

BMJ Open Quality Evaluation of a newly introduced tonsillectomy operation record for the analysis of regional post-tonsillectomy bleed data: a quality improvement project at the London North West Healthcare NHS Trust

Matt Lechner,^{1,2,3} Deepak Chandrasekharan,^{1,2,3} Rohan Vithlani,¹ Liam Sutton,² Carly Grandidge,¹ Behrad Elmiyeh¹

To cite: Lechner M, Chandrasekharan D, Vithlani R, *et al*. Evaluation of a newly introduced tonsillectomy operation record for the analysis of regional post-tonsillectomy bleed data: a quality improvement project at the London North West Healthcare NHS Trust. *BMJ Open Quality* 2017;**6**:e000055. doi:10.1136/bmjoc-2017-000055

► Additional material is published online only. To view please visit the journal online (<http://dx.doi.org/10.1136/bmjoc-2017-000055>)

ML, DC and RV contributed equally.

Received 15 March 2017
Revised 30 May 2017
Accepted 16 July 2017



CrossMark

¹Department of Otolaryngology – Head and Neck Surgery, Northwick Park Hospital, London North West Healthcare NHS Trust, Harrow, London, UK

²Royal National Throat, Nose and Ear Hospital/University College London Hospital, London, UK

³University College London, London, UK

Correspondence to

Matt Lechner;
m.lechner@ucl.ac.uk and
Deepak Chandrasekharan;
d.chandrasekharan@ucl.ac.uk

ABSTRACT

The primary objective of this audit and quality improvement project was to retrospectively analyse regional post-tonsillectomy haemorrhage data as per national recommendations. However, this process highlighted the need for high-quality routinely collected data; something that was not always available via retrospective audit and thus does not enable formal aetiological factor analyses. We therefore created further secondary objectives to facilitate our primary audit objective. These secondary objectives were (1) to introduce a standardised tonsillectomy operation proforma to improve completeness and quality of routinely collected data and (2) to evaluate and validate proforma use and usefulness in improving using routine data collection to help with a repeated audit of post-tonsillectomy haemorrhages with the eventual aim to help improve operative outcomes by identifying potential associated factors. The retrospective audit component, the prospective audit and the quality improvement component were all carried out at the Northwick Park Hospital and Central Middlesex Hospital (London North West Healthcare NHS Trust). First, 642 tonsillectomy records (2012–2014) were retrospectively reviewed. Free-text operative documentation and, where possible, potential factors associated with post-tonsillectomy haemorrhages were analysed. In addition, completeness of data available before and after the introduction of (A) a new paper-based and (B) electronic surgical record proforma was reviewed (2014–2015). Over a 2-year period, 62 of the 642 (9.7%) audited tonsillectomy patients had a post-tonsillectomy haemorrhage, and 19 of these (2.9%) had to return to theatre for surgical arrest of the haemorrhage. Bipolar diathermy was the most commonly used technique. During this period, data available from routine operative documentation in the surgical operation notes were variable and thus did not allow identification of potential factors associated with post-tonsillectomy haemorrhage. The completeness and quality of data significantly improved after the introduction of a standardised paper-based proforma with sections for required details based on known risk factors for post-tonsillectomy haemorrhage

and required operative details. Quality and completeness of data was further improved after the introduction of an electronic version. This electronic proforma will allow prospective spiral auditing results, early identification of raised bleeding rate, and provide individual surgeon audit results.

The introduction of the standardised electronic tonsillectomy surgical proforma replaced operation notes for tonsillectomies at London North West Healthcare NHS Trust. This has significantly improved the quality of routinely collected data for tonsillectomies. This will thus allow ease of continual reaudit of potential aetiological factors, operative outcomes and adverse events. Specifically, it will allow prospective spiral auditing of results and early identification of raised bleeding rate, and provide individual surgeon audit results. Based on these findings, we suggest that proformas incorporated in the electronic medical record system shall be evaluated for other operations in the region to further increase the compliance with concise documentation.

PROBLEM

The aim of this quality improvement project was to identify potential contributing factors to post-tonsillectomy haemorrhage via the retrospective review of operation notes over a 2-year period.

However, it soon became apparent that variability in free-text routine operative documentation precluded from effectively identifying potential factors associated with haemorrhage. As such, a standardised proforma was established to improve the completeness and quality of routinely inputted data (paper

based and then electronic; online (supplementary materials figure 1 and 2) to more efficiently and accurately assess, analyse and monitor post-tonsillectomy complications on a prospective and continual basis.

The retrospective audit component, the prospective audit and the quality improvement component were carried out at the Northwick Park Hospital and Central Middlesex Hospital (London North West Healthcare NHS Trust), both regional referral centres for otorhinolaryngology.

BACKGROUND

Post-tonsillectomy haemorrhages are classified into those that occur within 24 hours (primary) and those that occur up to 2 weeks after the operation (secondary). Various studies and data from the National Prospective Tonsillectomy Audit confirm that post-tonsillectomy haemorrhage rates are related to technique for dissection and haemostasis.^{1–4} Further factors, such as postoperative pain,⁵ postoperative course of antibiotics,⁶ perioperative medication,⁷ obesity⁸ and age and gender^{9,10} have been evaluated in the context of post-tonsillectomy haemorrhage.

The aim of this study was to help identify potential causes of post-tonsillectomy haemorrhage by retrospectively evaluating operation records over a 2-year period. However, routinely collected free-text operative documentation did not allow a valid root cause analysis, and in view of this and in line with previous studies,¹¹ we aimed to introduce a standardised (1) paper-based and subsequently (2) electronic tonsillectomy surgical proforma to replace tonsillectomy operation notes and for audit purposes (prospective component) and to analyse, understand and monitor postoperative complications of tonsillectomies.

MEASUREMENT

Our baseline data collection focused on all patients who underwent a tonsillectomy during a 2-year period to assess the extent of the problem. A proforma was used, measuring the number of post-tonsillectomy haemorrhages and for these cases further documented the location of surgery, operating surgeon, age, sex, surgical technique, haemostasis technique, use of local anaesthetic, average length of stay, body mass index and comorbidities. In addition, we also assessed the extent to which these data were readily available from the free-text perioperative documentation and operation note.

We found that only 50% of the required data were available at this point, and this made analysis of underlying causes of post-tonsillectomy haemorrhage difficult.

To facilitate future aetiological studies of post-tonsillectomy haemorrhage, we introduced a standardised paper proforma for tonsillectomy operative documentation and measured completion rate as well as post-tonsillectomy haemorrhage rates with the aforementioned subgroup details between April and July 2014. Subsequently, an electronic version of the standardised proforma was

introduced to facilitate easier documentation to help to meet our project aim of improving the documentation of tonsillectomy surgery to facilitate future audit of post-tonsillectomy haemorrhage rates.

DESIGN

This retrospective and prospective audit was registered with the London North West Healthcare NHS Trust (NWPB audit ID 1568) and was carried out at the Northwick Park Hospital and Central Middlesex Hospital. Data for the retrospective analysis were obtained for the period of 2012–2014, and medical notes were retrieved for 642 patients who underwent a tonsillectomy during this period.

The prospective audit was carried out from 2014 to 2015 and included the evaluation of the paper-based surgical proforma, a modified version of that used for the National Tonsillectomy Audit (online supplementary figure 1) in 83 patients and an updated electronic version (online supplementary figure 2) in 95 patients. Patients' details, grade of surgeon, date of operation, indication, tonsillectomy dissection type, type of haemostasis, surgical time, estimated blood loss, checks, perioperative use of topical bupivacaine and use of postoperative analgesia and antibiotics were included in the proforma.

STRATEGY

Our SMART aim was to better audit post-tonsillectomy haemorrhage rates by aiming for 85% completion of a proforma for operative documentation. We undertook two PDSA test cycles.

PDSA cycle 1

The first intervention was to create a paper-based standardised operative documentation proforma in consultation with nurses, anaesthetists and operating surgeons to effectively document the operative details relevant to tonsillectomy and risk factors for post-tonsillectomy bleeding as identified from literature searches. The introduction of this proforma coincided with publicity at clinical governance meetings, and this achieved an increase in data completeness to 74%. This was an increase of 24% from the preintervention documentation. We sought feedback from clinicians, and issues included the proforma not always being available in theatres and difficulty retrieving patient notes retrospectively for auditing of haemorrhage rates for clinical governance.

PDSA cycle 2

In order to further increase documentation and ease of notes recall, we created an electronic proforma for storage on a secure password-protected departmental hospital server that could be accessed from all operating theatres by the ENT team. Since introduction of the electronic proforma, complete datasets on the electronic version were present in 61% of tonsillectomies in January 2015, 55% in February 2015 and 58% in March 2015

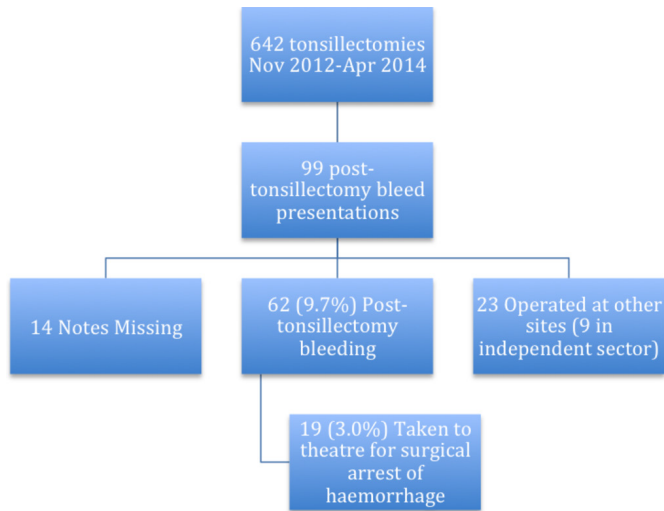


Figure 1 Flow diagram of the retrospective analysis of 642 post-tonsillectomy patients.

(with the paper one being used otherwise). Of those that were filled in either electronically or in paper form, there was 100% completion of operative details.

RESULTS
Retrospective audit

Over the 2-year period from 2012 to 2014, 62 of the 642 (9.7%) audited tonsillectomy patients had a post-tonsillectomy haemorrhage and 19 of these (2.9%) had to return to theatre for surgical arrest of the haemorrhage (figure 1). This is broken down into monthly proportions by figure 2.

A higher postoperative bleeding rate was observed in patients who were operated at Central Middlesex Hospital (74.2%; n=46), compared with patients at Northwick Park Hospital (25.8%; n=16). The Ealing site was not included as it was not part of the Trust at that time. No gender-specific differences were observed. Of all patients who presented with a post-tonsillectomy haemorrhage, 48.2% (n=41) were male and 51.8% (n=44) were female. A

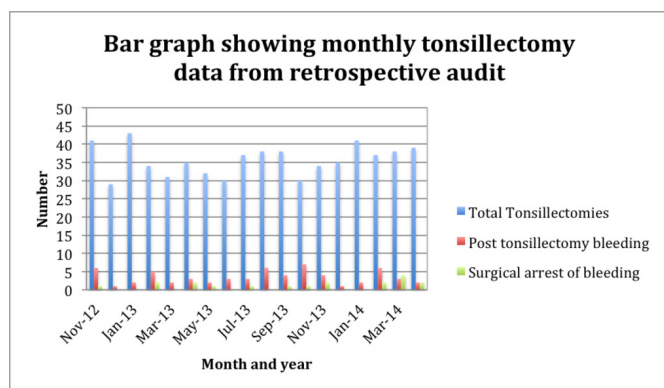


Figure 2 Bar chart to demonstrate the number of tonsillectomies, post-tonsil bleed presentations and arrest of post-tonsil bleed surgeries per month over the data collection period.

Table 1 The initial indication for surgery in all cases of post-tonsillectomy haemorrhage

Indication	Proportion of post-tonsillectomy haemorrhages (n)
Recurrent tonsillitis	48.4% (30)
Asymmetrical tonsils/histology	8.1% (5)
OSA/SDB	17.7% (11)
Mixed indication	24.2% (15)
Not documented	1.6% (1)

Mixed includes cases with both obstructive and infective indications. OSA, obstructive sleep apnoea; SDB, sleep disordered breathing.

percentage of 57.6 (n=49) were adults and 42.4% (n=36) were children.

Indication for surgery

Table 1 and figure 3 show the initial indication for surgery in all cases of post-tonsillectomy haemorrhage.

Surgical technique

Of the patients with post-tonsillectomy haemorrhage, bipolar dissection was the most commonly used technique (95% of the time) (see figure 4). Average watts used was 12.8W. However, this was not documented in 58.1% of patients. Figure 5 demonstrates the breakdown of haemostasis methods in these patients with post-tonsillectomy bleeds. Again of note is lack of documentation in 58.1% of patients.

Local anaesthetic in the form of a swab soaked in bupivacaine or lignocaine was used in 6.5% of patients who suffered a post-tonsillectomy haemorrhage. In the same population, there were no equipment problems documented, and 13 (20.1%) operation notes documented difficulty in surgery or some procedural issues.

In patients with post-tonsillectomy haemorrhage, during the primary operation, the average length of

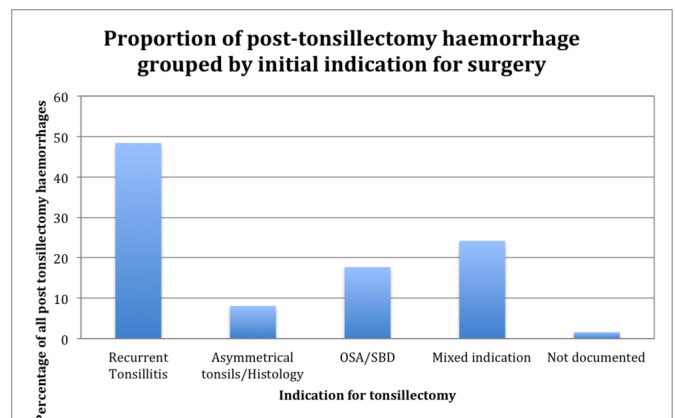


Figure 3 This figure demonstrates percentage breakdown of the indications for tonsillectomy of those patients who suffered post-tonsillectomy haemorrhage.

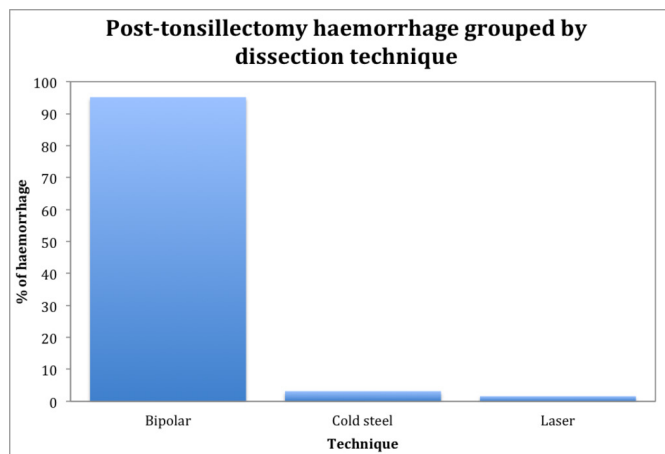


Figure 4 This illustrates the method of tonsillectomy in patients with post-tonsillectomy haemorrhage. Bipolar was used 95.2% of the time (n=59), cold steel was used 3.2% of the time (n=2) and laser was used 1.6% of the time (n=1).

stay was 1.7 days. Three patients were diabetic (4.8%), eight (12.9%) were current smokers and four (6.5%) ex-smokers; the remaining 50 (80.6%) were non-smokers. The average BMI in this patient group was 24.2.

It is very important to note that during this period, documentation in the surgical operation notes was limited in the majority of cases (>50% of the time). Hence, we were unable to draw any significant conclusions or perform a detailed case-control analysis.

Prospective audit of paper-based surgical operation record

The use of the paper-based proforma was audited between end of April 2014 and July 2014. Eighty-three patients underwent a tonsillectomy at either Northwick Park Hospital and Central Middlesex Hospital, and the proforma was completed in 62 patients (74%). Documentation before (n=642) and after the introduction of the proforma (n=62) were compared, and the documentation

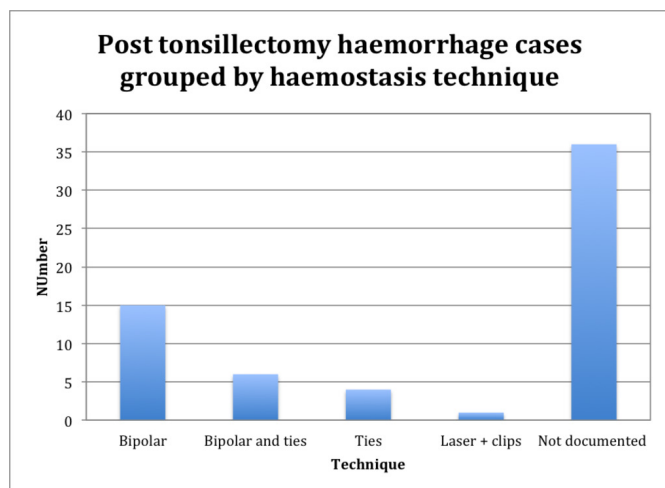


Figure 5 This demonstrates the method of haemostasis in patients with post-tonsillectomy haemorrhage. Bipolar: n=15; bipolar and ties: n=6; ties: n=4; Laser+clips: n=1, not documented n=36.

of various factors significantly improved after the introduction of the paper-based proforma.

Prospective audit of electronic data

As the most useful way to improve surgical outcomes would be to compare patients who had postoperative complications with those who did not (in a cohort manner or nested case-control study) using routinely collected data, we introduced an electronic proforma that was similar to the paper-based version. This could be completed online and a printed copy attached to the notes. The proforma was completed in 61% of tonsillectomies in January, 55% in February and 58% in March (with the paper one being used otherwise). Of those that were filled in, there was 100% completion of operative details. All tonsillectomies were performed using bipolar diathermy with a mean power of 8.2W for dissection and 8.4W for haemostasis. Ties were used 83% of the time and only on the inferior pole. The average operative time was 32.6 min.

Since introduction of the proforma, the overall bleed rate for the 2.5 months was 7.2%. However, on a month-by-month basis, February had a rate of 6.1% and March had 5.2%. There was one return to theatre (1.1%, return in January). While there is not enough power to calculate significance, the trend towards reducing bleed rates may suggest that monthly review of non-bleed and bleed cohorts may help in reducing adverse outcomes.

LESSONS AND LIMITATIONS

The overall aim of this audit and subsequent quality improvement project was to introduce (A) a new paper-based and (B) electronic surgical record proforma to retrospectively analyse regional post-tonsillectomy haemorrhage data and use the data from this to analyse, understand and monitor postoperative complications of tonsillectomies. By studying practice rigorously on a regular basis, good surgical practice can be shared and operative outcomes improved. In the course of the prospective audit, a post-tonsillectomy haemorrhage was only reported in 4.6% of cases in who bipolar diathermy forceps was used for tonsillectomy and only 0.9% of patients needed to return to theatres.

The collection of reliable data is the first step of a quality improvement project, and we have established a useful core dataset to help understand outcomes surrounding tonsillectomy. The data were used to standardise coding of procedures, allow improved capture of post tonsillectomy haemorrhage and enable root cause analysis at case level, operator level and hospital level to help identify improvement opportunities. The ability to pseudoanonymously study operator level data will hopefully allow for correction of learning curves and volume-outcome differences between individuals of different grades.

The proforma helped with better data-driven discussion at monthly clinical governance and mortality and morbidity meeting and also facilitated focused suggestions for changes in practice—both clinical and administrative.

The availability of the proforma on the secure hospital computers in theatre also meant ease of completion. The repeated cycles show that this is a sustainable and easy way to reliably collect a core dataset for tonsillectomies. While the power from a single centre study will necessarily be small, we hope that the improvements identified from this pilot in data capture, operative note access and discussions will enable broadening this study to a regional ENT trainee collaborative approved study.

From the retrospective component and the prospective component, a trend towards increased bleeding risk with higher power diathermy, and thus heat, may exist. In the prospective component, the average diathermy used for each month was 8.8W, then 8.1W, then 8W, which seems to correlate with the trend for reduced bleeding. Likewise, cooling may also help reduce haemorrhage rates. The findings of heat correlating with bleeding fit with evidence from the wider literature.^{12 13}

There was also a discrepancy in the bleeding rate with increased post-tonsillectomy bleeding from the day case ambulatory care and diagnostics (ACAD) site compared with the inpatient tonsillectomies usually performed at Northwick Park. First, there are more tonsillectomies performed at the ACAD site so this mitigates some of the increase. Second, the indication is predominantly OSA at Northwick Park, rather than recurrent tonsillitis and fewer children are operated on Northwick Park compared with the ACAD site. These differing demographics and indications may change the postoperative bleeding risk, but our data are at present underpowered to substantiate this. It may also be due to the overnight inpatient care. As the operating teams and instruments used are the same at both sites, this does not explain the discrepancies.

A prospective audit seems an efficient, low-cost way that is easily scalable for other ENT departments to monitor their own tonsillectomy practice to help facilitate both adequate surgical documentation as well as reviewing practice to improve outcomes. The trend towards a reduction in bleeding rate on a monthly basis after the prospective proforma may reflect this. However, as the numbers in the prospective component are small, it is possible these changes are regression to the mean or operator experience effects.

There are limitations to our study that warrant discussion. Although the retrospective study is comprehensive over 2 years and has a high number of operations, it is still retrospective in nature and thus prone to bias. The two prospective cycles with the paper proforma and the electronic version help reduce this bias. Nevertheless, the moderate return rate (60%) of the electronic format means that bias is possible from incomplete capture of all tonsillectomy operative notes and thus intraoperative data. However, this was addressed, and we identified ways in which we were able to increase the return rate. Until the hospital adopts paperless records, the success of this intervention will rely on compulsory use of the proforma and the mandatory monthly discussion of tonsillectomy bleed data at clinical governance based on the proforma.

Likewise, as there is no nationally agreed core dataset for tonsillectomies, the data collected may be modified in future based on interim analyses. For example, since the writing of this stage of the study, coblation has been adopted by the trust, and an increasing number of tonsillectomies are being performed using this technique. This will be studied in the next cycle of the QIP. Likewise, it will be important to set local practice (eg, variations in techniques used) in context of regional and national hospitals, and one potential opportunity would be to use the ENT trainee research collaborative to study this in greater detail. Our data must also be interpreted in the context of larger scale tonsillectomy audits such as the UK National Prospective Tonsillectomy Audit (2005) and more recent national registry analyses, for example, from Sweden. Our results broadly in alignment with hot techniques having a higher bleeding rate. However, two caveats must be borne in mind; first, the small numbers in our study compared with the national audit, and second, the 10 years that have passed since the audit, which will have seen changes in practice, for example, now with the re-emergence of coblation and intracapsular tonsillectomy/tonsillotomy.

Finally, as our hospitals are the regional referral centre for ENT, patients with post-tonsillectomy bleeding may go to other accident and emergencies in the region and may not have been discussed with our team or have been referred to other ENT centres in London. Future work would include a re-evaluation of our data set over a longer time scale with increased compliance with the electronic form.

CONCLUSION

In conclusion, the described use of the electronic form will allow surgical teams to continuously monitor practice, perform prospective spiral audits and provide surgeons with individual surgeon data to benchmark their practice. With the advent of multicentre trainee research collaboratives,¹⁴ the use of this form will facilitate larger scale prospective audits of tonsillectomies, including coblation tonsillectomies, across our region and other regions in the UK.

Acknowledgements We would like to thank the entire team of the ENT Department at Northwick Park Hospital and at Central Middlesex Hospital for their support with this quality improvement project. We would also like to thank Zaid Awad who provided the proforma which formed the foundations of the proforma used in our quality improvement project.

Contributors ML, DC, RV, CG have conducted the various stages of the QIR and written the report. LS has helped with data analysis and writing up the report. BE has supervised the project.

Competing interests None declared.

Provenance and peer review Not commissioned; externally peer reviewed.

Open Access This is an Open Access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>

© Published by the BMJ Publishing Group Limited. For permission to use (where not already granted under a licence) please go to <http://www.bmj.com/company/products-services/rights-and-licensing/>

REFERENCES

- 1 Söderman AC, 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;40:248-54-54.
- 2 Collison PJ, Mettler B. Factors associated with post-tonsillectomy hemorrhage. *Ear Nose Throat J* 2000;79:640-2.
- 3 Audit NP. Impact of NICE guidance on rates of haemorrhage after tonsillectomy: an evaluation of guidance issued during an ongoing national tonsillectomy audit. *Qual Saf Health Care* 2008;17:264-8.
- 4 Aydin S, Taskin U, Altas B, *et al*. Post-tonsillectomy morbidities: randomised, prospective controlled clinical trial of cold dissection versus thermal welding tonsillectomy. *J Laryngol Otol* 2014;128:163-5.
- 5 Sarny S, Habermann W, Ossimitz G, *et al*. Significant post-tonsillectomy pain is associated with increased risk of hemorrhage. *Ann Otol Rhinol Laryngol* 2012;121:776-81.
- 6 Dhiwakar M, Clement WA, Supriya M, *et al*. Antibiotics to reduce post-tonsillectomy morbidity. *Cochrane Database Syst Rev* 2012;12:CD005607.
- 7 Chan DK, Parikh SR. Perioperative ketorolac increases post-tonsillectomy hemorrhage in adults but not children. *Laryngoscope* 2014;124:1789-93.
- 8 Riechelmann H, Blassnigg EC, Profanter C, *et al*. No association between obesity and post-tonsillectomy haemorrhage. *J Laryngol Otol* 2014;128:463-7.
- 9 Ikoma R, Sakane S, Niwa K, *et al*. Risk factors for post-tonsillectomy hemorrhage. *Auris Nasus Larynx* 2014;41:376-9.
- 10 Akin RC, Holst R, Schousboe LP, *et al*. Risk factors for post-tonsillectomy haemorrhage. *Acta Otolaryngol* 2012;132:773-7.
- 11 Awad Z, Salter V, Hunt D, *et al*. Audit of specifically designed adenotonsillectomy operation sheet: how we do it. *Clin Otolaryngol* 2009;34:489-92.
- 12 Blanchford H, Lowe D. Cold versus hot tonsillectomy: state of the art and recommendations. *ORL J Otorhinolaryngol Relat Spec* 2013;75:136-41.
- 13 Tomkinson A, Harrison W, Owens D, *et al*. Risk factors for postoperative hemorrhage following tonsillectomy. *Laryngoscope* 2011;121:279-88.
- 14 Koliass AG, Cowie CJ, Tarnaris A, *et al*. Ensuring a bright future for clinical research in surgery with trainee led research networks. *BMJ* 2013;347:f5225.