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Effect of Prophylactic Labetalol on Hemodynamics during Nasal Septal Cartilage Harvesting in Rhinoplasty

Ehsan Ahmad, Ahmad Naseem, Abdullah Alqahtani

ABSTRACT

Objective: to evaluate the effect of prophylactic intravenous labetalol (5mg), administered two minutes before septal harvesting, on intraoperative blood pressure and heart rate in rhinoplasty procedures.

Study Design & Settings: Retrospective observational study conducted at Care Medical Centre, Riyadh, Saudi Arabia, from 1 January 2025 to 30 June 2025.

Methodology: Fifty ASA I and II patients (aged 20-45 years) undergoing rhinoplasty with septal harvesting were included. Labetalol (5 mg IV) was administered two minutes before harvesting. Systolic blood pressure, diastolic blood pressure, and heart rate were recorded at three intervals: pre-labetalol, two minutes post-administration, and post-harvesting. Surgical field quality and haemostasis were evaluated using surgeon-reported subjective assessments.

Results: Prophylactic labetalol effectively reduced intraoperative elevations in BP and HR in 80% of cases, with significant drops in systolic blood pressure (from 85 ± 3 to 82 ± 3 mmHg), diastolic blood pressure (from 45 ± 2 to 43 ± 2 mmHg), and heart rate (from 65 ± 3 to 63 ± 3 bpm) within two minutes. These values stayed within 5% of baseline at the end of harvesting, indicating stable and adequate hemodynamics. Surgeons noted improved visibility, less bleeding, and faster septal harvesting in patients who received labetalol.

Conclusion: Prophylactic low-dose intravenous labetalol reliably controls and stabilises intraoperative hemodynamics, while improving surgical field conditions during septal harvesting in rhinoplasty. Its favourable safety and performance profile support its use as a helpful adjunct in nasal surgeries. Further randomised trials are needed to validate these findings and compare the safety of labetalol to that of other agents.

Keywords: Blood pressure, controlled hypotension, heart rate, labetalol, rhinoplasty, septal harvesting

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INTRODUCTION:

Septal cartilage harvesting is a vital yet painful step during nasal reconstructive surgeries. Despite baseline-controlled hypotension and maintaining adequate intraoperative analgesia, the patient frequently exhibits a sharp sympathetic response, characterised by a rapid increase in blood pressure (BP) and heart rate (HR) during this stage.[1] This surge can compromise the surgical field visibility due to excessive bleeding, resulting in prolonged operating time.[2]

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In rhinoplasty, septal harvesting presents a challenge due to increased bleeding and hemodynamic fluctuations, owing to a rapid surge in blood pressure and heart rate, which can impair surgical field visibility and prolong operative time.[3,4] Techniques to optimise surgical field visibility commonly include controlled hypotension, achieved through agents such as beta blockers, nitroglycerine, dexmedetomidine, or clonidine.[5,6] Controlled hypotension, in this context, is defined as the reduction of mean arterial pressure (MAP) to approximately 55-65 mmHg, or 20-30% below the patient's baseline blood pressure, to reduce capillary bleeding and provide a cleaner operative field, while there is no contraindication to deliberate hypotension. This approach has been widely used in ENT surgery, but the septal harvesting phase remains uniquely problematic due to its intense nociceptive stimulation of the cartilage framework and the nasal mucosa. Even though hypotension is effectively maintained during other surgical steps in rhinoplasty, the manipulation of the septal cartilage produces a disproportionately high sympathetic response.

However, selecting the right hypotensive agent involves balancing effectiveness, the speed of action, duration of action, and potential side effects. Many commonly used

agents are either too short-acting, associated with rebound hypertension, or delay waking from anaesthesia. Additionally, rapid blood pressure changes during septal harvesting can increase the risk of intraoperative complications or extend surgical dissection time.[7] In outpatient settings where rhinoplasty is often performed, maintaining blood pressure stability with minimal medication is vital for safety and efficiency. Therefore, agents that offer a predictable, long-lasting effect without causing excessive sedation or heart-related problems are preferred. Recognising the limitations of traditional options has led to exploring more targeted and proactive strategies to control this sympathetic surge.[8]

In our centre, we observed that conventional anaesthesia techniques, such as deeper levels of anaesthesia and analgesics, including opioids (fentanyl, morphine, and pethidine), were insufficient to prevent this spike in sympathetic response. This limitation lies in the pharmacological properties of these agents: propofol can reduce the blood pressure but lacks the potent analgesic effects, meaning the painful input from cartilage dissection still provokes a sympathetic surge; fentanyl, morphine, and pethidine provide analgesia but either require time to take effect, have variable patient responses, or risk delayed recovery making them less suitable for short, high intensity painful stimulus. Morphine and pethidine, in particular, have slower onset times and less predictability for intraoperative hemodynamic control in short surgical intervals. Fentanyl, though fast-acting, may not fully suppress the cardiovascular response induced by septal manipulation. Thus, despite adequate baseline hypotension, none of these agents proved entirely satisfactory in preventing the hemodynamic spike during septal harvesting. In response, we introduced a low-dose prophylactic labetalol protocol to blunt this adrenergic surge before it activates (septal harvesting).

Labetalol, a non-selective beta and selective alpha-1 adrenergic blocker, has been shown to produce rapid onset hypotension with minimal reflex tachycardia, making it an attractive choice for short-term or temporary blood pressure (BP) control.[9] Its unique alpha- and beta-blocking properties were hypothesised to reduce the cardiovascular response, improve surgical field conditions, and facilitate smoother, faster surgical dissection. Unlike selective beta-blockers, the labetalol's alpha-blockade prevents excessive vasoconstriction, reducing mucosal bleeding without impairing tissue perfusion. Furthermore, its onset of action starts within two minutes, which makes it particularly suited for targeted use during septal cartilage harvesting.

While previous studies have assessed the intraoperative use of labetalol,[10] evidence specifically supporting pre-emptive administration before septal harvesting remains limited. Therefore, this study aimed to evaluate the impact of prophylactic low-dose intravenous labetalol on perioperative BP and heart rate (HR) control and its influence on the hemodynamic surge during nasal septal cartilage under general anaesthesia. We hypothesised that even a single, small (5 mg) IV dose administered two minutes before cartilage dissection would attenuate the blood pressure and heart rate surge, improve field visibility, and potentially shorten the harvesting time, thus improving surgical efficiency and safety in a day-case plastic surgery setting.

METHODOLOGY:

A retrospective observational study was conducted in the ENT surgical unit of Care Medical Centre, Riyadh, from January 1, 2025, to June 30, 2025. Ethical approval was obtained from the Institutional Ethical Review Committee of Care Medical Centre (Ref: ERC/CMC/2025/015). Due to the retrospective nature of the study, the requirement for obtaining informed consent from patients was waived by the Committee.

A non-probability consecutive sampling technique was used. All patients who underwent elective nasal septal cartilage harvesting under general anesthesia during the study period and fulfilled the eligibility criteria were included. The inclusion criteria comprised patients with ASA physical status I–II, aged between 20 and 45 years, scheduled for elective nasal septal cartilage harvesting under general anesthesia. Patients were excluded if they were currently on beta-blocker therapy, had ASA physical status III or higher, or presented with significant cardiovascular, respiratory, or hepatic comorbidities.

The source population included all adult patients undergoing elective nasal septal cartilage harvesting under general anesthesia at Care Medical Centre, Riyadh. All procedures were performed by the same surgical team following standardized institutional protocols. A total of 50 patients were included in the study, comprising 45 females and 5 males, with a mean age of 32 ± 6 years.

The sample size was determined based on convenience sampling of all eligible patients operated on during the six-month study period. Given the retrospective design, no prior power analysis was performed; however, the sample was deemed sufficient to identify statistically meaningful variations in hemodynamic parameters based on prior audit data from the centre.

All patients received standard general anesthesia induction with intravenous propofol (2.5 mg/kg), fentanyl (100 ìg), paracetamol (1 g), lornoxicam (16 mg), and tranexamic acid (1 g). Airway management was achieved using cuffed reinforced endotracheal tubes (6.5 mm for females and 7.0 mm for males). Anesthesia was maintained with sevoflurane in an oxygen–air mixture according to institutional protocol.

As part of the intervention, each patient received 5 mg of intravenous labetalol exactly two minutes before septal harvesting, following the standardized anesthesia protocol. Systolic blood pressure (SBP), diastolic blood pressure (DBP), and heart rate (HR) were recorded at three time

points: baseline (pre-labetalol), two minutes post-administration, and at the end of septal harvesting.

The operating surgeons assessed the surgical field for bleeding, visibility, and ease of dissection using a standardized four-point Likert scale (Excellent, Good, Fair, Poor). Continuous variables were expressed as mean ± standard deviation (SD). Paired t-tests were applied to compare hemodynamic parameters at the defined time points. A p-value of <0.05 was considered statistically significant. Data analysis was performed using SPSS version 26.

RESULTS:

A total of 50 patients were included in the study, with a mean age of 32 ± 6 years. The cohort consisted of 5 males and 45 females, all classified as ASA physical status I or II. Baseline hemodynamic parameters were stable across the group, with a mean systolic blood pressure (SBP) of 85 ± 3 mmHg, diastolic blood pressure (DBP) of 45 ± 2 mmHg, and heart rate (HR) of 65 ± 3 bpm.

Following the administration of 5 mg intravenous labetalol two minutes before septal harvesting, all three hemodynamic variables showed statistically significant reductions. Mean SBP decreased to 82 ± 3 mmHg ($p < 0.05$), DBP to 43 ± 2 mmHg ($p < 0.05$), and HR to 63 ± 3 bpm ($p < 0.05$). These reductions remained within a clinically acceptable range—less than 5% deviation from baseline—and were maintained through the completion of septal harvesting, with values of SBP 83 ± 4 mmHg, DBP 44 ± 2 mmHg, and HR 64 ± 3 bpm at the end of the procedure (all $p < 0.05$ compared to baseline).

No episodes of bradycardia, hypotensive crisis, or other adverse hemodynamic events were recorded. Intraoperative conditions were favourably influenced by labetalol administration. The operating surgeons reported improved surgical field visibility, less mucosal bleeding, and greater ease in performing the septal harvest. Subjective assessments indicated more efficient dissection and reduced operative time in most cases. No adverse events such as bradycardia, excessive hypotension, or delayed recovery were noted.

These results support the hypothesis that low-dose prophylactic labetalol can safely modulate cardiovascular responses during rhinoplasty without compromising patient safety or surgical workflow.

Mean systolic blood pressure (SBP), diastolic blood pressure (DBP), and heart rate (HR) were recorded at baseline, two minutes after prophylactic intravenous labetalol (5 mg) administration, and at the end of septal harvesting. Error bars represent standard deviation (±SD). All parameters showed statistically significant reductions post-labetalol compared to baseline ($p < 0.05$), with values remaining within 5% of baseline throughout the procedure.

In addition to hemodynamic stability, the operating surgeons subjectively assessed the quality of the surgical field. Ratings were recorded using a four-point scale: Excellent, Good, Fair, and Poor. Many cases were rated as Excellent or Good, with no instances of poor field quality.

These findings suggest that prophylactic labetalol may contribute to improved intraoperative visibility and ease of dissection, as perceived by the surgical team.

Table 1: Patient Demographics and Baseline Vitals

Variable	Value
Age (mean ± SD)	32 ± 6 years
Gender (M/F)	5 / 45
Baseline SBP	85 ± 3 mmHg
Baseline DBP	45 ± 2 mmHg
Baseline HR	65 ± 3 bpm

SBP: Systolic Blood Pressure, DBP: Diastolic Blood Pressure, HR: Heart Rate; SD: Standard Deviation

Table 2: Hemodynamic Changes at Different Time Points

Time Point	SBP (mmHg)	DBP (mmHg)	HR (bpm)
Baseline	85 ± 3	45 ± 2	65 ± 3
2 min post-labetalol	82 ± 3*	43 ± 2*	63 ± 3*
End of harvesting	83 ± 4*	44 ± 2*	64 ± 3*

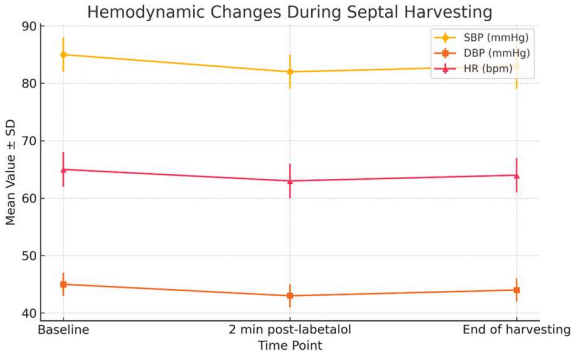
* Statistically significant ($p < 0.05$ vs baseline); Values expressed as Mean ± SD. SBP: Systolic Blood Pressure, DBP: Diastolic Blood Pressure, HR: Heart Rate

Table 3: Surgeon-Reported Assessment of Surgical Field Quality

Surgical Field Rating	Number of Cases (n=50)	Percentage (%)
Excellent	32	64%
Good	14	28%
Fair	4	8%
Poor	0	0%

Rating with a 4-point Likert scale (Excellent, Good, Fair, Poor); n = number of patients

Figure 1: Hemodynamic Changes During Septal Harvesting in Rhinoplasty



DISCUSSION:

This retrospective analysis highlights the potential benefits of prophylactic intravenous labetalol in enhancing intraoperative hemodynamic control during septal harvesting in rhinoplasty. The findings demonstrate that administering 5 mg of IV labetalol two minutes before harvesting effectively attenuates elevations in systolic and diastolic BP as well as HR, achieving statistically significant reductions from baseline values.[11] This supports the clinical utility of labetalol in promoting intraoperative cardiovascular stability, which is an essential component of successful rhinoplasty, where even minimal bleeding can obscure the operating field and prolong the surgery time.[12]

Labetalol's dual alpha- and beta-adrenergic blockade provides controlled hypotension with minimal compensatory tachycardia, a distinctive advantage over traditional agents such as nitroglycerine, which may induce a reflex increase in heart rate. Additionally, agents like dexmedetomidine, although effective in creating a dry surgical field, are associated with delayed emergence and prolonged sedation, as well as late-onset hypotension, making them less ideal for targeting hypotension in a single surgical step, such as septal harvesting.[13] The favourable pharmacodynamic profile of labetalol positions it as a practical choice for rhinoplasty, where rapid onset and predictable hemodynamic effects are crucial.

Several published studies support the effectiveness of labetalol in achieving controlled hypotension and improving surgical field conditions. El-Shmaa et al. demonstrated that labetalol provided stable hemodynamics and significantly reduced intraoperative bleeding during functional endoscopic sinus surgery, where outcomes were comparable to nitroglycerine and without undesired reflex tachycardia.[14] A more recent study by Kumar et al. compared labetalol with nitroglycerine and found that labetalol offered more consistent blood pressure control and fewer hemodynamic fluctuations, making it more suitable for bleeding control and a clearer operating field.[15] Additionally, El Servi et al. compared pre- and intraoperative infusions of labetalol and nitroglycerine for hypotensive anaesthesia during functional endoscopic sinus surgery and concluded that labetalol was more effective in reducing intraoperative blood pressure, heart rate, and bleeding, and it also improved surgical field quality compared to nitroglycerine.[16]

In addition to its favourable pharmacological profile, labetalol may also facilitate a smoother postoperative recovery and improve patient safety. Studies indicate that labetalol's ability to maintain stable intraoperative hemodynamics decreases the risk of postoperative complications, such as rebound hypertension, excessive sedation, or delayed emergence from anaesthesia.[17] This is particularly important in rhinoplasty, which is often performed as an outpatient procedure where quick recovery and early discharge are essential. Furthermore, the predictable hemodynamic effects of labetalol may reduce the risk of myocardial ischemia or arrhythmias in patients with borderline cardiovascular risk, although our study excluded those with significant comorbidities. A study by Tuncer Uzun et al. found that prophylactic beta-blocker use in ENT procedures was associated with a decreased need for additional intraoperative anaesthetic agents, which could, in turn, lower the risk of drug interactions and fluctuations in anaesthetic depth.[18] This aligns with our centre's experience, where labetalol use correlated with fewer adjustments in volatile anaesthetic concentrations during surgery. Although these observations were not formally documented in our dataset, they warrant further investigation in future prospective studies. Therefore, labetalol may not only improve surgical conditions but also assist anaesthesia teams in maintaining hemodynamic stability with fewer interventions. These wider perioperative benefits enhance its potential role in streamlining care pathways in outpatient nasal surgery.

In our study, the reduction in heart rate and arterial blood pressure translated into a subjectively improved surgical field, as reported by the operating surgeons. Better visualisation, reduced bleeding, and faster septal harvesting were consistently observed in the patients who received labetalol. This corresponds with existing literature that supports the use of beta-blockers to optimise surgical field conditions, particularly in functional endoscopic sinus surgery and nasal septal procedures.[19] Although this study did not objectively quantify blood loss, the surgeon reported improvements that align with prior findings, suggesting that labetalol contributes to more efficient and safer surgical workflows.[20]

Despite the promising results, several limitations must be acknowledged when interpreting the clinical significance of this study. The retrospective observational design inherently restricts control over confounding variables, which may have influenced outcomes. Although all patients underwent similar surgical procedures performed by the same surgeon, individual variations in anaesthetic technique, intraoperative stimulation levels, and pain thresholds could have affected hemodynamic responses. The absence of a control group further limits causal inference and precludes direct comparison with other interventions or baseline fluctuations. While prior literature supports our findings, a prospective, randomised controlled trial (RCT) would provide stronger evidence for the effectiveness of prophylactic labetalol in this setting.[21]

Another notable limitation is the reliance on a subjective scale for assessing surgical field quality. Despite using consistent scoring criteria, inter-observer variability and inherent biases cannot be fully eliminated.[22] Incorporating objective endpoints such as quantified blood loss or video-based grading systems could enhance the validity of future assessments. Additionally, a single fixed dose (5 mg) of

labetalol was used across all patients, without titration for weight or hemodynamic baseline. Although effective in most cases, it may not represent the optimal dosing strategy for diverse patient profiles or longer operative durations. Exploring dose-response relationships or adjusting based on body weight might yield more individualised and effective results.

Furthermore, the study was conducted at a single centre with a relatively small sample size of 50 patients, predominantly female (90%), reflecting typical rhinoplasty demographics. However, this gender imbalance may affect the generalizability of the findings to broader populations, including males or patients with comorbidities. The limited sample and setting also constrain applicability to other surgical environments where anaesthesia protocols and surgeon experience may differ. These factors underscore the need for future multicentre trials with larger, more diverse populations and standardised protocols. Such studies should incorporate both subjective and objective endpoints to more definitively establish labetalol's role and compare its efficacy and safety to other agents used for intraoperative hemodynamic control in nasal surgeries.[23]

Nevertheless, this study provides meaningful preliminary data suggesting that low-dose prophylactic labetalol is a safe, practical, and easily implementable strategy for controlling intraoperative hemodynamics and improving surgical conditions during septal harvesting.[24] Its use may offer a pragmatic approach to enhancing surgical efficiency and patient safety in rhinoplasty, particularly in ambulatory surgical settings where time and rapid recovery considerations are paramount.[25]

CONCLUSION:

Prophylactic administration of 5 mg IV labetalol two minutes before septal harvesting in nasal reconstructive surgery was associated with minimal blood pressure and heart rate fluctuations, stable hemodynamic profiles, and improved surgeon-rated operative field quality. These benefits were observed even in patients already under controlled hypotensive anaesthesia, highlighting labetalol's ability to blunt procedure-specific sympathetic surges that conventional anaesthetic agents alone may not fully prevent. Its rapid onset, predictable duration, and combination of alpha- and beta-blockade make it a practical and safe adjunct in the perioperative management of septal cartilage harvesting, particularly in outpatient or short-stay surgical settings, where efficiency and faster recovery are the main priorities.

While the results are encouraging, the retrospective nature of this study highlights the need for prospective, randomised controlled trials to validate these findings, quantify the impact on blood loss and operative time, and directly compare labetalol's performance with that of other hypotensive agents.

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Authors Contribution:
Ehsan Ahmad: Manuscript writing, study concept, data collection and analysis
Ahmad Naseem: Manuscript writing, conduct of discussion, proof reading
Abdullah Alqahtani: Literature search, review of manuscript, final approval

REFERENCES:

1. Ganjeh Y, Martorana A, Keane JF, Goldstein LB. Evaluation of pain management in patients undergoing septoplasty. J Comm Med Public Health Rep. 2022;3(8). https://doi.org/10.38207/JCMPHR/2022/OCT030802110
2. D¹browska-Bieñ J, Skar¿yñski PH, Gwizdalska I, £azêcka K, Skar¿yñski H. Complications in septoplasty based on a large group of 5639 patients. Eur Arch Otorhinolaryngol. 2018;275(7):1789–94. https://doi.org/10.1007/s00405-018-4990-8
3. Gencay I, Muluk NB, Kilic R, Yazici I, Aydin G, Sencan Z et al. Effects of osteotomy on hemodynamic parameters and depth of anesthesia in rhinoplasty operations. J Craniofac Surg. 2020; 31(6): 1705–8. https://doi.org/10.1097/S CS.0000 000000006447
4. Motazedian G, Sohrabpour M, Jahromi MS, Ghaedi M. Bleeding management in rhinoplasty surgery: a systematic review study on clinical trial studies conducted in Iran. J Emerg Health Care. 2021; 10(4): 32–40. Available from: https://intjmi.com/article-1-715-en.html
5. Radman M, Jadidi F, Jafarabadi AP. Comparison of clonidine and labetalol with regard to haemodynamic status, amount of haemorrhage, and surgeon's satisfaction in rhinoplasty. J Evolution Med Dent Sci. 2020; 9(46): 3418. Available from: https://link.gale.com/apps/doc/A643689428/AONE?u=anon~e684af73&sid=googleScholar&xid=073dfe78
6. Radman M, Mousavi N, Jadidi F, Ayoobi F. Comparing the hemodynamic changes, bleeding, and surgeon's satisfaction during rhinoplasty surgery by use of two drugs, labetalol and dexmedetomidine added to anesthetic technique: a randomized clinical trial. J Italian Surg Associat. 2024;44(4):54. https://doi.org/10.1097/IA9.0000000000000054
7. Gowtham K, Shankar M, Sowjanya B. Controlled hypotension during functional endoscopic sinus surgery (FESS) – a comparative evaluation between esmolol and nitroglycerine. J Anaesth Pain. 2023;4(3). https://doi.org/10.21776/ ub.jap. 2023.004.03.02
8. Khetpal S, Elias A, Alford J, Partownavid P, Roostaeian J. Anesthesia for rhinoplasty: a summary of clinical considerations, therapeutic modalities, outcomes, and future directions. JCA Adv. 2024;1(3–4):e100040. https://doi.org /10.1016/j.jcadva.2024.100040
9. Elvir Lazo OL, White PF, Yumul R, Yumul F, Kariger RK, Kaplan M, et al. Labetalol as an alternative to esmolol and fentanyl for maintaining hemodynamic stability during laparoscopic surgery: comparative effects on recovery profiles and a literature review. J Surg Res. 2020;3:444–56. https://doi.org/10.26502/jsr.10020099

10. Rezaeekia S, Akbari H, Jalali M, Haddadi S, Nasiri Formi E. Comparing the effect of intravenous administration of magnesium sulfate and labetalol on intraoperative bleeding, edema, and ecchymosis after rhinoplasty. J Mazandaran Univ Med Sci. 2023;33(223):208–9. Available from: https://www.magiran.com/p2763049

11. Singh H, Ramdev B, Kaur P, Sara H. A randomized comparative study of nitroglycerine, labetalol and propofol infusion for controlled hypotension during head and neck surgeries. Int J Anesthesiol Res. 2024;6(2):10–15. https://doi.org/10.33545/26648849.2024.v6.i2a.45

12. Said AM, El-Serwi HB. Labetalol (preoperative oral and intraoperative infusion) overrides nitroglycerine infusion for hypotensive anesthesia during functional endoscopic sinus surgery. Res Opinion Anesth Intensive Care. 2019;6(2):192–9. https://doi.org/10.4103/roaic.roaic_96_17

13. Parvizi A, Haddadi S, Faghih Habibi A, Nemati S, Akhtar N, Ramezani H. Dexmedetomidine efficacy in quality of surgical field during endoscopic sinus surgery. Iran J Otorhinolaryngol. 2019;31(5):281–8. https://doi.org/10.22038/ ijorl.2019. 35561.2178

14. El Shmaa NS, Ezz HAA, Younes A. The efficacy of labetalol versus nitroglycerin for induction of controlled hypotension during sinus endoscopic surgery: a prospective, double blind and randomized study. J Clin Anesth. 2017;39:154–8. https://doi.org/10.1016/j.jclinane.2017.03.003

15. Sujay JN, Kumar S, Vijay T. To compare the efficacy of dexmedetomidine versus labetalol in providing controlled hypotension in functional endoscopic sinus surgery. Anesth Pain Med. 2021;11(1):e108915. https://doi.org/10.5812/ aapm.108915

16. Saleh AH, Othman SA, Hameed NS, Jadoo SAA, Mohammed AS. Comparative analysis of labetalol and remifentanil for inducing hypotension in oncological patients undergoing functional endoscopic sinus surgery. Onkologia i Radioterapia. 2024;18(1):1–8. https://doi.org/10.2131/oar.2024.001

17. Chacko RS, Priyadharsini KS, Arif M, Prasad TK. A randomized controlled trial to compare the efficacy of dexmedetomidine and labetalol for induced hypotensive anesthesia in ear, nose, and throat surgeries. Arch Med Health Sci. 2023;11(1):37–43. https://doi.org/10.4103 /amhs. amhs_34_23

18. Ahmed ES, Ahmed MH, Hesham MA. Labetalol hypotensive anesthetic protocol paves the way to safe open abdominal myomectomy. J Anesth Intern Care Med. 2017;3(2):555606. https://doi.org/10.19080/JAICM.2017.03.555606

19. Lavere PF, Rana NA, Kinsky MP, Funston JS, Mohamed SS, Chaaban MR. Blood loss and visibility with esmolol vs labetalol in endoscopic sinus surgery: a randomized clinical trial. Clin Med Insights Ear Nose Throat. 2019;12:1179550619847992. https://doi.org/10.1177/11 79550619847992

20. Zayed M, Nassar H, Hasanin A, Saleh AH, Hassan P, Saad D, et al. Effects of nitroglycerin versus labetalol on peripheral perfusion during deliberate hypotension for sinus endoscopic surgery: a randomized, controlled, double-blinded trial. BMC Anesthesiol. 2020;20(1):85. https://doi.org/10.1186/s12871-020-01006-w

21. Rahimi Z, Masoudifar M, Nazemroaya B, Almadi H. Comparison of the effect of two different doses of labetalol to induce controlled hypotension on hemodynamic changes during spinal fusion surgery: a randomized clinical trial. Anesth Pain Med. 2021;11(5):e118341. https://doi.org/10.5812 /aapm.118341

22. Calim M, Karaaslan K, Yilmaz S, Senturk E, Deniz H, Akbas S. The effects of hypocapnia and hypercapnia on intraoperative bleeding, surgical field quality, and surgeon satisfaction level in septorhinoplasty: a prospective randomized clinical study. Aesthetic Plast Surg. 2024;48(2):167–176. https://doi.org/ 10.1007/s00266-023-03433-9

23. Kim DH, Lee J, Kim SW, Hwang SH. The efficacy of hypotensive agents on intraoperative bleeding and recovery following general anesthesia for nasal surgery: a network meta-analysis. Clin Exp Otorhinolaryngol. 2021;14(2): 200–209. https://doi.org/10.21053/ceo.2020.00584

24. Razavi M, Najaf Najafi M, Ahmadi M, Kashani I. Comparison of labetalol and nitroglycerine's effects on deliberate hypotension in septo-rhinoplasty surgery: a randomized clinical trial. Rev Clin Med. 2020;7(4):176–179. https://doi.org/1 0.22038/rcm.2021.47435.1313

25. Banfield GK, McKiernan D, Hinton AE. Day case rhinoplasty. J R Army Med Corps. 2000;146(3):212–214. https://doi.org/ 10.1136/jramc-146-03-11