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Original Research Article

Efficacy and Safety of Adrenaline in Nasal Surgery: A Case Series

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Abstract:

Objective: To evaluate the efficacy and safety of adrenaline use in nasal surgery and address common misconceptions surrounding its application.

Methods: A retrospective review of 100 patients who underwent various nasal surgeries with the use of adrenaline at a tertiary care centre from January 2022 to December 2022 was conducted. Data on intraoperative blood loss, surgery duration, postoperative complications, and systemic effects were collected and analysed.

Results: Adrenaline was effective in reducing intraoperative bleeding, facilitating clearer surgical fields, and reducing overall surgery time. Minimal systemic effects were observed, and no significant complications such as tissue necrosis or cardiovascular events were reported.

Conclusion: Adrenaline, when used appropriately, is both effective and safe in nasal surgery. This case series provides evidence to debunk several myths associated with its use.

Keywords: adrenaline, septoplasty, functional endoscopic sinus surgery, hemostasis.

Introduction

Nasal surgeries-septoplasty and functional endoscopic sinus surgery (FESS) under local or general anaesthesia are most commonly performed surgeries in otolaryngological practice. These are minimally invasive surgeries performed with different angled endoscopes which magnify the field of view and enable to reach even inaccessible areas. Adequate hemostasis is necessary for optimal visualization in nasal surgeries. Vasoconstriction of nasal mucosa is therefore very important and had been conventionally applied both topically and injected. A variety of vasoconstrictors are used in rhinological surgery including cocaine, adrenaline, phenylephrine and oxymetazoline. Adrenaline (epinephrine) is widely used in nasal surgery for its hemostatic and vasoconstrictive properties. Adrenaline has become popular due to its cost effectiveness and is readily available .It is used in conjunction with other anaesthetic drugs like 2% lignocaine, bupivacaine and greatly improves the surgical experience. It is used in both topical and infiltrative routes in various concentrations 1:1000,1;2000,1:1,00,000 and 1:2,00,00 0.Despite its benefits, various myths persist regarding its safety and efficacy. This case series aims to provide empirical evidence to address these misconceptions.

Materials and Methods

Study Design

A retrospective review of 100 patients who underwent nasal surgeries (septoplasty, functional endoscopic sinus surgery) with use of adrenaline at GGH, Kurnool from January 2022 to December 2022 was performed. Adrenaline was used in concentrations of 1:100,000 to 1:200,000, 1:1000, 1:2000 in both topical and infiltration routes.

The study protocol was approved by the institutional review board, and informed consent was obtained from all patients.

Inclusion Criteria

- Patients of both sexes aged 18-65 years
- Patients diagnosed with deviated nasal septum clinically and radiologically
- Patients with recurrent acute sinusitis ,chronic rhinosinusitis ,sinonasal polyposis
- Patients with sufficient clinical and imaging data available for analysis

Exclusion Criteria

- Patients with history of bleeding disorders
- Patients on antiplatelet medication
- Patients with history of allergy to adrenaline, lignocaine
- Patients less than 18 years and more than 65 years
- Patients who have not given consent

Procedure

After receiving informed consent from patients who were posted for septoplasty and FESS under GA or local anaesthesia, detailed history, general physical and ENT examination and routine preanesthetic evaluation were done.

Baseline heart rate (HR), lead II electrocardiogram (ECG), systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean arterial pressure (MAP) were noted from the multipara monitor. For general anaesthesia, premedication was given with glycopyrrolate, ondansetron, midazolam. Induction of GA was done with injection thiopentone sodium or propofol, and maintenance done with sevoflurane and vecuronium infusion. Throat pack was kept to prevent aspiration.

All the surgeries were performed in reverse Trendelenberg position. Adrenaline was used as infiltration in concentrations of 1:100,000 and 1:2,00,000 and was injected intranasally at axilla of middle turbinate ,posterior end of middle turbinate at the sphenopalatine area and at the uncinate process in patients undergoing FESS and over septum in patients undergoing septoplasty. Merocele pledgets soaked in 1:2000 and 1:1000 dilution of epinephrine were kept endoscopically in each nasal cavity at the floor of the nasal cavity, middle meatus, sphenoethmoidal recess, and at the uncinate process for about 30-60sec for topical usage. Preoperatively they were used in same concentration for packing for about 10minutes.

Intraoperative blood loss, duration of surgery, hemodynamic effects such as changes in heart rate(HR), systolic BP ,diastolic BP and MAP(mean arterial pressure) were noted at 0 min,1 min, 3 min,5 min and 7 min respectively. Hemostatic effect was analyzed using the Fromme–Boezaart Visual Analog Scale (table 1) and the volume of blood in the suction apparatus was measured to calculate blood loss. Postoperative outcomes in terms of postoperative pain, tissue necrosis and recovery were assessed. All observations were entered by the principal investigator in the study proforma sheet. With all these information, the analysis was done to obtain the outcome of the study.

Statistical Analysis:

Statistical analyses were performed using SPSS version 25.0. Descriptive statistics were summarized, using mean (SD) for continuous variables and frequency and percentages for discrete variables. Analysis of covariance by adjusting for baseline measurements was used to test for the difference between the groups in the HR and BP at 0, 1, 3, 5 and 7 minutes.

Table 1: Grade of intraoperative bleeding (Fromme-Boezaart grading)

Grade	Description
Grade 0	No bleeding
Grade 1	Slight bleeding; no suctioning required
Grade 2	Slight bleeding ;occasional suctioning required; bleeding doesn't threaten surgical field
Grade 3	Slight bleeding ;frequent suctioning required ;bleeding threatens surgical field for a few seconds after removal of suction
Grade 4	Moderate bleeding; frequent suctioning required; bleeding threatens surgical field immediately after removal of suction
Grade 5	severe bleeding ;constant suctioning required; bleeding appears faster than it can be removed by suction; surgical field threatened and surgery not possible

Results

Patient Demographics: The study included 100 patients -70 % were males and 30 % were females (figure 1). The mean age of patients was 42 years with range of 18-65 years.

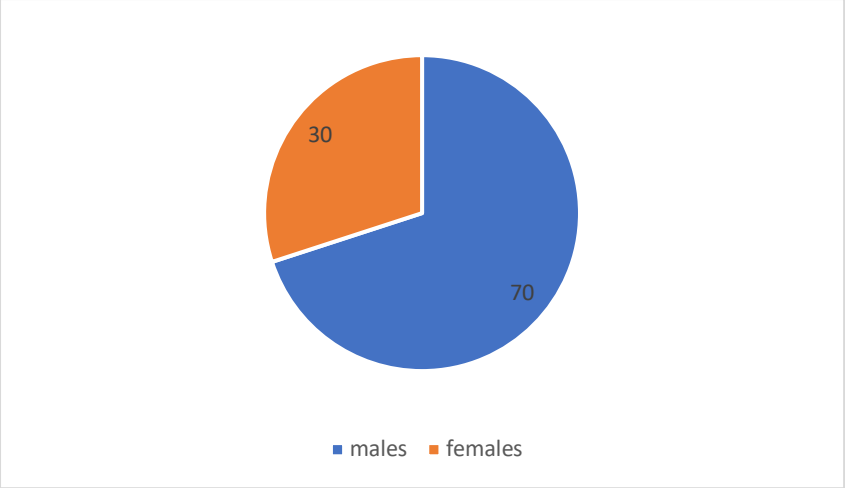

Figure 1: Sex distribution

Intraoperative Blood Loss: The average blood loss was 50 mL with a range of 20-80 mL, significantly lower than the typical 100-200 mL reported in literature for similar procedures without adrenaline.

The Fromme–Boezaart Visual Analog Scale used for analysis of hemostatic effect showed grades I or II in all the patients.

Surgery Duration: The average duration of surgery was reduced by 20% compared to historical controls not using adrenaline because of the prolonged action of local anaesthetic used.

Systemic Effects: Continuous monitoring of hemodynamic parameters revealed an increase in HR at 1 and 3 minutes after injection and levels plateaued down to the baseline level after 5 minutes. A similar pattern was noted in SBP, DBP and mean BP measurements an increase in SBP, DBP, and mean BP were noted in the 1st and 3rdminutes and a gradual decrease to baseline was noted by the 5thand 7thminutes.

Minimal and transient changes in blood pressure, heart rate with no significant cardiovascular events were recorded. (Tables: 2,3)

Postoperative Complications: No cases of tissue necrosis were observed. Mild systemic effects such as transient tachycardia and hypertension were noted in 5 patients (10%) but were self-limiting and required no intervention.

Postoperative pain was also less comparatively with the use of adrenaline and all patients recovered well.

Table 2: hemodynamic parameters with topical adrenaline

	0 min	1 min	3 min	5 min	7 min
HR,bpm	77.4(14.7)	77.9(14.5)	76.0(14.0)	75.3(13.4)	75.1(13.5)
SBP,mm Hg	102.2(15.4)	107.1(15.8)	104.1(15.8)	102.5(16.9)	102.6(17.3)
DBP,mm Hg	59.0(12.8)	58.8(10.7)	58.4(10.7)	57.7(9.8)	56.6(10.7)
MAP,mm Hg	73.4(12.1)	74.9(11.3)	73.6(11.5)	72.6(11.1)	71.3(11.9)

Table 3: hemodynamic parameters with infiltrative adrenaline

	0 min	1 min	3 min	5 min	7 min
HR,bpm	75.4(17.1)	86.8(18.2)	82.3(18.2)	76.7(18.9)	75.0(17.1)
SBP,mm Hg	107.3(17.5)	127.5(27.0)	128.0(28.7)	110.2(20.3)	104.8(19.8)
DBP,mm Hg	61.1(11.2)	72.7(15.0)	70.6(14.5)	61.3(14.1)	57.2(13.1)
MAP,mm Hg	76.5(11.8)	91.0(17.6)	89.7(17.1)	77.6(14.5)	73.1(13.7)

Discussion

A clear field of vision is essential for a safe and effective nasal surgery. But as a result of their vasodilating effects, general anesthesia and some local anesthetics during such surgical procedures cause hyperemia of the local (nasal) mucosa and a bloody surgical field. This suggests that topical vasoconstrictors should be used in addition to local anaesthetics to reduce nasal blood flow. Cocaine, adrenaline, phenylephrine are commonly used. Cocaine has both local anaesthetic and vasoconstrictor properties, but had restricted usage due to significant potential for toxicity and addiction.

Phenylephrine usage was also limited because of significant systemic effects on blood pressure.

Otorhinolaryngologists frequently utilize concentrated epinephrine as a topical or submucosal injection during endoscopic sinonasal surgery to reduce bleeding and maintain adequate exposure. Adrenaline due to its vasoconstrictive properties has been used widely as an adjunct to local anaesthesia. Use of adrenaline with local anaesthetic was first introduced in 1903 by Braun. It is a sympathomimetic amine acts on both alpha adrenergic receptors 1,2 in higher concentrations and on beta adrenergic receptors in low dose, causes systemic vasoconstriction.

The benefits of adrenaline usage along with local anaesthetic are faster onset and longer duration of anaesthesia, delayed systemic absorption, reduced toxicity and the ability to use a higher volume of anaesthetic while maintaining a bloodless surgical field .In addition adrenaline infiltration also aids in the elevation of mucoperichondrial flap by hydrodissection method. Topical usage of adrenaline in various concentrations in nasal surgeries also has hemostatic effect to infiltrative adrenaline with minimal change in hemodynamic parameters .The use of adrenaline in nasal surgery in both topical and injectable routes was supported in study done by Lanza and Kennedy, which stressed that use of vasoconstrictor is superior in hemostasis and is required during FESS.

In our study, the intraoperative blood loss was reduced due to vasoconstrictor effect of adrenaline and was 50ml on average .This vasoconstrictive effect was more obvious in the first 15minutes of surgery and provided clearer surgical field. This is supported by study done by Johnson B et al in which there was less blood loss with usage of adrenaline in either topical or infiltration technique [3]. In study done by Lee et al to determine the feasibility of the use of a topical vasoconstrictor for hemostasis during FESS, the conclusion was that topical use of adrenaline achieved a hemostatic effect similar to intranasal injection [4]. Sarmento Junior Krishnamurti Matos et al studied the topical use of epinephrine in different concentrations for ESS and concluded in favouring the use of topical epinephrine 1:2000 dilution due to a clear superiority in hemostasis. All these studies correlated with the findings from our study that the topical and intranasal injection of epinephrine alone achieves a hemostatic effect

Surgery Duration: Contrary to beliefs that adrenaline prolongs surgery, our data shows it shortens operative time by providing a clearer surgical field. It was reduced by 20% compared to surgeries done without use of adrenaline. Anderhuber et al were the first group to analyze the systemic absorption of injected adrenaline during ESS.

A significant increase in the plasma catecholamine level was noted after injection with associated hemodynamic fluctuations which were only transient .In a more recent study, Cohen-Kerem et al investigated the pharmacokinetic effect of topical and injected adrenaline during FESS [2]. Similar to these results in our study, substantial hemodynamic fluctuations in HR,SBP,DBP and MAP were noted following the use of injected epinephrine up to 3 min but later plateaued at 5 minutes and reached baseline and were very minimal with topical adrenaline and no significant cardiovascular events were recorded.

The hypotensive effects of adrenaline at subtherapeutic concentrations were recently evaluated in a series of reports by Yang et al [1]. This mechanism was attributed to the preferential stimulation of the 2 receptors at lower concentrations .In our study, no hypotensive episodes were observed following injection of the study drugs .We attribute this to the use of concentrations of adrenaline preferentially stimulating the alpha and beta 1 receptors, thereby manifesting the vasoconstrictive effect.

Another RCT done by Günel et al concluded that the use of adrenaline infiltration during septal surgery is associated with minimal and transient cardiogenic side effects due to systemic absorption. Rasheed M et al conducted a prospective observational study to determine the hemodynamic and hemostatic effects of topical and intranasal infiltration of adrenaline and concluded that topical application of 1:2000 adrenalines has better hemostatic effect [5].

There were no cases of tissue necrosis in this study. This is supported by a study conducted by Hafner et al in 2004, who reported no significant necrosis of ear, nose or flaps in over 10,000 cases using adrenaline supplemented lidocaine for flap surgeries. This case series demonstrates that adrenaline effectively reduces intraoperative bleeding and surgical duration without significant adverse effects. These findings challenge common myths:

1. Systemic Effects: Low concentrations of adrenaline resulted in minimal systemic absorption and transient cardiovascular effects, refuting the notion of significant systemic risks.
2. Surgery Duration: Contrary to beliefs that adrenaline prolongs surgery, our data shows it shortens operative time by providing a clearer surgical field.
3. Cardiovascular Safety: Adrenaline can be safely used in patients with controlled cardiovascular conditions under proper monitoring, opposing the myth that it should be completely avoided in such patients.

4. Tissue Necrosis: No instances of tissue necrosis were reported, supporting the safety of adrenaline in the concentrations used.
5. Overall Utility: Beyond hemostasis, adrenaline's role in reducing postoperative edema and promoting better healing outcomes highlights its multifaceted benefits in nasal surgery.

Conclusion

The use of adrenaline in nasal surgery is both safe and effective.

This case series provides evidence to debunk several myths, emphasizing the importance of appropriate dosage and monitoring. Further studies with larger sample sizes are recommended to validate these findings. This case series aims to serve as a comprehensive resource for clinicians, promoting informed and evidence-based use of adrenaline in nasal surgery.

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