders modification of the Stammberger criteria for post-tonsillectomy haemorrhage provides a simple system for data comparison.

Key words: Tonsillectomy; Ablation Techniques; Postoperative Hemorrhage; Complications; Palatine Tonsil; Data Collection; Adverse Effects

Introduction

Tonsillectomy remains one of the most common surgical procedures performed worldwide.[1,2] Haemorrhage is a common and potentially serious complication of tonsillectomy.[3–5] Haemorrhage may be minor and require no intervention; serious haemorrhage may require hospital readmission or a return to the operating theatre.[6] Rarely, haemorrhage is severe enough to result in exsanguination.[4,7]

Tonsillectomy can be performed in many different ways; for example, using cold steel and ties, monopolar or bipolar diathermy (used either for dissection, haemostasis or both), a harmonic scalpel, or laser or plasma ablation (coblation).[4,8] There is considerable controversy regarding the differences in haemorrhage rates between tonsillectomy techniques, fuelled in part by the results of the British National Prospective Tonsillectomy Audit and, more recently, a large audit from Wales.[6,9] In both of these audits, the rate of haemorrhage was an outcome of interest, and in both audits coblation tonsillectomy was shown to have a higher haemorrhage rate than cold steel and ties. However, other studies have found no difference in haemorrhage rates.[7]

An Australian coblation tonsillectomy audit demonstrated a clear learning curve; inexperienced surgeons demonstrated high bleed rates, with acceptable rates being achieved once 50 procedures had been performed.[10] A similar finding was observed in Denmark.[11] Studies showing significantly higher haemorrhage rates with the use of coblation in tonsillectomy have generally neglected to account for the learning curve of 50–60 operative procedures required in order to master the technique.[10,12] In the USA, coblation tonsillectomy is rapidly gaining acceptance,[2] but in other countries, such as the UK and Australia, surgeons remain guarded, possibly as a result of the negative findings of the British audit.[13]

Primary haemorrhage is widely accepted as the preferred term for bleeds that occur within the first 24

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hours following surgery, and secondary haemorrhage is used to refer to bleeds that occur outside of this time window.[12] A study from Scotland demonstrated that up to 40 per cent of patients will admit to a small secondary bleed if questioned in a more detailed fashion, but very few of these patients will present to a doctor (27 per cent), and even fewer require readmission or a return to the operating theatre (8 per cent and 3 per cent respectively).[14] In fact, depending on data collection techniques and definitions of haemorrhage, secondary haemorrhage rates vary considerably, and have been reported to range between 0 and 50 per cent.[4] We believe that the analysis of readmission and return to operating theatre rates provides more insight into the efficacy of coblation tonsillectomy than isolated reports of haemorrhage occurrence.[15]

Using audit data from Austria, a team from Graz proposed the 'Stammberger classification system' to categorise tonsillectomy bleeds.[3] This system aims to facilitate the comparison of data from different institutions more accurately and is the most comprehensive classification system identified in the literature to date.[3] We utilised a modified version of the Stammberger classification system in preparation of this detailed single-surgeon audit of an experienced coblation surgeon; it includes readmission and return to operating theatre rates for patients who experienced post-tonsillectomy haemorrhage.

Materials and methods

Ethics

The Flinders Clinical Human Research Ethics Committee gave ethical approval for this study.

Audit methodology

The electronic medical record database of the senior author (ASC) was searched for patients who underwent tonsillectomy prior to and during October 2011. Patients were identified by tracking Australian Medicare benefit scheme billings for tonsillectomies performed in patients aged less than 12 years (Medicare benefit scheme code 41789) and tonsillectomies performed in patients aged 12 years or older (Medicare benefit scheme code 41793).

The operation records were reviewed to confirm that ASC was the surgeon who performed these procedures and that the procedure was extracapsular dissection using a coblation EVac® 70 wand. Children who underwent simultaneous adenoidectomy and/or ventilation tubes were included. Adults who underwent uvulopalatopharyngoplasty or other pharyngeal surgical procedures were excluded. Patients who underwent subtotal tonsillotomy, excision of tonsil remnants, tonsillectomy performed by other methods, or procedures performed by other surgeons or trainees were excluded.

Private practice records, public hospital database entries, general practitioner notes and emergency room databases were scrutinised to ensure that any patient who presented outside the private practice was accounted for. Where there was any doubt about possible tonsil haemorrhage, general practitioner clinics, parents or patients were telephoned to clarify the clinical scenario.

All haemorrhages were classified as primary (occurring within 24 hours of surgery) or secondary (occurring after 24 hours of surgery, up to day 21) (Table I). Both the day of the bleed events and severity of the bleeds were classified according to the Flinders modification (Table I) of the original Stammberger classification system.[3] Management of haemorrhage events was recorded, specifically including readmission to hospital and return to operating theatre rates. In rare cases of multiple reported bleeds, the more severe bleed was included for analysis.

Results

A total of 1081 patients underwent tonsillectomy during the audit period. Of these, 684 underwent total tonsillectomy by coblation and were suitable for inclusion in this study: 289 patients (42 per cent) were under 12 years of age at the time of surgery; 395 (58 per cent) were 12 years or older.

Post-operative haemorrhages

Of the 684 patients, 610 (89.2 per cent) reported no bleeding at all, 5 patients (0.7 per cent) experienced a primary haemorrhage and 69 patients (10.1 per cent) reported some degree of secondary haemorrhage.

Twenty-three patients (3.4 per cent) required readmission to hospital following a bleed and, overall, 9 patients (1.3 per cent) returned to the operating theatre. Of the 684 patients, 0.4 per cent returned to the operating theatre after a primary haemorrhage and

TABLE I
FLINDERS MODIFICATION OF STAMMBERGER CRITERIA

Classification	Description
Haemorrhage classification	
– P	Primary bleed: within 24 hours following extubation
– S	Secondary bleed: after 24 hours following surgery
Bleeding severity classification	
– A	Minor reported bleed or blood-tinged sputum; no bleeding on examination; clot may be present; no shock
– B	Bleeding actively under examination or no active bleeding but larger reported bleed; no shock
– C	Surgical treatment under general anaesthesia; no shock
– D	Dramatic haemorrhage causing shock, or blood transfusion required
– E	Death due to haemorrhage or haemorrhage-related complications

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0.9 per cent returned to the operating theatre because of a secondary haemorrhage.

The most delayed haemorrhage occurred 20 days post-operation and was minor (classified as a secondary A bleed according to the Flinders modified Stammberger criteria). The majority of all haemorrhages (59.5 per cent) occurred 5–7 days following the operation; 18.9 per cent of all bleeds occurred on day 5, 25.7 per cent on day 6 and 14.9 per cent on day 7 (Figure 1). The timing of haemorrhage following a patient's operation did not vary between age groups.

Primary haemorrhage

Of those patients aged less than 12 years ($n = 289$), 1 patient experienced a primary haemorrhage (0.3 per cent); the bleed severity was classified as C and required a return to the operating theatre.

Of those patients aged 12 years or older ($n = 395$), 4 patients (1 per cent) experienced a primary haemorrhage; 1 case settled after observation, 1 was treated with silver nitrate cautery and 2 (0.5 per cent) required a return to the operating theatre. The severities of the primary haemorrhages were categorised as follows: one A bleed, one B bleed and two C bleeds.

Secondary haemorrhage

Sixty-nine patients (10.8 per cent) experienced some form of secondary bleeding; 23 (3.4 per cent) were readmitted to hospital and 6 (0.9 per cent) returned to the operating theatre. The distribution of secondary bleeding cases according to patient age and haemorrhage severity is shown in Figure 2. None of the patients aged less than 12 years were returned to the operating theatre for operative management of secondary haemorrhage. Fifty-five of these 69 patients experienced minor, self-limited bleeds that required no treatment. All 14 secondary haemorrhage patients with bleed severity classified as B, C or D (i.e. requiring some form of treatment) were readmitted to hospital.

In the under 12 years age group, 2 patients were readmitted with secondary haemorrhage and both were managed without operative management; one case was classified as a B bleed and the other a D bleed (blood transfusion, but no return to the operating theatre).

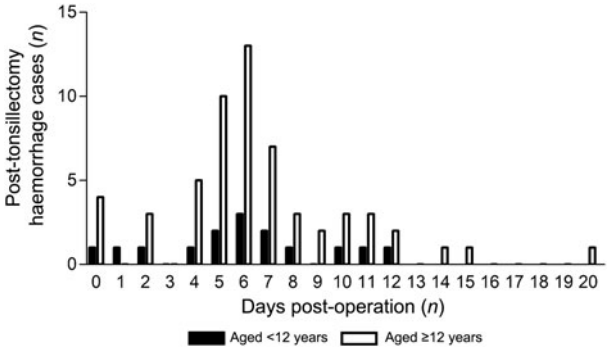

FIG. 1

Distribution of haemorrhage cases according to patient age group and number of days post-operation.

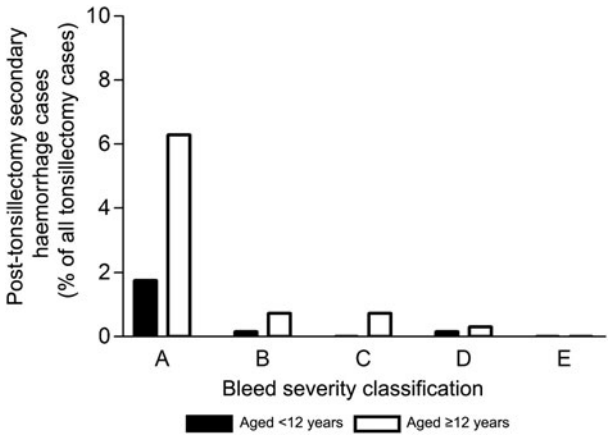

FIG. 2

Distribution of secondary haemorrhage cases according to patient age group and bleed severity (assessed using Flinders modified Stammberger criteria).

Fourteen patients aged 12 years or older required readmission following a secondary bleed (3.5 per cent); 6 patients returned to the operating theatre (1.5 per cent), 2 cases were classified as grade D because of the transfusion requirement. In this age group, there were no patients requiring transfusion who did not return to the operating theatre.

Classification of post-operative haemorrhages

Using the Flinders modified Stammberger criteria (Table I), mild post-operative bleeds, which required no treatment, were grouped in category A. More severe haemorrhages were categorised as B, C or D depending on the severity of the bleed and the treatment required. The majority of haemorrhage cases identified were category A and required no treatment for bleeding. Fifty-six patients (8.2 per cent) were in this group and accounted for 76 per cent of all haemorrhage cases. Eighteen patients had more significant bleeds, categorised as B–D. None of the patients died (i.e. no patients in category E).

Category A patients

Fifty-six patients (8.2 per cent) suffered a category A bleed (i.e. they were not bleeding at the clinical examination), accounting for 76 per cent of all patients who reported bleeding. Twelve of the patients were less than 12 years old and 44 were aged 12 years or older. Two patients aged less than 12 years and 7 aged 12 years or older were readmitted for the management of pain or infection, and/or for observation because of social or geographical issues.

Category B, C and D patients

The remaining 24 per cent of haemorrhage cases consisted of seven category B bleeds, eight C bleeds and three D bleeds.

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There was only 1 primary B bleed, which occurred in a patient aged 12 years or older; the remaining B bleeds were secondary (1 in a patient aged less than 12 years and 6 in patients aged 12 years or older).

All patients who suffered category C bleeds were returned to the operating theatre; there was 1 primary C bleed in a patient aged less than 12 years and 2 in patients aged 12 years or older. All 5 category C secondary bleeds were in patients aged 12 years or older.

Of the 3 patients who suffered category D haemorrhages, the 2 patients aged 12 years or older returned to the operating theatre. The child aged less than 12 years, who was discussed above, did not return to the operating theatre.

Discussion

Readmission and return to operating theatre rates have been proposed to be the most important and clinically relevant methods of assessing and comparing haemorrhage complication rates post-tonsillectomy.[14] The data collected and published to date have suffered from the lack of a consistent definition of post-tonsillectomy haemorrhage.

This issue has only recently been addressed, with the publication of commendable post-tonsillectomy haemorrhage guidelines, by Sarny *et al*., in 2011.[3] Prior to this, a multitude of studies discussed the difficulties in comparing findings to those of other groups and the limited ability to accurately compare outcomes more broadly.[7] Readmission to hospital and return to operating theatre rates following post-operative haemorrhage may be significantly influenced by local policies and procedures. In line with proposals by Sarny *et al*., we suggest that documentation of readmission and return to operating theatre rates, along with the use of a classification system for the analysis of haemorrhage severity, is the best way to achieve consistent data for comparison.

We commenced this audit with the intention of using the original Stammberger classification system for tonsillectomy bleeds.[3] As the audit progressed, it became apparent that the original classification system has some limitations. Furthermore, bleeding history, and subsequent classification, did not adequately convey the severity of the presentation for some patients. Modified criteria were developed based on the following key elements: presence of bleeding at clinical examination, presence of shock, requirement for surgery and requirement for blood transfusion.

Most significantly, the modifications have excluded a drop in haemoglobin as a discriminator within our classification system. Instead, the requirement for transfusion was used as an indicator of severe physiological impairment requiring correction. Transfusion remains a discriminator in category D, to clearly signpost the associated clinical scenario arising from significant blood loss.

The measurement of haemoglobin levels at presentation of post-tonsillectomy haemorrhage is important and needs to be considered on an individual basis. A confusing picture can arise when trying to include a rise or fall in haemoglobin within haemorrhage classification criteria; minor ooze over a prolonged time, dehydration, aggressive intravenous fluid management or a large bleed that settles very quickly can all cause a change in haemoglobin levels, but this would not necessarily reflect the overall clinical scenario. For these reasons, we excluded a simple fall of haemoglobin as a discriminator.

The following case outlines how the modified classification system has been applied. One patient aged less than 12 years experienced a significant haemoglobin drop resulting from ongoing post-operative ooze that settled spontaneously. While the operating theatre was not necessary, after consultation with his paediatrician, blood transfusion was indicated and performed. The C classification is defined by the occurrence of surgical treatment performed under general anaesthesia, and if the scale is interpreted as ordinal, surgery may be also be assumed for a D classification.[3] In this case, the patient's haemorrhage was managed conservatively in an operative sense; however, the transfusion requirement should not be overlooked. The child was allocated to category D in light of the blood transfusion and the overall severity of the clinical scenario.

Return to operating theatre rates are most commonly used as the benchmark in the comparison of post-tonsillectomy haemorrhages.[14] It is widely accepted that haemorrhage complication rates following tonsillectomy are lower amongst young children.[16] Minimal differences between cold dissection and coblation in return to operating theatre rates have previously been documented.[4] Only 1 of the 289 children aged less than 12 years who underwent coblation tonsillectomy returned to the operating theatre because of a primary haemorrhage and none returned as a result of secondary bleeding. This clinical audit lacks a non-coblation comparison group; however, the fact that no children under 12 years experienced a secondary haemorrhage which required a return to the operating theatre would support the suggestion that coblation is a safe tool in this group.

An overall readmission rate of 3.4 per cent was noted in this study, with young children only accounting for two of the readmissions (0.01 per cent of all patients operated on). This is consistent with figures reported in the literature.[7] Despite the low rates for readmission because of haemorrhage within this audit, it is reasonable to agree that readmission rates are likely to be affected by local policies and procedures.[9,17] Evans *et al*. (2003) reported the overall readmission rate for adults following tonsillectomy at 8 per cent; however, tonsillectomy technique was not specified.[14] A review of readmission rates post-tonsillectomy conducted by Harris *et al*. (2008) found that readmission rates for haemorrhage ranged from 0 to 22 per cent depending on local policy.[17] The use of classification systems in studies of this type will hopefully allow

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more accurate future comparison. The return to operating theatre rate is an additional useful objective measure widely reported in these studies.

The majority of patients (76 per cent) who reported bleeding in this study experienced small, self-limiting haemorrhages that were not active on examination. It has been previously stated that on close questioning, up to 40 per cent of all tonsillectomy patients may report a minor haemorrhage, but only a small percentage will seek medical assistance; this results in dramatic variation between studies reporting rates of minor haemorrhage.[4] 'Minor' haemorrhage definitions are also inconsistent and this further confuses the issue (as revealed by a large meta-analysis of coblation tonsillectomy[7]). Objective measures, such as return to operating theatre rates post-tonsillectomy, avoid these limitations when attempting comparison between techniques.

In this study, the total primary haemorrhage rate was 0.7 per cent. The National Prospective Tonsillectomy Audit identified primary haemorrhage rates of 1.0 per cent for coblation, 0.8 per cent for cold steel with ties or packs, and 0.5 per cent for cold steel with monopolar or bipolar diathermy.[9] Individual surgeon experience has also been shown to contribute to a reduction in overall coblation tonsillectomy complications.[10] The rates of primary haemorrhage in this study demonstrate that coblation tonsillectomy has a primary haemorrhage risk comparable to that reported for other 'cold' techniques (e.g. cold steel and ties).

- **Tonsillectomy is one of the most common surgical procedures performed worldwide; haemorrhage is a potentially serious complication of tonsillectomy**
- **Controversy exists over coblation tonsillectomy haemorrhage rates**
- **Studies reporting higher haemorrhage rates with coblation tonsillectomy have not accounted for the learning curve of inexperienced surgeons**
- **Depending on data collection method and haemorrhage definitions, secondary haemorrhage rates have been reported as between 0 and 50 per cent**
- **We recommend the Flinders modification of the Stammberger criteria for future standardisation of post-tonsillectomy haemorrhage data**

This is a retrospective case note audit and is therefore subject to particular limitations and biases. The authors recognise that previous studies are likely to have under-reported bleeds because of limited available documentation and variable patterns of presentation. As with all post-operative tonsillectomy studies, low-severity haemorrhages may be under-reported due to failure of the patient to present for assessment and management. Extensive effort was taken in this study to ensure that no patients were overlooked. The return to operating theatre rate was used as an additional objective measure; this is arguably more reliable than haemorrhage rates alone. Finally, a control group was not included. This would have contributed further information to this single-surgeon case series.

Conclusion

This study, which has a level of evidence 4 (case series), used the Flinders modification of the Stammberger criteria in order to allow a detailed analysis of a potentially complex dataset. It may enable more standardised comparison across the relevant literature. Unfortunately, because of the lack of standardisation, retrospective comparisons will remain difficult to perform until this (or any other) classification system is adopted and used more widely in a prospective manner.

Coblation tonsillectomy was demonstrated to be a safe and effective alternative technique for total tonsillectomy in the hands of an experienced coblation surgeon. Low rates of readmission and return to the operating theatre were identified, particularly for children aged less than 12 years.

Modifications were applied to the recent Stammberger classification system for post-tonsillectomy haemorrhage; these facilitate more complete comparison of outcomes associated with this operative technique. We recommend the Flinders modification of the Stammberger criteria for future standardisation of post-tonsillectomy haemorrhage data.

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