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Perioperative tranexamic acid in day-case paediatric tonsillectomy

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ABSTRACT

INTRODUCTION Tranexamic acid has been used for many years to minimise blood loss during surgery and, more recently, to reduce morbidity after major trauma. While small studies have confirmed reduction in blood loss during tonsillectomy with its use, the rate of primary haemorrhage following tonsillectomy has not been reported. In the UK, less than 50% of children having a tonsillectomy are managed as day cases, partly because of concerns about bleeding during the initial 24 hours following surgery.

METHODS A retrospective review of clinical records between January 2007 and January 2013 produced 476 children between the ages of 3 and 16 years who underwent Coblation™ tonsillectomy, with or without adenoidectomy and/or insertion of ventilation tubes. All children were ASA (American Society of Anesthesiologists) grade 1 or 2 and anaesthetised using a standard day surgery protocol. Following induction of anaesthesia, all received intravenous tranexamic acid at a dose of 10–15mg/kg.

RESULTS Two children (0.4%) had minor bleeding within two hours of surgery. Both returned to theatre for haemostasis and were discharged home later the same day with no further complications. The expected rate for primary haemorrhage in the UK using this technique for tonsillectomy is 1%.

CONCLUSIONS Perioperative tranexamic acid in a single, parenteral dose might reduce the incidence of primary haemorrhage following paediatric tonsillectomy, facilitating discharge on the day of surgery. The results from this observational study indicate a potential benefit and need for a large, prospective, multicentre, randomised controlled trial.

KEYWORDS

Tranexamic acid – Tonsillectomy – Paediatric – Haemorrhage – Complications

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Tranexamic acid (TXA) has been available for over 40 years but has only recently been established as a valuable pharmaceutical tool for reducing blood loss during surgery and following major trauma.[1,2] While a clinical indication for TXA is prevention and reduction of bleeding after tonsillectomy,[3] the drug has not achieved widespread, routine use.

TXA is a synthetic lysine analogue, producing an antifibrinolytic effect by the reversible blockade of lysine binding sites on plasminogen molecules. This inhibits the conversion of plasminogen to plasmin on the surface of the fibrin.[4] The drug has been widely used parenterally in cardiac, orthopaedic and urological surgery to reduce perioperative blood loss.[5] In orthopaedic surgery, TXA has been shown to lessen blood loss during knee arthroplasty by 50%, reducing the need for transfusion with no increased risk of thromboembolic complications.[6] It has also been used topically as a mouthwash following dental and oral surgery.[7]

TXA has been reported as part of the management of patients undergoing adenotonsillectomy with inherited bleeding disorders.[8,9] TXA applied topically as a gel during tonsillectomy showed no benefit over placebo in reducing haemorrhage following tonsillectomy.[10] Minimising postoperative bleeding on the day of surgery with TXA may facilitate a rise in the rate of ambulatory care (day-case) tonsillectomy in the UK.

Methods

Between 1 January 2007 and 14 January 2013, 476 children underwent elective day-case tonsillectomy, with or without adenoidectomy and/or insertion of ventilation tubes. All children fulfilled the medical and social criteria for day surgery.[11]

The indications for tonsillectomy were recurrent acute tonsillitis and sleep disordered breathing. Children with severe obstructive sleep apnoea, confirmed by domiciliary overnight pulse oximetry, not suitable for general hospital day surgery, were excluded from this pilot study. Data were collected from the computerised clinical records and written operating records, both of which were cross-correlated for accuracy.

The objective of the study was to assess whether TXA would minimise or abolish the primary haemorrhage on the day of surgery, facilitating discharge home the same day. Secondary haemorrhage was not assessed in this study. In the UK, TXA is routinely available only in tablet form, unsuitable for paediatric administration. The short half-life of TXA means that no effect on secondary haemorrhage would be expected from a single perioperative dose.

The children were aged between 3 and 16 years. Only children who were ASA (American Society of Anesthesiologists) grade 1 or 2 and suitable for day-case tonsillectomy, with discharge six hours after surgery, were included in this observational study. The indications for surgery were children with either recurrent tonsillitis, eligible for surgery within UK guidance,[12] or sleep disordered breathing, and a body weight of over 15kg.[13]

The same surgeon operated on all the children, using Coblation™ dissection and haemostasis for the tonsillectomy and suction diathermy for the adenoidectomy.[14] In all cases, the blood loss was not measured but it was clinically negligible, with swabs rarely required for haemostasis.

The children were anaesthetised using an adapted version of a previously published day-case anaesthetic protocol.[15] The protocol was modified to substitute intravenous paracetamol at 15mg/kg for rectal paracetamol. Perioperative slow intravenous infusion of TXA at 10–15mg/kg was administered.

Postoperatively, the children were observed for a minimum of six hours with measurement of pulse and respiration rates according to a standard nurse-led protocol. Any evidence of bleeding, either by a change in observations or with fresh blood from the nose or mouth, triggered immediate review by a doctor.

Results

There were no significant adverse effects from the administration of the TXA. Two of the children (0.4%) in the study experienced a single episode of postoperative vomiting but without evidence of bleeding. Two children (0.4%) developed minimal bleeding within the first two postoperative hours. (Our routine management is to return to theatre any child producing fresh blood from the mouth or nose during the immediate postoperative period of observation on the ward.) Both patients had minor bleeding points treated under general anaesthesia using Coblation™. Both were discharged home the same day, six hours after the second procedure. No child developed bleeding following an adenoidectomy.

All children were discharged home on the day of surgery. There were no readmissions with reactionary bleeding during the 24 hours following surgery.

Discussion

In this observational pilot study, the outcomes were benchmarked relative to the UK National Prospective Tonsillectomy Audit (NPTA).[16] This included 21,063 children under the age of 16 years undergoing a tonsillectomy. Only 12% were discharged home on the day of the operation as ambulatory care patients. Bleeding accounted for 22% of delayed discharges. (During the audit, Coblation™ was associated with a higher postoperative bleeding rate than other techniques.)

The 0.4% primary haemorrhage rate in our study of nearly 500 children compares well with the NPTA, which reported a 1% primary haemorrhage rate following Coblation™ tonsillectomy for 1,565 patients.[16] Using this as a comparison group, the data from our study are too small to produce statistical significance with chi-squared test analysis. They do, however, indicate a potential beneficial outcome from the use of prophylactic TXA during tonsillectomy surgery, both to reduce bleeding on the day of surgery and to increase the rate of discharge from hospital on the day of operation.

A number of studies have published variable results on bleeding after tonsillectomy using different types of antifibrinolytics. One showed no significant benefit from the routine use of TXA during tonsillectomy[17] while others have confirmed significant reduction in blood loss during surgery using conventional dissection techniques.[18,19] In a further randomised controlled trial (RCT), a single dose of intravenous, perioperative TXA at 10mg/kg produced a mean blood loss of 36.64ml compared with 66.32ml in the control group.[20] The authors reported no adverse effects from TXA. Three patients (3%) developed primary haemorrhage but none of these required operative intervention.

A systematic review and meta-analysis of the use of TXA for tonsillectomy confirmed TXA reduced blood loss during surgery but failed to demonstrate any reduction in the rate of haemorrhage following tonsillectomy.[21] The authors noted that of the 38 citations found in an extensive literature search, only 7 could be included in their final analysis. These studies varied enormously in the age range, dosage, schedule and duration of TXA administration, including one paper reporting topical application of a TXA paste, resulting in a higher bleeding rate than the placebo group.[22]

The small number of studies included in this meta-analysis[21] was so heterogeneous that it is difficult to draw meaningful conclusions regarding the applicability of TXA in reducing postoperative bleeding after tonsillectomy. A helpful conclusion is the safety of TXA, with only 1 of the 7 studies reporting adverse effects, in 3 out of 40 patients. All the adverse effects were minor, including headache, dizziness and vomiting.

Conclusions

This study's primary haemorrhage rate is lower than that reported in the UK NPTA.[16] Evidence already supports the routine use of TXA in tonsillectomy surgery to reduce perioperative blood loss and in the management of postoperative bleeding. Our study shows that the use of a single dose of TXA perioperatively could contribute to reducing primary postoperative haemorrhage and subsequently facilitate day-case discharge after tonsillectomy surgery.

Weaknesses of the study include the comparison of the study group to the NPTA, considered the UK benchmark

for complications following tonsillectomy. While our patients were all ASA grade 1 or 2, the NPTA did not stratify children into ASA grades. However, the proportion of children having an elective tonsillectomy who are ASA grade 3 or 4 is minimal. The numbers in our study were small but a power analysis indicates a study population of thousands would be needed to deliver statistical significance. Our study was restricted to primary haemorrhage to consider the benefits of day-case discharge after tonsillectomy and because no suitable paediatric preparation of oral TXA is currently available in the UK.

This study reports a single surgeon experience, using only Coblation™ for tonsillectomy and suction coagulation for adenoidectomy. While the comparative data from the NPTA were for the same tonsillectomy technique, it is uncertain what effect the TXA had over and above that of the surgeon's experience and the techniques used.

Our pilot study supports the conclusions of a meta-analysis published in 2013[21] that an adequately powered, prospective, RCT is needed to assess the potential benefit of TXA in the reduction of primary haemorrhage after tonsillectomy. A large, multicentre, prospective, RCT could also administer a suitable oral TXA preparation for ten days following surgery to assess any reduction in secondary haemorrhage.

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