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Comparison of Intraoperative Bleeding During Bilateral Endoscopic Sinus Surgery with or without Pterygopalatine Fossa Block

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Abstract

Background: Intraoperative bleeding is a common problem encountered during endoscopic sinus surgery.

Aim: This study aimed to assess the role of pterygopalatine fossa block in reducing the intraoperative bleeding and operative time during bilateral functional endoscopic sinus surgery.

Methods: It was a prospective, comparative study. 38 patients requiring bilateral functional endoscopic sinus surgery (FESS) for chronic rhinosinusitis with nasal polyps (CRSwNP) were enrolled. Pterygopalatine fossa (PPF) block was given using 2% xylocaine and 1:2,00,000 adrenaline through greater palatine canal trans-orally on one side only based on lottery. The intraoperative bleeding was graded as per Boezaart and Van Der Merwe scale for endoscopic grading of bleeding on each side. The operative time on each side was also noted.

Results: The mean endoscopic grading of intraoperative bleeding on the side of PPF block was 2.06±0.50 and 2.50±0.47 on the contralateral side, with the difference being statistically significant (*p* value = 0.00). The mean operative time on the side of PPF block was 44.97±12.85 minutes and 51.47±15.35 on the side without the PPF block and the difference was statistically significance (p value – 0.04).

Conclusion: The PFF block with 2% xylocaine and 1:2,00,000 adrenaline significantly reduced both intraoperative bleeding and operative time during FESS. It provided a comparatively better visualization of the surgical field consequently reducing the need for frequent cleaning of endoscope and nasal packing to secure hemostasis hence reducing the operative time.

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Introduction

Functional endoscopic sinus surgery (FESS) is a commonly performed surgery with the general aim to clear disease from the nasal cavity and sinuses and to re-establish the ventilation and drainage of the diseased sinuses through their physiological route under the visualization of rigid endoscope. It is a well-accepted alternative for managing the chronic sinus infections and inflammations not responding to medical treatments. The overall incidence of minor and major complication in FESS ranges from 0.4% to 30% (1,2). Intraoperative bleeding, the most common complication, accounts for 50% of the minor complications. It not only prolongs intraoperative time, but also adds stress to the operating surgeon (3,4). To achieve a comparatively bloodless surgery, preparation

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starts from preoperative period and continues intraoperatively as well. Anti–inflammatory agents, antibiotics, optimization of the comorbidities, topical vasoconstrictor, local injection of vasoconstrictors into pterygopalatine fossa, reverse Trendelenburg position, hypotensive anesthesia, hot saline irrigation and use of tranexamic acid are options available used either solely or in combination. These measures have variable success rates (3,5).

Sphenopalatine artery, branch of the third part of internal maxillary artery, is the major blood vessel that supplies the nasal septum and most part of the lateral nasal wall. Targeting this vessel at pterygopalatine fossa with the infiltration of local anesthetic agent with vasoconstrictor could significantly reduce the intraoperative bleeding thus improving the surgical field. This can be performed via the greater palatine canal (GPC) trans-orally (3,6). The probable mechanisms of hemostasis obtained via this route includes epinephrine-induced vasoconstriction, mechanical tamponade of the vessels, and a parasympathetic block allowing unopposed sympathetic activity (7). There are limited studies assessing the effectiveness of (PFF) block in endoscopic sinus surgery and have shown variable results (3, 6–9). Hence, this study aimed to assess if this adjunct reduced intraoperative bleeding and consequent duration of surgery.

Methods

Study design

It was a prospective, comparative study. Ethical approval was obtained from the Institutional Review Committee of Institute of Medicine, Kathmandu, Nepal {Ref.:- 441(6-11)E2075/076}. Written informed consent was taken for enrollment in the study and the procedure thereafter.

The study was conducted in Department of ENT- Head and Neck Surgery, Tribhuvan University Teaching Hospital, Kathmandu, Nepal from May 2019 to March 2020. Patient aged 15 years and above, of any gender, with chronic rhinosinusitis with nasal polyposis (CRSwNP) undergoing bilateral FESS were included. Those with unilateral CRSwNP, benign and malignant tumors of nose and paranasal sinuses, bleeding disorders, currently on anti-coagulants as well as edentulous patients were excluded.

Disease symmetry on either side was ascertained by modified Lund-Kennedy endoscopic grading and Lund-Mackay computed tomographic staging. Those with the CT score difference of more than two in either side was considered as asymmetric and were excluded from the study. As per the department protocol, all patients received pre-operative tapering dose of oral steroids for three weeks and a week of oral amoxicillin + clavulanic acid. After intubation, the PFF block was performed on one side of the hard palate as per the operating surgeon's choice. With the jaw retracted, greater palatine foramen (GPF) was located midway between the posterior margin of upper second molar tooth and the midline. Two ml 2% lignocaine with 1:2,00,000 adrenaline was drawn in three ml syringe. Twenty-six gauze needle bent approximately 25mm from tip at an angle of 45^0 was loaded onto the three ml syringe. The needle was negotiated through the GPF into GPC until its bent part touched the palatal mucosa as per the technique recommended by Douglas and Wormald (10).

Aspiration was done prior to infiltration of the solution to prevent intravascular penetration. Patient was then positioned in reverse Trendelenburg position to reduce venous congestion. The surgery was completed first on the PPF block side and proceeded onto the other side.

Intraoperative bleeding

Intraoperative grading of bleeding on each side was graded every 15 minutes by the operating surgeon based on Boezaart and Van Der Merwe scale (11) (Table 1).

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Statistical analysis

Statistical analysis was done using Statistical Package for the Social Sciences (SPSS) version 25 software. Descriptive statistics (mean, standard deviation and frequency) and inferential statistics (independent t-test) were used and p value < 0.05 was considered to be statistically significant.

Table 1. Boezaart and Van Der Merwe scale for endoscopic grading of bleeding

Grades	Status
Grade 1	Slight bleeding. No suctioning of blood required
Grade 2	Slight bleeding. Occasional suctioning required. Bleeding does not threaten surgical field.
Grade 3	Slight bleeding. Frequent suctioning required. Bleeding threatens surgical field a few seconds after suction is removed.
Grade 4	Moderate bleeding. Frequent suctioning required. Bleeding threatens surgical field immediately after suction is removed.
Grade 5	Severe bleeding. Constant suctioning required. Bleeding appears faster than can be removed by suction. Surgical field threatened and surgery not possible.

Results

A total of 38 patients aged 16 to 65 years (mean 36.79±14.15) were included. There were 22 males (58%) and 16 females (42%) with male to female ratio 1.4:1. Among 38 patients, 35 were primary FESS whilst three were revision.

There was no difference in the mean of modified Lund-Kennedy endoscopic score (p = 0.594) and Lund-Mackay CT score (p = 0.935) of the sides with or without PPF block indicating symmetry of disease on both sides (Table 2).

Table 2. Preoperative assessment of disease symmetry (n =38)

Staging system	Pterygopalatine fossa block		p value
	Yes	No	
Mean Endoscopic Score (Modified Lund-Kennedy)	1.79±0.41	1.74±0.44	0.595
Mean CT Grade (Lund-Mackay staging)	8.97±2.86	9.03±2.78	0.935

The intraoperative bleed and operative time

The endoscopic grading of bleeding (p = 0.00) and the operative time (p = 0.04) on the side with PPF block was less than on the side without, the difference being statistically significant (Table 3).

Table 3. The endoscopic grading of bleeding and operative time in two groups (n=38)

	Pterygopalatine fossa block		p value
	Yes	No	
Boezaart and Van Der Merwe scale endoscopic grading of bleeding			
Range	1-4	2-4	
Mean	2.06±0.50	2.50±0.47	0.00
Operative time			
Mean operative time (minutes)	44.97 ±12.85	51.47±15.35	0.04
Range (minutes)	15- 65	20 - 90	

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During the first 45 minutes of the surgery, the mean endoscopic grading of bleeding on PPF block side was statistically less than the side without PPF block. However, at 60 minutes, the difference was statistically not significant (p = 0.246) (Table 4). Although, the maximum surgical completion time was 90 minutes on the side without PPF block, the endoscopic grading of the bleeding was not recorded further than 60 minutes as the maximum surgical completion time on the PPF block side was 65 minutes and hence bleeding could not be assessed any further.

Table 4. Mean endoscopic grading of bleeding based on time interval (n=38)

Time (in minutes)	Number of patients	Pterygopalatine fossa Block	Mean endoscopic grading of bleeding ± SD	p value
15	38	Yes No	1.95 ±0.51 2.53±0.55	0.000
30	37	Yes No	2.16±0.60 2.51±0.55	0.006
45	30	Yes No	2.33±0.66 2.70±0.70	0.042
60	8	Yes No	2.25±0.70 2.63±0.51	0.246

Discussion

Functional endoscopic sinus surgery (FESS) is one of the most common surgical procedures performed by otolaryngologists for the CRSwNP not responding to maximal medical therapy. Intraoperative control of bleeding is an important and demanding task for the operating surgeon. This study assessed the effect of infiltration of local anesthesia with vasoconstrictor in the pterygopalatine fossa aimed at sphenopalatine artery, the main vascular supply to the nose, in an attempt to optimize the surgical field.

In this study, assessing the intraoperative bleed on the side with or without PPF block in the same patient established the same physiological state, vitals parameter and thus maintained the homogeneity in both sides. Valdes et al. (8) took the difference of more than three points in Lund-Mackay CT grading as asymmetric disease. The current study reduced the difference to two indicating more symmetry with lesser difference.

The infiltration technique followed in this study was similar to that by Shankar et al. (12), Mathew et al. (13) and Valdes et al. (8). A 26 gauze 38 mm long needle was bent to 45^0 angulation at 25 mm from the tip for infiltration of PPF through transoral route. As per Douglas and Wormald (10), bending the needle at 45^0 allows smooth passage of needle through the GPC, the safe length of needle being 25.4 mm which prevents the needle from penetrating deep into the pterygopalatine fossa. Deep penetration increases the chances of intraorbital or intracranial complications whereas under penetration deposits infiltrates in greater palatine canal and soft tissue over hard palate (14). In the current study, the infiltration was abandoned in two females due to difficulty in identifying the GPF and negotiating the needle through GPC. This could be due to variations in the GPF or GPC like tortuous course, anterolateral direction, horizontally angled opening of GPF in relation to hard palate and rarely absence of GPF (13–16). In addition, female skulls are lighter, have less demarcated bony prominence and comparatively smaller diameter of foramen (15). Valdes et al. (8) reported postoperative palatal discomfort post PPF block in eight of 65 patients. Similarly, Shenoy et al. (9) reported transient tachycardia for several minutes not requiring any treatment in three of 33 patients. In this study, except for a self-resolving ecchymosis over the hard palate

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in a patient, none of the other reported complications occurred.

In the current study, the PPF block side was operated first to assess the effect of block. This avoided the risk of its effect wearing off over time if non-PPF block side was operated first. To overcome this, Mathew et al. (13) and Wormald et al. (3) changed the side of operation every 30 minutes whilst Shankar et al. (12) alternated every 15 minutes keeping the surgeon blinded with respect to side of PPF block. On the contrary, in the study by Valdes et al. (8), one side was completed before operating on the contralateral side irrespective of the side of PPF block.

In this study, the side that received the PPF block had less endoscopic grading of bleeding. The mean endoscopic grading in the PPF block side was 2.06 ±0.50 whilst on the non-PPF block side, it was 2.50 ± 0.47 (p= 0.000). This resonated with the findings of Wormald et al. (3), who found the mean endoscopic surgical field grade on PPF block and non-PPF block side to be 2.59 ± 0.22 and 2.99 ± 0.23 respectively. The results of Shenoy et al. (9) also supports the current study. However, Valdes et al. (8) found no statistical significant differences in surgical field grading (p = 0.161), surgery duration (p = 0.994) and amount of blood loss (p = 0.630) between the PPF block and non-PPF block side. They had used 1% xylocaine with 1:1, 00,000 adrenaline, a different concentration of the solution to the one used (2% xylocaine with 1: 2,00,000 adrenaline) in the current study. Besides that, patients on systemic steroids 4 weeks prior to surgery were also excluded.

Intraoperative bleeding had direct relation with the operative time. In this study, the operative time on the PPF block side (44.97±12.85 minutes) was statistically less than on the non-PPF block side (51.47±15.35 minutes) (p = 0.04). The effective duration of the action sustained by PPF block was estimated by the maintenance of difference in the endoscopic surgical field grading in between the PPF block and non-PPF block side. In this study, the improvement in surgical field was seen up to 60 minutes, however statistically significant difference was maintained up to 45 minutes only. Shenoy et al. (9) noted statistically significant difference in the surgical field maintained up to maximum of 135 minutes whilst Wormald et al. (3) reported the action lasting up to 200 minutes with reduction of effect of infiltration with time. The use of the lower concentration of adrenaline i.e. 1:2,00,000 as compared to 1:80,000 used by Shenoy et al. (9) and Wormald et al. (3) might have made a difference as lower concentration of adrenaline causes comparatively weaker vasospasm and thus higher rate of absorption of drugs into systemic circulation and quicker clearance from pterygopalatine fossa causing shorter action. The adrenaline concentration of 1:2,00,000 was used in the current study due to its easy availability, similar efficacy in reduction in blood loss but less cardiovascular stimulation and alteration in vitals parameters when compared to higher concentration of adrenaline (16).

The strength of this study includes the avoidance of any confounding variable since the intraoperative bleeding in the PPF block and non-PPF block side was assessed in the same patient. Limitations of this study include involvement of three surgeons, operating and subjectively assessing the intraoperative bleed, however, to avoid discrepancies, a standard surgical protocol and a widely accepted, easy to follow endoscopic intraoperative grading system were followed.

Conclusion

The PPF block with 2% xylocaine and 1:2,00,000 adrenaline significantly reduced both intraoperative bleeding and operative time during FESS. It provided a comparatively better visualization of the surgical field thus reducing the need for frequent cleaning of endoscope and nasal packing to secure hemostasis.

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Conflicts of Interest
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Ethics
The study was approved by Institutional Review Committee of Institute of Medicine, Kathmandu, Nepal; Ref: 441(6-11)E^{2}075/076

Author's contribution
Urmila Gurung, Designed the work, drafted, revised and approved manuscript, accountable for all aspect of the work. Kapil Shahi, Data collection and analysis. Bibhu Pradhan, Designed the work, revised and approved manuscript. Sajish Khadgi, Drafted, revised and approved manuscript.

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