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Xylometazoline pretreatment reduces nasotracheal intubation-related epistaxis in paediatric dental surgery

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Key points

- Epistaxis is a common complication of nasotracheal intubation (NTI).
- Topical vasoconstriction can reduce epistaxis, but has not been sufficiently evaluated in children.
- Addition of α-adrenergic receptor agonist to lidocaine jelly was tested before NTI in a randomized controlled trial of 104 children.
- Use of a topical vasoconstrictor is a simple and effective approach to reducing epistaxis after NTI without evidence of complications.

Background. Epistaxis is the most common complication encountered during nasotracheal intubation (NTI) in children. The aim of this study was to test the efficacy of prophylactic intranasal admixture of xylometazoline and local anaesthetic gel in reducing epistaxis after NTI in children.

Methods. Children presenting for dental procedures requiring NTI were randomly allocated into two groups: Group 1 (xylometazoline group, $n=53$) and Group 2 (control group, $n=51$). After sevoflurane inhalation induction, the more patent nostril in each subject was lubricated with lidocaine 2% (1 ml) jelly, followed by 0.6 ml of either xylometazoline hydrochloride 0.1% nasal drops (Group 1) or sodium chloride 0.9% (Group 2). The presence and extent of bleeding occurring during intubation, extubation, or both and navigability through the nasal passage were assessed.

Results. The incidence and severity of bleeding were significantly reduced between the study group (7.5%) compared with the control group (27.5%; $P<0.01$). Navigability was similar in both groups.

Conclusions. Admixture of intranasal xylometazoline 0.1% drops and lidocaine 2% jelly reduced the incidence and severity of epistaxis after NTI in preschool children.

Keywords: epistaxis; nasotracheal intubation; xylometazoline

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Nasotracheal intubation (NTI) is the preferred method to secure a patent airway and unobstructed surgical field during lengthy dental procedures in children, but carries the risk of dislodgement of the adenoid tissue with subsequent epistaxis. Epistaxis is the most common complication of NTI with an incidence as high as 80%.[1 2] Epistaxis can obscure the surgical field and, in the severe cases, can lead to loss of the airway.[3]

Several methods have been described to reduce the incidence of traumatic NTI, including selection of the more patent nostril, use of lubricating gel, progressive dilation with nasopharyngeal airways, use of a smaller tracheal tube (TT), warming of the TT,[4] and telescoping the TT into catheters.[5]

Topical vasoconstrictors, such as cocaine and α-adrenergic agonists (phenylephrine, xylometazoline, and oxymetazoline), have shown similar reduction in the incidence of epistaxis.[6] Many clinicians do not use topical nasal vasoconstrictors in children, due to concerns regarding their efficacy, complications, and a method to ensure uniformity of their distribution down the nasal passages.

There is limited information on the use of topical vasoconstrictors for NTI in children. The primary aim of this study was to investigate the efficacy and safety of intranasal pretreatment with xylometazoline (0.1%), as an admixture with lidocaine 2% jelly, in reducing intra- and postoperative epistaxis after NTI in preschool children undergoing dental procedures.

Methods

After obtaining institutional approval (Doha Clinic Hospital, Doha, Qatar) and informed written parental consent, a prospective, randomized, double-blind study was conducted from July 2008 through September 2009. Children (2–6 yr) undergoing elective dental restorations and extractions under general anaesthesia were enrolled in the study.

All subjects were ASA I and had a normal preoperative coagulation profile. Exclusion criteria included history of common cold during the prior 2 weeks, treatment with oral decongestants, anti-histamines, or non-steroidal anti-inflammatory drugs, clear symptoms and signs of adenoid hypertrophy (snoring, mouth breathing, and recurrent

upper respiratory tract infections), history of nasal trauma, nasal deformity, recurrent epistaxis, and known allergy to any of the medications used. Subjects were randomly allocated by a computer into two groups: Group 1 (xylometazoline group; $n=53$) and Group 2 (control group; $n=51$).

During the preoperative visit, each subject was asked to choose a sealed envelope with a group assignment, and the name, file number, body weight, and most patent nostril were recorded in the sealed envelope. The envelopes were opened before the induction of anaesthesia. NTI was performed by the anaesthesiologist assigned to the case who was blinded to the study group. On the morning of surgery, subjects were premedicated with 0.5 mg kg^{-1} oral midazolam in apple juice 0.5 ml kg^{-1} body weight 30 min before induction of anaesthesia.

Study medications were prepared by a trained anaesthesia technician (not involved in any other part of the study) in the identical 1 ml syringes. Induction of anaesthesia was carried out using sevoflurane 6 vol% in oxygen 100% (6 litre min^{-1}) via a face mask. I.V. cannulation was performed 60 s after induction. Fentanyl 1 μg kg^{-1} and cisatracurium 0.15 mg kg^{-1} were given. In all subjects, the more patent nostril was lubricated with lidocaine 2% (1 ml) jelly (Xylocaine jelly®, AstraZeneca AB, Sodertalje, Sweden) followed by either 0.6 ml (three drops) of xylometazoline 0.1% nasal drops (Otrivine®, Novartis Consumer Health SA, Nyon, Switzerland) in Group 1 or 0.6 ml of sodium chloride 0.9% in Group 2. Manual-assisted ventilation was continued for 3 min after the application of lidocaine jelly and nasal drops to ensure adequate spread. Subsequently, NTI was carried out using an appropriately sized, cuffed TT lubricated with a water-soluble lubricant (preformed siliconized soft flexible nasal TT with low-pressure cuff and Murphy eye tip; P3 Medical Ltd, Bristol, England). If resistance was encountered, the tube was withdrawn and re-inserted with counterclockwise rotation and cephalic tilting of the tube. If this was not successful, the other nostril was used. During nasal intubation, the degree of navigability through the nasal passage, defined as smooth or impinged (any subjective feeling of obstruction while passing a TT) was estimated. Intubation was completed, if necessary, with direct laryngoscopy and using Magill forceps. The anaesthesiologist who performed the intubation was allowed to estimate the navigability of the tube through the nasal passage and the presence of any bleeding on the cuff, while an independent observer estimated the degree of bleeding on a four-point rating scale as follows: no bleeding, mild, moderate, or severe bleeding. Blood encountered only on the tube or its cuff was considered mild bleeding; pooling of blood in the pharynx indicated moderate bleeding; and blood in the pharynx sufficient to impede intubation indicated severe bleeding. To differentiate between moderate and severe bleeding, a folded 4×4 in. gauze was used to swab the posterior pharynx in a square pattern, inspected for blood and tissue, graded as either moderate or severe bleeding with the aid of illustrative photographs. The observer of bleeding was aware of the hypothesis of the study but was not aware of the treatment assignment or present in the operating theatre until completion of the intubation.

Anaesthesia was maintained with sevoflurane 1.5–2 vol% in oxygen and nitrous oxide (35%:65%). Ventilation was adjusted to keep end-tidal CO_2 between 32 and 40 mm Hg. I.V. acetaminophen (Perfalgan® 100 ml vial, UPSA, France) 15 mg kg^{-1} was infused shortly after induction. All patients were monitored using electrocardiography, pulse oximetry, non-invasive arterial pressure, inspiratory and expiratory N_2O, O_2, and sevoflurane, end-tidal CO_2, and peak and plateau airway pressures.

At the end of the procedure, anaesthetic agents were discontinued and replaced with O_2 100%. The TT was smoothly removed by the same intubating anaesthesiologist upon fulfilling the criteria of extubation, and its cuff was checked for traces of bleeding. Before discharge from the post-anaesthesia care unit and from hospital, subjects were checked for difficulty with nasal breathing, persistent nasal bleeding, nasal pain, and nasal trauma.

Statistics

Sample size estimation was based on a reported[7] incidence of bleeding of 33%. The sample size estimate, based on an α of 0.05 and a β of 0.2 to detect a reduction in bleeding from 33% to 10%, was 49 subjects per group. Allowing for some exclusions and failure to follow-up, we increased the sample size of each group to be 54 subjects (Fig. 1).

Data were analysed using SPSS (Statistical Program for Social Science, v. 12) to determine mean, SD, and range.

Paired *t*-test was used to compare quantitative variables in the same group before and after treatment, and unpaired *t*-test was used to compare groups for quantitative variables. χ^2 test or Fisher's exact test was used to compare groups for qualitative variables ($P<0.05$ was considered significant).

Results

Patient characteristic data, duration of anaesthesia, number of intubation attempts, side of intubation, navigability during intubation (smooth–impinged), and number of extracted teeth showed no significant differences between the groups (Table 1).

Table 2 shows the incidence, severity, and persistence of nasal bleeding. Bleeding was more frequent in the control group (27.5%) than in the study group (7.5%; $P<0.001$). Similarly; severe, moderate, and persistent postoperative bleeding were also more frequent among controls compared with the study group ($P<0.01$). Bleeding was only mild in the four affected subjects within the study group, whereas six (11.8%) and five (9.8%) subjects had moderate and severe bleeding, respectively, in the control group. Two subjects (3.8%) continued with post-extubation bleeding in the study group, whereas 11 subjects (21.6%) continued with post-extubation bleeding in the control group ($P<0.001$). In the postoperative period, five subjects in the control group experienced persistent epistaxis, which necessitated temporary nasal packing in one subject. No subjects in the study

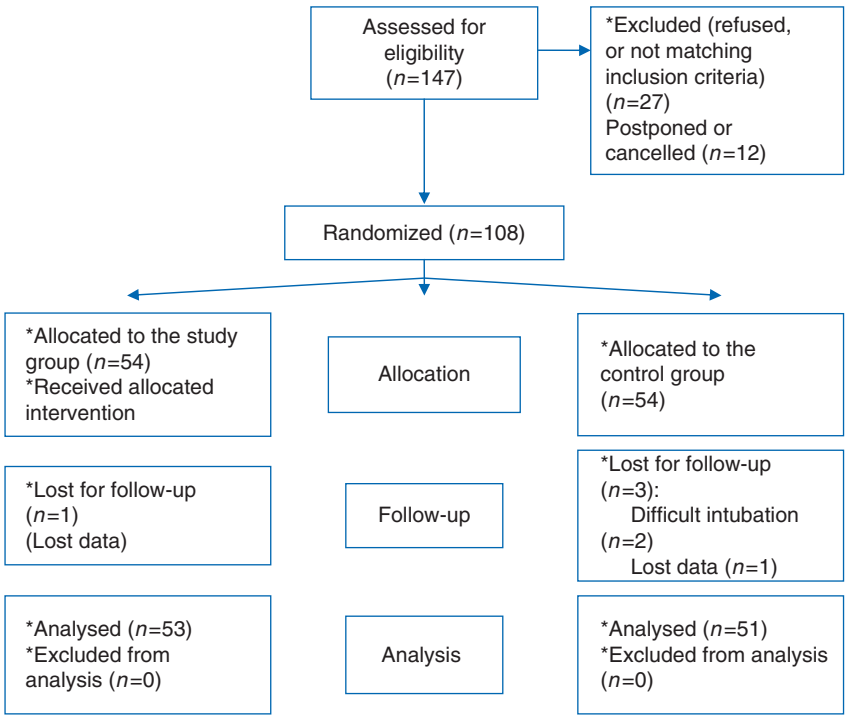

Fig 1 Flow chart of subjects through the trial.

Table 1 Patient and intubation characteristics. NS, not significant; CI, confidence interval

Variable	Study group ($n=53$)	Control group ($n=51$)	*P*-value	Odds (95% CI)
Age (yr) [mean (range)]	4.3 (2–6)	4.1 (2–6)	NS	
Gender [*n* (%)]				
Male	28 (52.8%)	27 (52.9%)	NS	
Female	25 (47.2%)	24 (47.1%)		
Body weight (kg) [mean (SD)]	17.9 (3.6)	NS	0.39	
Navigability [*n* (%)]				
Smooth	37 (69.8%)	37 (72.5%)	0.43	0.9 (0.02–4)
Impinged	16 (30.2%)	14 (27.5%)		
Number of attempts [*n* (%)]				
1	37 (69.8%)	39 (76.5%)	$\chi^2=2.1$, 0.22	0.8 (0.06–4.9)
2	14 (26.4%)	12 (23.5%)		
3	2 (3.8%)	0		
Nostril [*n* (%)]				
Right	41 (77.4%)	40 (78.4%)	0.62	0.6 (0.2–6.5)
Left	12 (22.6%)	11 (21.6%)		
Duration of anaesthesia (min) [mean (SD)]	87.3 (25.1)	89.5 (26.7)	0.6, *t*-value=0.4	−12.9 to 8.5
Number of extractions [mean (SD)]	2.27 (0.1)	2.1 (1.1)	0.350, *t*-value=0.9	−0.22 to 0.61

group had bleeding during the postoperative period, and no *de novo* post-extubation bleeding was reported in either group.

No difficulty in nasal breathing, nasal pain, blood crusts, or mucosal tearing were reported upon hospital discharge in any subject.

Discussion

We found that the overall incidence and severity of intubation-related epistaxis were significantly less in children pretreated with a combination of xylometazoline nasal drops and lidocaine jelly compared with lidocaine jelly alone. The

Table 2 Severity and incidence of epistaxis after NTI. CI, confidence interval

Epistaxis [*n* (%)]	Study group (*n*=53)	Control group (*n*=51)	χ^2	*P*-value	Odds (95% CI)
After intubation					
No bleeding	49 (92.5%)	37 (72.5%)	17	0.0001	2.2 (1–8)
Bleeding	4 (7.5%)	14 (27.5%)			
Mild	4 (7.5%)	3 (5.8%)			
Moderate	0	6 (11.8%)			
Severe	0	5 (9.8%)			
Post-extubation	2 (3.8%)	11 (21.6)		0.0000	2.5 (1–7)
Persistent bleeding					
No	53 (100%)	46 (90.2)		0.043	1.9 (1–6)
Yes	0	5 (9.8%)			

use of xylometazoline decreased the incidence of clinically relevant bleeding to 7.5% compared with 27.5% in the control group. Furthermore, the severity of bleeding in the xylometazoline group was significant with no reported persistent epistaxis, compared with five cases of sustained postoperative epistaxis in the control group. The 7.5% incidence of clinically relevant bleeding in the study group was better than the 29% incidence of bleeding reported by Elwood and colleagues,[7] who used oxymetazoline (an imidazoline topical vasoconstrictor similar to xylometazoline) but no lubricating gel before NTI in children. However, the primary aim of their trial was not to test the efficacy of topical vasoconstrictors in reducing epistaxis. Our study adds to the limited literature concerning the use of topical vasoconstrictors during NTI in children by demonstrating the efficacy of xylometazoline in the prevention of epistaxis.

Lidocaine gel decreases systemic absorption of the vasoconstrictor and reduces postoperative nasal pain.[8] Proper spread of the admixture also contributed to the good TT navigability in both groups. Although a reduced-strength formulation of xylometazoline is available for use in younger children, we used the adult formulation due to the expected dilution upon concomitant administration with lidocaine jelly.

O'Hanlon and Harper[1] suggested that the use of the xylometazoline helped reduce epistaxis during nasal intubation. The combination of oxymetazoline and lidocaine 4% spray was shown to provide similar nasal anaesthesia and vasoconstriction compared with cocaine in outpatients undergoing dacryo-cystorhinostomy.[9]

The rate of smooth intubation (navigability) was high in both groups (69.8% in the study group and 72.5% in the control). Moreover, the incidence of bleeding in the control group, in spite of being significantly higher than the study group, was lower than results of previous studies. This can be postulated to be due to the soft siliconized TTs used in our study. Kihara and colleagues,[10] who tested the hypothesis that a silicone-based tube is superior to a polyvinyl chloride (PVC-based) tube for NTI, found that the incidence of epistaxis was 32.5% with silicone TTs *vs* 80% with PVC tubes. Immersing preformed tubes in saline at 37°C resulted in less epistaxis, but thermo-softening appeared less effective in increasing flexibility.[11]

There are some limitations to our study. First, the absence of a third control group in which no lubricant gel was used, but this was not considered ethical and thus not considered in the study design. Secondly, the method of epistaxis assessment was subjective. However, standardizing the independent observer to all subjects along with the re-assessment of external bleeding after extubation improved the validity of this method. Thirdly, we did not report the time of hospital discharge and whether it was influenced by our method, but this outcome depends on numerous factors affecting the discharge time in our hospital.

The outcome of the present study demonstrated that bleeding can be significantly decreased with a simple, inexpensive, easily applicable technique using an over-the-counter drug. In conclusion, admixture of intranasal xylometazoline 0.1% nasal drops and lidocaine 2% jelly was an effective method of reducing the incidence and severity of epistaxis after NTI in preschool children.

Conflict of interest

None declared.

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