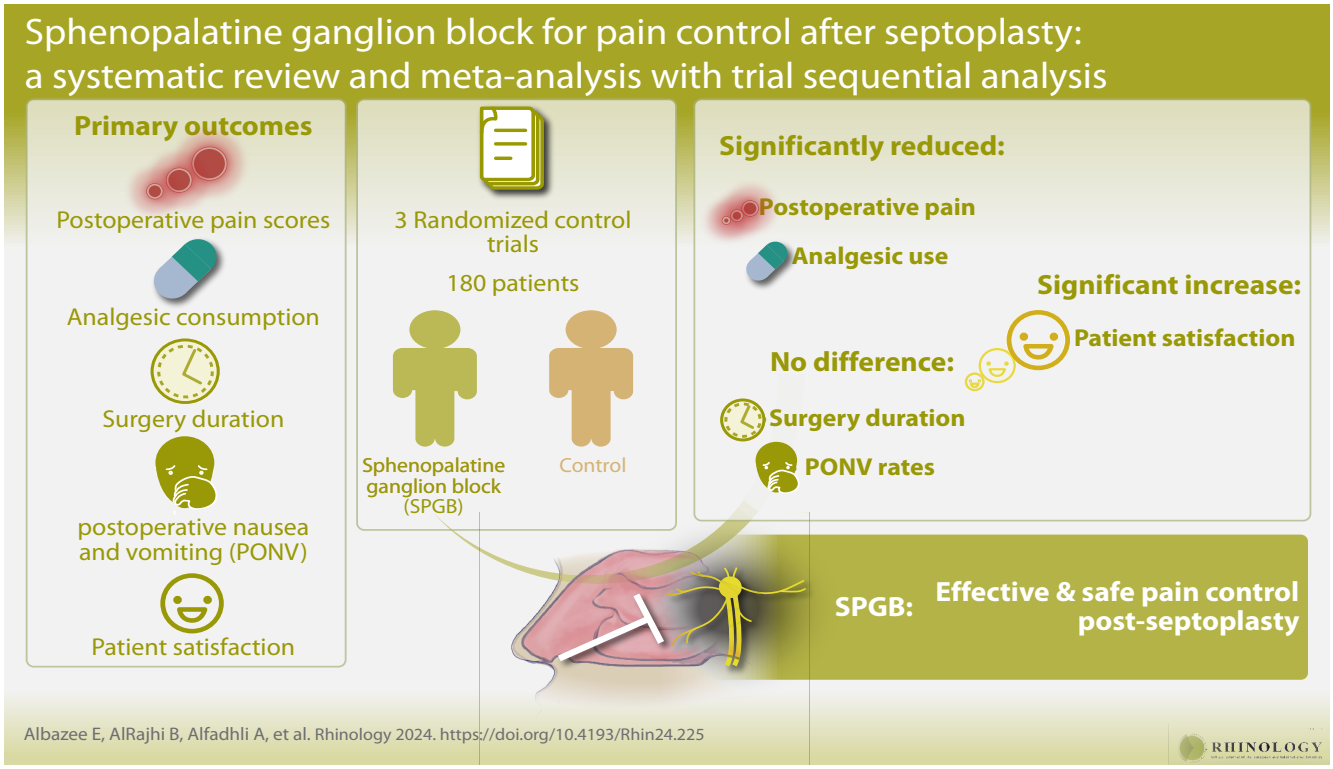
Sphenopalatine ganglion block for pain control after septoplasty: a systematic review and meta-analysis with trial sequential analysis

Ebraheem Albazee[1], Bassam AlRajhi[2], Alwaleed Alfadhli[3], Abdullah M. Alharran[4], Mohannad Al-Qudah[5]

Rhinology 62: 6, 642 - 651, 2024
https://doi.org/10.4193/Rhin24.225



Abstract

Introduction: Septoplasty corrects a deviated nasal septum (DNS) and improves nasal obstruction. Sphenopalatine ganglion block (SPGB) effectively reduces postoperative pain after septoplasty, but conclusive evidence is still lacking. This systematic review and meta-analysis aim to comprehensively evaluate the analgesic efficacy of SPGB in septoplasty patients.

Methods: We systematically searched PubMed/Medline, Scopus, Web of Science, Embase, and CENTRAL from inception to April 10th, 2024. Randomized controlled trials (RCTs) were assessed using the RoB-2 tool. The primary outcomes were postoperative pain scores, analgesic consumption, surgery duration, postoperative nausea and vomiting (PONV), and patient satisfaction. Continuous data were pooled as mean difference (MD), and dichotomous data as risk ratio (RR) with a 95% confidence interval (CI) using STATA software. Additionally, trial sequential analysis (TSA) was conducted.

Results: Three RCTs with 180 patients were included. Two RCTs had a 'low risk' of bias, while one RCT had 'some concerns'. The SPGB group had significantly lower postoperative pain within 24 hours compared to controls, particularly after particularly after 1-2 hours (MD = -1.85), 4-6 hours (MD = -2.02), 12 hours (MD = -2.14), and 24 hours (MD = -2.36) TSA confirmed the conclusive evidence. Analgesic use was significantly reduced in the SPGB group. No significant differences were observed in surgery duration or PONV rates between groups. Patient satisfaction was significantly higher in the SPGB group.

Conclusion: SPGB demonstrates efficacy and safety in managing postoperative pain in patients undergoing septoplasty for DNS.

Key words: meta-analysis, pain, septoplasty, sphenopalatine ganglion block, SPGB

Introduction

Septoplasty is a common surgery to correct a deviated nasal septum (DNS) and treat nasal obstruction [1–3]. Functional septoplasty can significantly improve patients quality of life and effectively relieve obstructive symptoms [4–6]. Complications are rare but can include bleeding, infection, septal perforation, saddle nose deformity, and anosmia [3,7]. After septoplasty, patients may experience mild to moderate pain a few days later, which can be managed with pain medication [8]. However, in some cases, patients may experience more severe pain that can impact their daily activities and quality of life [3]. Therefore, healthcare providers must closely monitor patients postoperatively to promptly identify and manage any complications or significant pain

The sphenopalatine ganglion (SPG), also known as the pterygopalatine ganglion, is a critical structure in the autonomic regulation of the nasal mucosa [9,10]. Anatomically, it is situated within the pterygopalatine fossa, posterior to the maxillary sinus, anterior to the pterygoid process of the sphenoid bone, inferior to the greater wing of the sphenoid, and lateral to the palatine bone [9,11,12]. The SPG receives sensory input primarily from the maxillary nerve, parasympathetic innervation via the greater petrosal nerve, and sympathetic fibers through the deep petrosal nerve originating from the cervical sympathetic chain [10].

This ganglions neural outputs significantly influence the mucosal surfaces of the nasal cavity, pharynx, lacrimal gland, and palatal regions [10–12].

The sphenopalatine ganglion block (SPGB) is a targeted intervention where anesthetic agents, such as lidocaine or bupivacaine, are administered near the SPG [9]. This procedure aims to interrupt nociceptive signals by selectively blocking the neural pathways associated with the SPG, thereby providing analgesic effects in the affected regions [9]. Several randomized controlled trials (RCTs) [13–15] showed the efficacy of SPGB in reducing postoperative pain after septoplasty, especially within the first 24 hours, and decreasing the need for high doses of analgesics . However, this evidence is based on individual studies and a pooled estimate has not yet been synthesized.

Therefore, our aim is to provide the highest level of evidence by performing a systematic review and meta-analysis of RCTs to evaluate the efficacy of SPGB in reducing postoperative pain scores in patients undergoing septoplasty due to DNS. Moreover, our secondary aims are to assess overall analgesic usage, duration of surgery, the rate of postoperative nausea and vomiting (PONV), and patient satisfaction scores. This information will support healthcare providers in making well-informed decisions about the use of SPGB, ultimately enhancing patient outcomes after septoplasty.

Materials and methods

Study protocol

This study followed the guidelines outlined in the Cochrane Handbook for Systematic Reviews of Interventions [16] and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [17]. The study protocol was registered in the International Prospective Register of Systematic Reviews (PROSPERO) under the identification number [CRD42024536873]. Ethical approval was unnecessary as this research is based on previously published data.

Eligibility criteria

In this systematic review, we included studies that meet our inclusion criteria, which were defined according to the PICOS format as follows: the population comprised adult patients (aged 18 or above) with a DNS who were undergoing septoplasty (either endoscopic or open approach); the intervention consisted of SPGB, regardless of the type of anesthetic agent (i.e., lidocaine or bupivacaine) and route of administration (i.e., transnasal or transoral); the comparison involved a control group (placebo or no treatment); and our main outcomes of interest included postoperative pain scores, analgesic use, duration of surgery, the rate of PONV, and patient satisfaction scores; the study design was exclusively limited to RCTs.

On the other hand, our exclusion criteria were as follows: (i) patients who underwent septoplasty combined with other procedures such as rhinoplasty or endoscopic sinus surgery, (ii) local anesthesia to other nerve bundles without targeting the SPG, such as the greater palatine nerve, (iii) study designs other than RCTs including non-randomized clinical trials, single-arm clinical trials, observational studies, narrative reviews, letters, and animal studies.

Information sources and search strategy

We systematically searched five major databases, including PubMed/Medline, Scopus, Web of Science, Embase, and the Cochrane Central Register for Controlled Trials (CENTRAL), from their inception to April 10th, 2024. Our search terms included: (septoplasty OR septorhinoplasty OR "septal surgery" OR "nasal surgery" OR "septal deviation surgery" OR DNS OR "deviated nasal septum") AND ("sphenopalatine block" OR "sphenopalatine ganglion block" OR "sphenopalatine ganglion nerve block" OR "sphenopalatine ganglion blockade" OR "sphenopalatine ganglion" OR SPGB OR SGB OR "pterygopalatine fossa block" OR "pterygopalatine block" OR pterygopalatine). Detailed search strategies for each database are provided in Table S1. Additionally, we searched ClinicalTrials.gov and ResearchGate. We manually screened the reference lists for relevant articles to ensure a comprehensive search. Two coauthors (BA and AMA) independently screened the titles and abstracts of the exported records, followed by the full-text screening phase. Any conflicts were resolved by the senior author (MA) or through consensus.

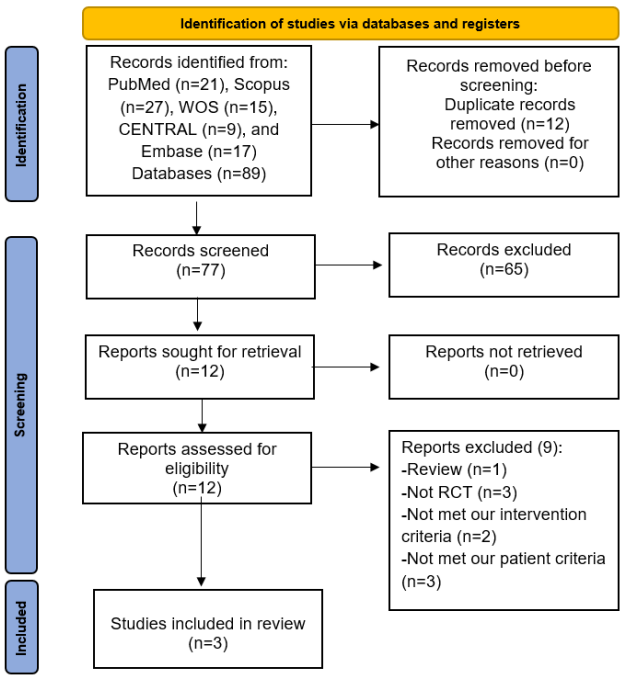


Figure 1. Flow diagram of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).

Risk of bias and publication bias assessment

We used the second iteration of the Cochrane Risk of Bias Assessment Tool (RoB-2) to assess the quality and determine the potential for bias in the studies we considered [18]. This tool examines bias that may arise from various aspects of the study, such as the randomization process, deviations from intended interventions, missing outcome data, outcome measurement, selection of reported results, and the overall risk of bias in the study. The risk of bias in each study can be categorized as low, some concern, or high. Two co-authors (EA and AA) independently assessed the risk of bias, and any disagreements were resolved by the senior author (MA) or through consensus.
Egger et al. [19] suggest that when fewer than 10 studies per outcome are combined, relying on Egger's test to identify publication bias through funnel plot asymmetry is not considered reliable. Therefore, we could not use this test to identify potential publication bias in our study.

Data collection and outcomes measurement

A standardized sheet was used to extract data from each included study. We extracted data pertaining to study characteristics, including author name, year of publication, country, study design, study duration, sample size, trial arms, anesthetic agent, surgical procedure, type of anesthesia, and timing of follow-up. We also extracted data on the characteristics of the included patients, including mean age (years), sex, body mass index (BMI), American Society of Anesthesiology (ASA) score, and intervention regimen details including volume, concentration, and route of administration. Our specific outcomes included postoperative pain after various time intervals: 1-2 hours, 4-6 hours, 12 hours, and 24 hours. Pain levels were assessed using the Visual Analogue Scale (VAS), which is a 10-point scale where lower scores indicate less pain and higher scores indicate more pain. Additionally, we evaluated overall analgesic use, the duration of surgery in minutes, the rate of PONV, and patient satisfaction scores on a 3-point scale (poor, good, and excellent). The overall use of analgesics was reported as the number of times a patient used or required a prescribed dosage of any kind of analgesic.

Effect measures and data synthesis

Our statistical analyses were performed using STATA software (Version 17 for Windows) and RevMan (Version 5.3 for Windows). We employed the Mantel–Haenszel method for dichotomous data and presented the results as risk ratios (RR) with 95% confidence intervals (CI). Continuous data were analyzed using the Inverse-Variance method, and the results were reported as mean differences (MD) with 95% CI. The random effects model was used for all analyses. We considered heterogeneity significant when the Chi-square p-value was < 0.1 and the I^2 statistic exceeded 50% [16]. Sensitivity analyses were conducted by systematically excluding one RCT at a time and recalculating the effect size based on the remaining RCTs to assess the robustness of the outcomes. A p-value < 0.05 was deemed statistically significant. We utilized Web Plot Digitizer version 4 (Free Software Foundation) to extract the required data for studies that only presented data in figures. When multiple arms or interventions were involved in the same study, each arm was considered a distinct group and compared to the same control group [16].
Trial sequential analysis (TSA) was conducted using TSA software (version 0.9.5.10 Beta from the Copenhagen Trial Unit, Center for Clinical Intervention Research at Rigshospitalet, Copenhagen, Denmark). Due to the limited available data and the cumulative pooling of trials, there was an increased risk of type-I and type-II errors. Therefore, TSA was employed to determine whether the evidence from the pooled trials was conclusive and reliable. The confidence level for the intervention was considered conclusive and sufficient when the Z-line on the curve crossed both the conventional boundary and the boundary of sequence monitoring, indicating that no further studies were necessary. Conversely, if the Z-line on the curve did not cross any boundary, it signified insufficient evidence, necessitating additional studies. In this meta-analysis, we used an alpha error of 0.05 and a beta error of 80% power. We calculated the MD in the current meta-analysis to determine the required sample size for TSA.

Results

Study selection

The initial search in the digital databases yielded 89 citations, of which 12 were excluded as duplicate articles. The remaining 77

Table 1. Overall summary of the included randomized controlled trials.

Study ID	Study design	Country	Trial duration	Sample-size	Trial arms		Anesthetic agent	Surgical procedure	Type of anesthesia	Follow-up
					Interven-tion	Control				
Ekici 2019	RCT	Turkey	February 2019-May 2019	N = 60	SPGB	Nothing	Bupiva-caine	Septo-plasty	General	168 hours
Ghazaly 2024	RCT	Egypt	Not reported	N = 60	SPGB	Placebo	Lidocaine or Bupiva-caine	Septo-plasty	General	24 hours
Karaoğullarından 2024	RCT	Turkey	April 2022 December 2022	N = 60	SPGB	Nothing	Bupiva-caine	Septo-plasty	General	168 hours

RCT= randomized controlled trial, SPGB= sphenopalatine ganglion block.

Table 2. Summary overview of the characteristics of the included patients.

	Group	Regimen details	Sample size, n	Sex, n [male/ female]	Age (years)	BMI (kg/m²)	ASA [I/II]	Route of ad-ministration	Self-control [yes/no]
Ekici 2019	SPGB	1.5 ml per region of 0.5% of bupivacaine	N = 30	[17/13]	29.43 ±8.52	NR	NR	Transnasal	No
	Control	nothing	N = 30	[14/16]	29.13 ±8.01	NR	NR	N/A	
Ghazaly 2024	SPGB (a)	2.5 ml per region of (lido-caine 2% and 1 mL 4 mg dexamethasone)	N = 20	[11/9]	35.50 ±12.4	27.23 ±2.2	[17/3]	Transnasal	No
	SPGB (b)	2.5 ml per region of (0.5% bupivacaine and 1 mL 4 mg dexamethasone)	N = 20	[13/7]	35.10 ±12.3	26.98 ±1.9	[15/5]	Transnasal	
	Placebo	2.5 ml per region of normal saline	N = 20	[13/7]	34.35 ±11.8	27.51 ±2.1	[16/4]	Transnasal	
Karaoğullarından 2024	SPGB (a)	1.5 ml per region of 0.5% of bupivacaine	N = 20	[9/11]	36 ±8.46	NR	NR	Transnasal	No
	SPGB (b)	1.5 ml per region of 0.5% of bupivacaine	N = 20	[7/13]	37.1 ±9.2	NR	NR	Transoral	
	Placebo	nothing	N = 20	[10/10]	36.2 ±9.03	NR	NR	N/A	

SPGB= sphenopalatine ganglion block, BMI= body mass index, ASA= American Society of Anesthesiology, NR= not reported, N/A= not applicable.

citations were screened based on titles and abstracts, leading to 12 that met the inclusion criteria and underwent full-text assessment. After this assessment, nine citations were excluded [20–28], with details of the excluded studies provided in Table S2. Overall, three RCTs [13–15] comprising five arms were included in this systematic review. Figure 1 illustrates the PRISMA flowchart, which outlines the screening and study selection processes.

Study characteristics

A total of three RCTs, comprising five arms, were included in this meta-analysis [13–15]. Two RCTs were conducted in Turkey [13,15] and one in Egypt [14]. All trials were conducted between February 2019 and December 2022, and one trial did not report its duration [14]. A total of 180 patients were included in this study. Of these, 110 patients were assigned to the SPGB group and 70 patients to the control group. In two trials [13,15], the control group received no treatment, while in one trial [14], the control group received a placebo. Two trials [13,15] used bupivacaine as an anesthetic agent, while one trial [14] used either bupivacaine or lidocaine. One trial used dexamethasone with the local anesthetic agent [14]. All the trials used general anesthesia, and the follow-up time ranged between 24 and 168 hours. The trials characteristics are shown in Table 1. Of the 180 participants, 94 were males and 86 were females. The mean age of participants was 38.35 years (ranged between 29.13 and 37.1). The mean BMI was 27.24 (ranged between 26.98 and 27.51). Two trials [13,14] employed a transnasal route of administration in comparison to a control group. Furthermore, one trial [15] independently compared both transoral and transnasal routes with a control group. The drugs used for overall analgesics usage were diclofenac, acetaminophen, and meperidine. None of the included trials utilized within-subject controls. Further details are presented in Table 2.

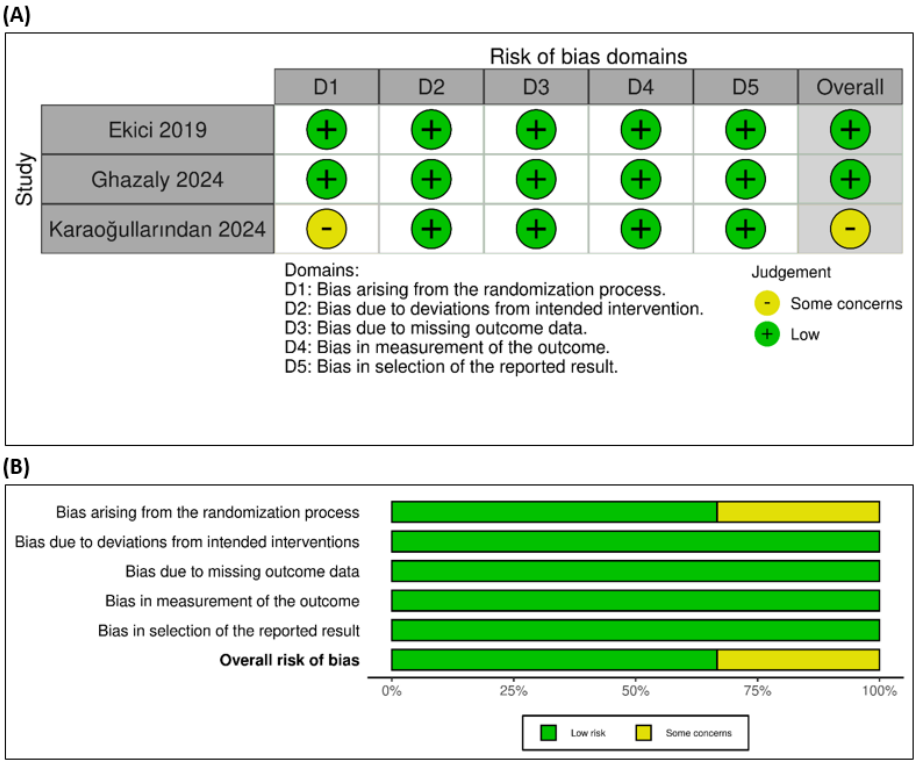


Figure 2. Risk of bias (A) graph, and (B) summary for each included trial.

Risk of bias within studies

Overall, of the three included RCTs, two RCTs [13,14] had a low risk of bias and one RCT [15] had some concerns. Two RCTs [13,14] had a low risk of bias in the randomization process, while one RCT some concerns [15] because they did not provide any information regarding the randomization and allocation concealment process. All studies had a low risk of bias due to deviation from interventions. All studies had a low risk of bias due to missing data, measurement of the outcome, and selection of the reported results. Further details regarding the risk of bias domains are presented in Figure 2.

Postoperative pain [VAS]

The overall pooled analysis demonstrated a significant reduction in mean postoperative pain within 24 hours in the SPGB group compared to the control group, particularly after 1-2 hours (n = 180 patients, MD = -1.85, 95% CI [-3.22, -0.47], p = 0.01, Figure 3A), after 4-6 hours (n = 180 patients, MD = -2.02, 95% CI [-3.53, -0.50], p = 0.01, Figure 4A), after 12 hours (n = 180 patients, MD = -2.14, 95% CI [-3.60, -0.67], p < 0.001, Figure 5A), and after 24 hours (n = 180 patients, MD = -2.36, 95% CI [-3.78, -0.94], p < 0.001, Figure 6A). The overall pooled analyses showed heterogeneity (chi-square p < 0.001, I^2 >50%).

Moreover, the TSA indicated that the cumulative Z-curve crossed both the conventional boundary for benefit and the trial sequential monitoring boundary for benefit, entering the area of benefit in all time intervals (Figures 3B–6B). This crossing indicates substantial and conclusive evidence supporting the analgesic efficacy of SPGB in reducing postoperative pain in patients undergoing septoplasty.

Figure S1 shows the results of leave-one-out sensitivity analyses. All time interval results showed robustness, except after 1-2 hours, in which omitting one arm "Ghazaly 2024 (b)" rendered the overall effect size statistically insignificant (p = 0.052).

Overall analgesic usage

The mean overall analgesic usage was statistically significantly lower in the SPGB compared to the control group (n = 120 patients, MD = -2.38, 95% CI [-3.01, -1.74], p < 0.001, Figure S2A). The pooled analyses showed heterogeneity (chi-square p < 0.001, I^2 >50%). Leave-one-out sensitivity analysis demonstrated the robustness of the results, Figure S2B.

Duration of surgery [minutes]

The mean duration of surgery did not differ significantly between both groups (n = 120 patients, MD = 1.42, 95% CI [-1.82, 4.65], p = 0.39, Figure S3A). The pooled analyses showed heterogeneity (chi-square p < 0.001, I^2 > 50%). Leave-one-out sensitivity analysis demonstrated the robustness of the results, Figure S3B.

Postoperative nausea and vomiting [%]

There was no significant difference between the SPGB and control groups in the rate of PONV (n= 120 patients, RR = 1.66, 95%

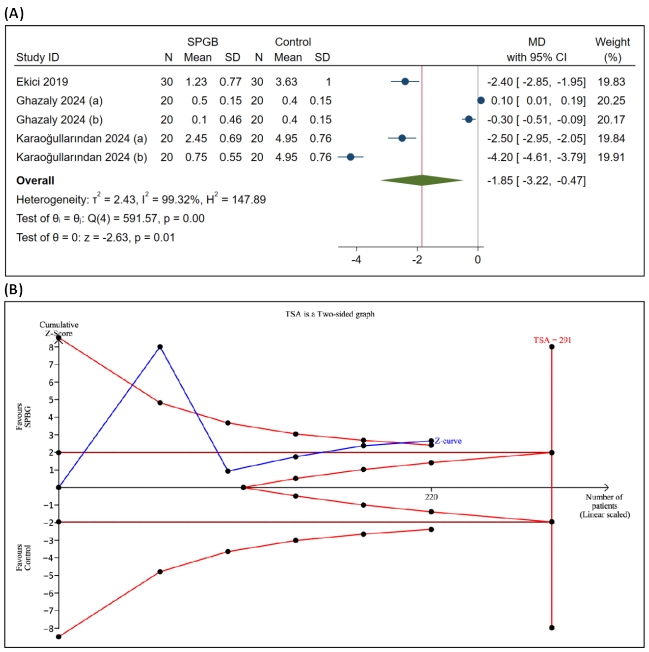


Figure 3. (A) Forest plot, and (B) trial sequential analysis of the mean postoperative pain score [VAS] after 1-2 hours.

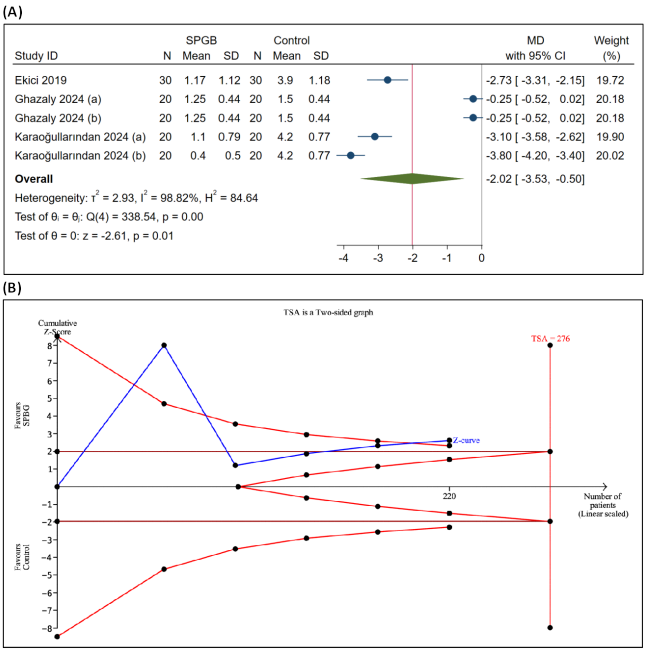


Figure 4. (A) Forest plot, and (B) trial sequential analysis of the mean postoperative pain score [VAS] after 4-6 hours.

CI [0.67, 4.16], p = 0.28, Figure S4). The pooled analyses showed homogeneity (chi-square p > 0.1, I^2 = 0%).

Patient satisfaction score [3-point]

For the poor category, SPGB group has a significantly lower score compared to the control group (n = 120 patients, RR = 0.17, 95% CI [0.03, 0.98], p = 0.05, Figure S5A). However, for the good category, there was no significant difference between the SPGB and control groups (n = 120 patients, RR = 0.83, 95% CI [0.59, 1.16], p = 0.28, Figure S5B). Finally, for the excellent category, SPGB group has a significantly higher score compared to the control group (n = 120 patients, RR = 2.28, 95% CI [1.08, 4.82], p = 0.03, Figure S5C). The pooled analyses showed homogeneity (chi-square p > 0.1, I^2 = 0%).

Discussion

Summary of the review key findings

This systematic review and meta-analysis thoroughly examined the clinical analgesic efficacy of SPGB in patients undergoing septoplasty due to DNS. Data were collected from three RCTs, comprising five arms, which involved a total of 180 patients. Of these, 110 patients were assigned to the SPGB group and 70 patients to the control group. The quality of the studies varied, with two RCTs considered to have a low risk of bias, and one RCT having some concerns due to missing information about randomization and allocation concealment method. The SPGB group had significantly lower postoperative pain within 24 hours compared to the control group. TSA confirmed the conclusive evidence and the lack of need for further RCTs. Additionally, overall analgesic use was significantly lower in the SPGB group. However, there was no substantial difference in the duration of surgery and the rate of PONV between the two groups. Leave-one-out sensitivity analyses demonstrated the robustness of the pooled analysis in all outcomes except for postoperative pain after 1-2 hours. Patient satisfaction scores were significantly higher and demonstrated a positive response in the SPGB group, with lower scores in the 'poor category' and higher scores in the 'excellent category' compared to the control group, with no difference in the 'good category'.

Furthermore, the meta-analysis unveiled a considerable degree of heterogeneity. There are several possible explanations for this observation. The most important one is the slight difference in the methods of administration (transnasal vs. transoral), anesthetic agent (bupivacaine vs. lidocaine), and use of additional drugs (i.e., dexamethasone). There are other plausible reasons for the observed heterogeneity, such as methodological quality disparities and patient characteristics.

Interpretation and relevance for clinical practice

In otolaryngology, septoplasty is a common surgery aimed at improving the quality of life for patients suffering from nasal obstruction due to a DNS. However, managing postoperative pain remains a major challenge, as it can greatly impact a patient's quality of life [29]. The intensity of pain and the need for analgesic medications during the recovery period have been widely studied. In our meta-analysis, the mean difference for postope-

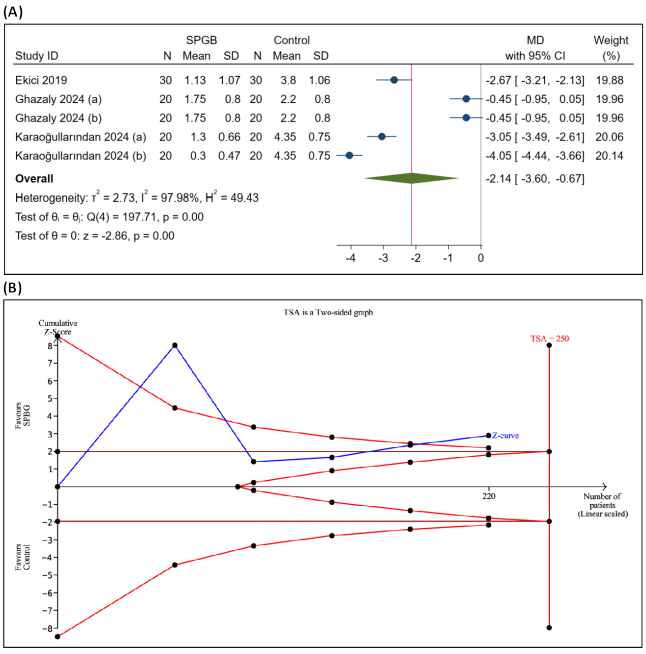


Figure 5. (A) Forest plot, and (B) trial sequential analysis of the mean postoperative pain score [VAS] after 12 hours.

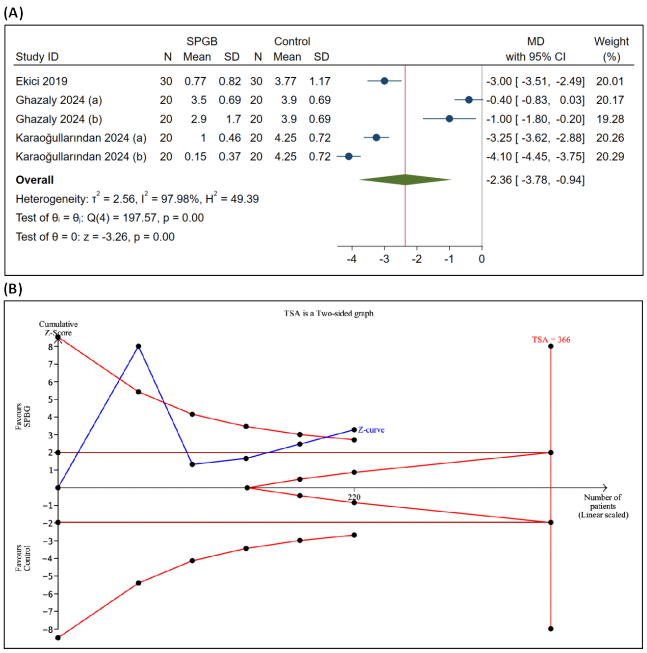


Figure 6. (A) Forest plot, and (B) trial sequential analysis of the mean postoperative pain score [VAS] after 24 hours.

rative pain was significantly reduced in favor of the SPGB group compared with the control group, with this difference observed at various time points, ranging from as early as 1-2 hours to as late as 24 hours after septoplasty. Statistically and clinically, the pooled MD values reflected 'large' effect size, and the change in postoperative pain scores was relevant, as reflected by a change greater than 1-point on the VAS, ranging from -1.85 to -2.36 [30]. Therefore, SPGB demonstrated both statistically and clinically significant reductions in postoperative pain. As a result, the overall use of analgesics (i.e., NSAIDs or opioids) was significantly reduced. By minimizing opioid use after septoplasty, SPGB not only helps protect patients from undesirable side effects such as constipation, diaphoresis, gastrointestinal bleeding, respiratory depression, and dizziness, but also potentially limits opioid usage, reducing the risk of addiction in susceptible patients [13,15]. In line with these findings, Shafiee et al. [29] conducted an evidence-based systematic review investigating different interventions for pain control after septoplasty. They found that local interventions versus pre/post-operative analgesic medications are highly recommended to replace opioids and NSAIDs, as they have shown prominent efficacy with no significant adverse events [13,15]. This conclusion is consistent with our findings. Additionally, in terms of safety, our meta-analysis of the included RCTs found no major complications such as headaches, visual disturbances, or bleeding. Furthermore, the rate of PONV was found to be comparable in both groups. Moreover, patients who underwent SPGB demonstrated higher satisfaction rates compared to the control group.

The SPG contains parasympathetic neurons that innervate the nasal mucosa, palate, lacrimal glands, pharynx, and paranasal sinuses, with sensory afferents from the maxillary nerve passing nearby [20]. Consequently, these nerves can also be affected during an SPGB. The SPGB can be performed using three main approaches: (i) anterior (transnasal), (ii) inferior (transoral), and (iii) lateral (infrazygomatic) [31]. According to the RCTs included in our review, all of them used the anterior approach, and one arm in one RCT utilized the inferior (transoral) approach [15]. The anterior approach involved inserting a hypodermic needle into the nasal cavity mucosa, just behind and above the middle turbinate tail, targeting the pterygopalatine fossa on both sides, using a 0° angle rigid endoscope [13]. The inferior approach was performed by inserting a hypodermic needle through the greater palatine foramen, positioned 11 mm from the medial side of the third molar tooth, with the needle bent at a 45° angle [15]. The transnasal approach is considered a simple and non-invasive method [31]. Karaoğullarından et al. [15] directly compared the transnasal and transoral approaches for SPGB and found that the transoral approach is more effective in postoperative pain control than the transnasal approach. They attributed this advantage to the better absorption of local anesthetics via the transoral route, which is due to the higher vascularity of the region, leading to more effective blockade of pain-sensitive nociceptors [15,32]. Furthermore, the transoral approach is closer to the areas where bone deviations occur during septoplasty, which often require more forceful and destructive removal. Consequently, the transoral route can more effectively block pain

fibers stimulated by denser fibrotic bands and greater blood supply in these bony regions, resulting in greater reduction of postoperative pain [15,32]. However, no direct comparison or subgroup analysis was conducted to investigate which route (transnasal vs. transoral) is superior in our meta-analysis, as only one arm was available for the transoral route. Although this procedure could theoretically prolong surgery, our results indicated no significant extension in the duration of surgery compared to the control groups.

Different local anesthetic agents were used, mainly bupivacaine. Bupivacaine is a long-acting amide-type local anesthetic agent, typically lasting for 6-8 hours or more [33]. On the other hand, lidocaine is an intermediate-acting amide-type local anesthetic agent, usually lasting for a shorter period of time (1-2 hours) than bupivacaine [33]. Generally, lidocaine is considered safer than bupivacaine; which carries some risk of cardiotoxicity [33]. However, in our meta-analysis, no major complications were observed, indicating that both agents are effective and safe. Adjuvants, such as dexamethasone, were used in one study [14]. We did not directly compare or conduct subgroup analysis to investigate which type (bupivacaine vs lidocaine) is better in our meta-analysis. This limitation arose from the limited number of arms, as there was only one arm for lidocaine.

The analgesic efficacy of SPGB has been investigated in several procedures other than septoplasty. A meta-analysis of six RCTs investigated the analgesic efficacy of SPGB after endoscopic sinus surgery [34]. The study found that SPGB significantly reduced pain after 6 hours and 24 hours, as well as reducing the number of rescue analgesics. Another study conducted by Dwivedi et al. [31] consisted of a systematic review and meta-analysis of nine RCTs to examine the analgesic efficacy of transnasal SPGB after post-dural puncture headache (PDPH). The researchers concluded that SPGB provides pain relief in PDPH, but the effect does not last for 6 hours or longer. The study also demonstrated the superiority of SPG block over conservative treatment and lignocaine puff. Additionally, Binfalah et al. [35] conducted a retrospective observational study to assess the analgesic effect of transnasal SPGB in patients with acute migraine headaches. The researchers concluded that SPGB is emerging as an effective and safe option for the treatment of several disabling headache and facial pain conditions such as migraine, cluster headache, and trigeminal neuralgia. Its ease of administration using non-invasive devices, safety profile, and quick pain relief make it an attractive treatment option for these conditions.

Strengths and limitations

This investigation has several noteworthy strengths. It represents the first-ever meta-analysis of RCTs examining the analgesic efficacy of SPGB in patients undergoing septoplasty due to DNS. We conducted a contemporary, PRISMA-compliant study and searched five major databases to gather all relevant studies. We included only RCTs in our meta-analysis, ensuring conclusions are drawn from high-quality studies. Additionally, we focused solely on septoplasty (excluding septorhinoplasty) to maintain uniform baseline procedural characteristics. Furthermore, we performed a leave-one-out sensitivity analysis and TSA to assess the stability and robustness of the pooled results. However, this investigation has several limitations that should be highlighted. The small number of meta-analyzed RCTs and their corresponding small sample size of patients are significant limitations. Additional limitations include substantial between-study heterogeneity for some endpoints, which may be due to variations in the route of SPGB administration, the surgeon's technical expertise, and the types of local anesthetic agents used. Moreover, all the meta-analyzed studies originated from Turkey and Egypt, limiting the generalizability of the results and raising the potential for reporting bias. Lastly, given the small number of included studies ($n < 10$ RCTs), the results of publication bias should be interpreted with caution, as the power of Egger's test is too low to distinguish chance from actual asymmetry.

Future directions and suggestions for further research

Given the acknowledged limitations of this analysis, additional RCTs with better-controlled interventions, larger sample sizes, and well-defined outcome measures are needed. Future research should focus on identifying the optimal route and type of anesthetic agent administration to achieve maximum analgesia with minimal side effects. Additionally, it would be valuable to investigate the direct analgesic efficacy of combination therapy that includes a local anesthetic agent with adjuvants (e.g., dexamethasone or epinephrine) in patients undergoing septoplasty due to DNS.

Conclusion

This systematic review and meta-analysis demonstrated the analgesic efficacy and safety of SPGB in patients undergoing septoplasty for DNS. Additionally, SPGB was not found to prolong the duration of surgery and was associated with a higher rate of patient satisfaction. However, there was no significant difference in the rate of PONV. Nonetheless, further RCTs are needed to identify the optimal protocol for SPGB administration in this context.

Acknowledgement

None.

Authors' contributions

EA: contributed to study conception, study design, data collection, data analysis, write up of original draft of manuscript, and review of manuscript for editorial and intellectual contents. BAR, AA, and AMA: contributed to literature review, data collection,

and review of manuscript for editorial and intellectual contents. MAQ: contributed to supervision and review of manuscript for editorial and intellectual contents. All authors read and approved the final draft of manuscript.

Funding

None.

Conflicts of interest

None

Data transparency

All data are available within the manuscript and can be obtained from the corresponding author upon a reasonable request.

References

1. Dietz de Loos D, Lourijsen ES, Wildeman MAM, et al. Prevalence of chronic rhinosinusitis in the general population based on sinus radiology and symptomatology. J Allergy Clin Immunol. 2019;143(3):1207–1214.
2. 2.Vuyk HD, Langenhuijsen KJ. Aesthetic sequelae of septoplasty. Clin Otolaryngol Allied Sci. 1997;22(3):226–232.
3. Ketcham AS, Han JK. Complications and management of septoplasty. Otolaryngol Clin North Am. 2010;43(4):897–904.
4. Alessandri-Bonetti M, Costantino A, Cottone G, et al. Efficacy of septoplasty in patients with nasal obstruction: a systematic review and meta-analysis. Laryngoscope. 2023;133(12):3237–3246.
5. Fearington FW, Awadallah AS, Hamilton GS 3rd, Olson MD, Dey JK. Long-term outcomes of septoplasty with or without turbinoplasty: a systematic review. Laryngoscope. 2024;134(6):2525–2537.
6. Akça B, Arslan A, Yılbaş AA, Canbay Ö, Çelebi N. Comparison of the effects of patient controlled analgesia (PCA) using dexmedetomidine and propofol during septoplasty operations: a randomized clinical trial. Springerplus. 2016;5:572.
7. Al Arfaj A. A rare complication of septorhinoplasty. Vol. 2, Plastic and reconstructive surgery. Global open. United States; 2014. p. e273.
8. Sclafani AP, Kim M, Kjaer K, Kacker A, Tabaee A. Postoperative pain and analgesic requirements after septoplasty and rhinoplasty. Laryngoscope. 2019;129(9):2020–2025.
9. Al-Qudah M. Endoscopic sphenopalatine ganglion blockade efficacy in pain control after endoscopic sinus surgery. Int Forum Allergy Rhinol. 2016;6(3):334–338.
10. Mojica J, Mo B, Ng A. Sphenopalatine ganglion block in the management of chronic headaches. Curr Pain Headache Rep. 2017;21(6):27.
11. Nalavenkata S, Meller C, Novakovic D, Forer M, Patel NP. Sphenopalatine foramen: endoscopic approach with bony landmarks. J Laryngol Otol. 2015;129 Suppl:S47-52.
12. Spielman DB, Kim M, Overdevest J, Gudis DA. Locating and preserving the sphenopalatine ganglion in endoscopic endonasal pterygopalatine fossa surgery: an anatomical study. Am J Rhinol Allergy. 2020;34(3):348–351.
13. Ekici NY, Alagöz S. The effectiveness of endoscopic sphenopalatine ganglion block in management of postoperative pain after septal surgery. Int Forum Allergy Rhinol. 2019;9(12):1521–1525.
14. Ghazaly HF, Khalefa MM, Sedeek MA, Hasanen MK. Sphenopalatine ganglion block with lidocaine versus bupivacaine for optimizing intraoperative bleeding and surgical field visibility during endoscopic septoplasty: a randomized double-blind controlled trial. Anaesthesia, Pain Intensive Care. 2024;28(1):92–99.
15. Karaoğullarından A, Erkan SO, Ekici NY. Is transoral sphenopalatine ganglion blockade more effective on postoperative pain than endoscopic sphenopalatine ganglion blockade? Eur Arch Otorhinolaryngol. 2024;281(1):193–199.
16. Higgins JPT, Thomas J, Chandler J, et al. Cochrane handbook for systematic reviews of interventions. Cochrane Handbook for Systematic Reviews of Interventions. 2019. 1–694 p.
17. Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. Int J Surg. 2021 Apr;88:105906.
18. Sterne JAC, Savović J, Page MJ, et al. RoB 2: a revised tool for assessing risk of bias in randomised trials. BMJ. 2019;366:l4898.
19. Egger M, Smith GD, Schneider M, Minder C. Bias in meta-analysis detected by a simple, graphical test. Br Med J. 1997;315(7109):629–634.
20. Gökçek E, Kozan G. Postoperative effects of bilateral sphenopalatine ganglion blockade in septorhinoplasty operations; double-blind randomized clinical trial. Braz J Otorhinolaryngol. 2024;90(2):101373.
21. Ahmadi A, Hosseindoost S, Rahmati J, Golparvaran S, Eslami B, Pestei K. Effect of sphenopalatine ganglion nerve block on bleeding and pain during and after rhinoplasty and septoplasty surgeries: a double-blind randomized clinical trial. Arch Neurosci. 2023;10(4).
22. Sari N, Uysal E. Endoscopic sphenopalatine ganglion block efficacy in the management of periorbital edema and ecchymosis after septorhinoplasty. J Craniofac Surg. 2021;32(3):983–987.
23. Degirmenci N, Ozdem A, Uysal H, et al. The effect of sphenopalatine ganglion block on the postoperative pain in patients undergoing septorhinoplasty. Ann Otol Rhinol Laryngol. 2020;129(7):722–726.
24. Borodulin VG, Filimonov SV. [The blockade of sphenopalatineganglionthrough the palatal approachin the present-day rhinological practice]. Vestn Otorinolaringol. 2016;81(4):38–41.
25. Dadgarnia MH, Shahbazian H, Behniafard N, et al. Epinephrine injection in greater palatine canal: an alternative technique for reducing hemorrhage during septoplasty. J Craniofac Surg. 2016;27(3):548–51.
26. Fujiwara T, Kuriyama A, Kato Y, Fukuoka T, Ota E. Perioperative local anaesthesia for reducing pain following septal surgery. Cochrane database Syst Rev. 2018;8(8):CD012047.
27. Karthik Madesh R, Sahu PK, Arjun AP, Vallur S, Pyadala N. Comparison of postoperative analgesia between greater palatine nerve block with local infiltration and local infiltration alone in septoplasty surgeries. Int J Otorhinolaryngol Head Neck Surg. 2020;6(4):759.
28. DeMaria SJ, Govindaraj S, Chinosorvatana N, Kang S, Levine AI. Bilateral sphenopalatine ganglion blockade improves postoperative analgesia after endoscopic sinus surgery. Am J Rhinol Allergy. 2012;26(1):e23-27.
29. Shafiee A, Arabzadeh Bahri R, Teymouri Athar MM, et al. Pain management following septorhinoplasty surgery: evidence from a systematic review. Eur Arch Otorhinolaryngol. 2023;280(9):3931–52.
30. Myles PS, Myles DB, Galagher W, et al. Measuring acute postoperative pain using the visual analog scale: the minimal clinically important difference and patient acceptable symptom state. Br J Anaesth. 2017;118(3):424–429.
31. Dwivedi P, Singh P, Patel TK, et al. Trans-nasal sphenopalatine ganglion block for postdural puncture headache management: a meta-analysis of randomized trials. Brazilian J Anesthesiol. 2023;73(6):782–793.
32. Robbins MS, Robertson CE, Kaplan E, et al. The sphenopalatine ganglion: anatomy, pathophysiology, and therapeutic targeting in headache. Headache. 2016;56(2):240–258.
33. Powell MF, Jarzombek KW, Venhuizen KJ, Tubinis MD, Morgan CJ, Frölich MA. Comparing bupivacaine, lidocaine, and a combination of bupivacaine and lidocaine for labor epidural activation: a prospective, randomized, double-blind study. Asian J Anesthesiol. 2019;57(2):55–60.
34. Wang P. The efficacy of sphenopalatine ganglion block for pain management after endoscopic sinus surgery: a meta-analysis of randomized controlled studies. Eur Arch

Otorhinolaryngol. 2021;278(8):2681–2687.
35. Binfalah M, Alghawi E, Shosha E, Alhilly A, Bakhiet M. Sphenopalatine ganglion block for the treatment of acute migraine headache. Pain Res Treat. 2018;2018:2516953.

ORCID:
Bassam AlRajhi
https://orcid.org/0000-0002-1983-9661
Alwaleed Alfadhli
https://orcid.org/0009-0006-8659-0241
Abdullah M. Alharran
https://orcid.org/0009-0003-2337-6588
Mohannad Al-Qudah
https://orcid.org/0000-0003-0734-9961

Ebraheem Albazee, MD
Kuwait Institute for Medical Specializations (KIMS)
Kuwait City
Kuwait

Mobile: +96550958282
E-mail: Ebraheemalbazee@gmail.com
ORCID: https://orcid.org/0000-0003-1244-7769

Ebraheem Albazee[1], Bassam AlRajhi[2], Alwaleed Alfadhli[3], Abdullah M. Alharran[4], Mohannad Al-Qudah[5]

[1] Kuwait Institute for Medical Specializations (KIMS), Kuwait City, Kuwait
[2] College of Medicine, King Saud bin Abdulaziz University for Health Sciences, Jeddah, Saudi Arabia
[3] School of Medicine, Royal College of Surgeons, Dublin, Ireland
[4] College of Medicine, Arabian Gulf University, Manama, Kingdom of Bahrain
[5] Department of Special Surgery, Division of ORL-HNS, Jordan University of Science and Technology and King Abdullah University Hospital, Irbid, Jordan

Rhinology 62: 6, 642 - 651, 2024
https://doi.org/10.4193/Rhin24.225

Received for publication:
June 2, 2024
Accepted: August 29, 2024

Assocociate Editor:
Ahmad Sedaghat

This manuscript contains online supplementary material

SUPPLEMENTARY MATERIAL

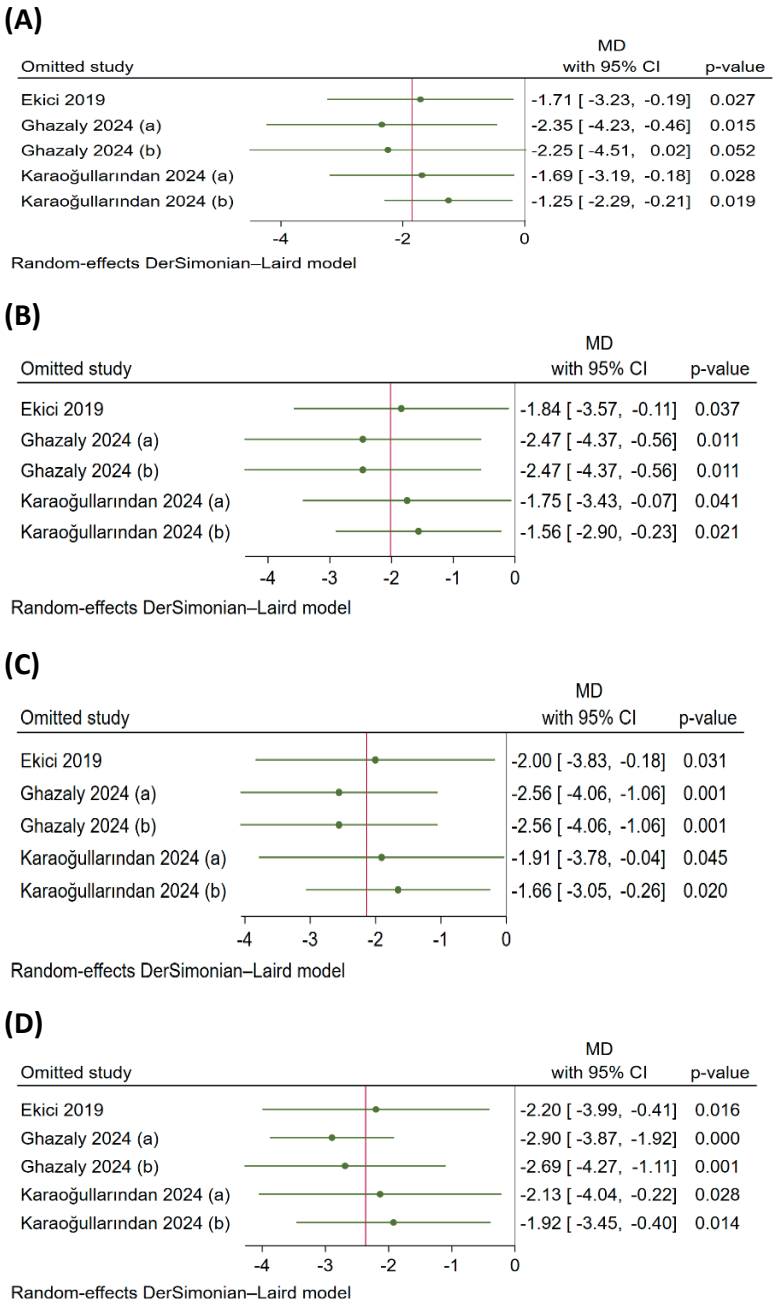


Figure S1. Leave-one-out sensitivity analysis of the mean postoperative pain score [VAS]; (A) after 1-2 hours, (B) after 4-6 hours, (C) after 12 hours, and (D) after 24 hours.

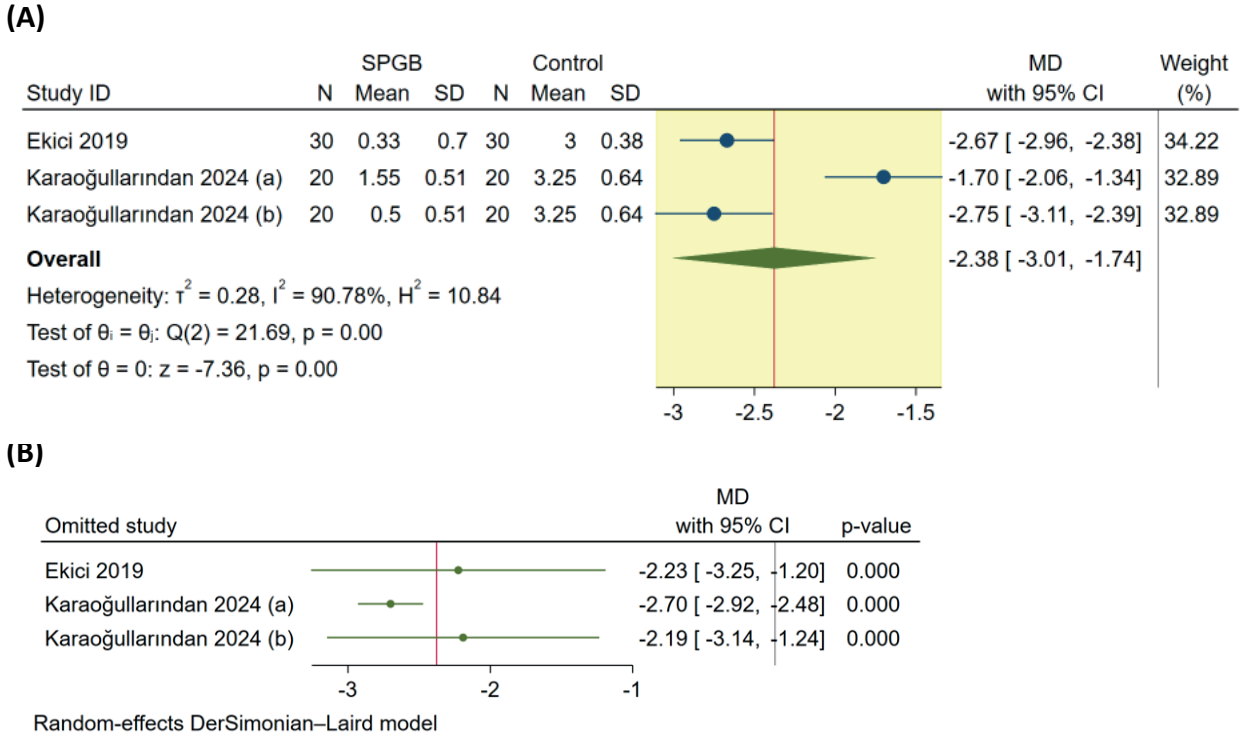


Figure S2. (A) Forest plot, and (B) leave-one-out sensitivity analysis of the overall analgesic usage.

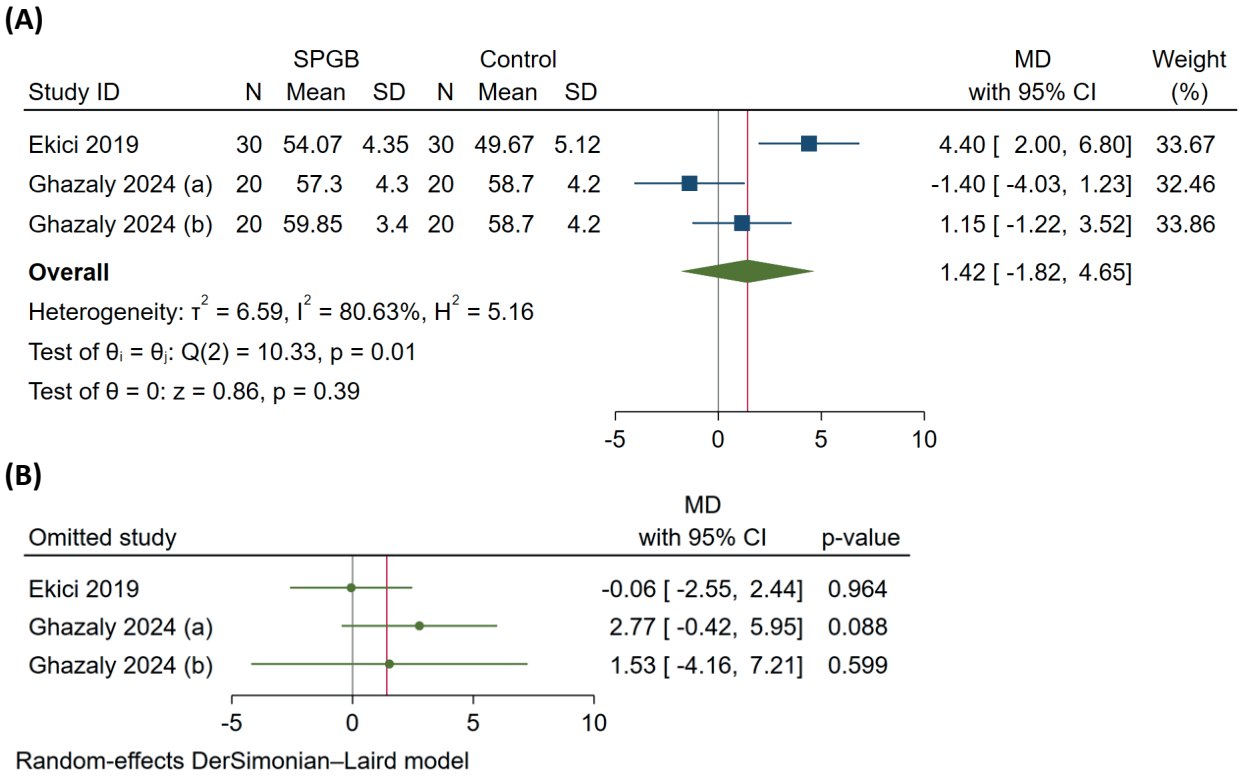


Figure S3. (A) Forest plot, and (B) leave-one-out sensitivity analysis of the duration of surgery [minutes].

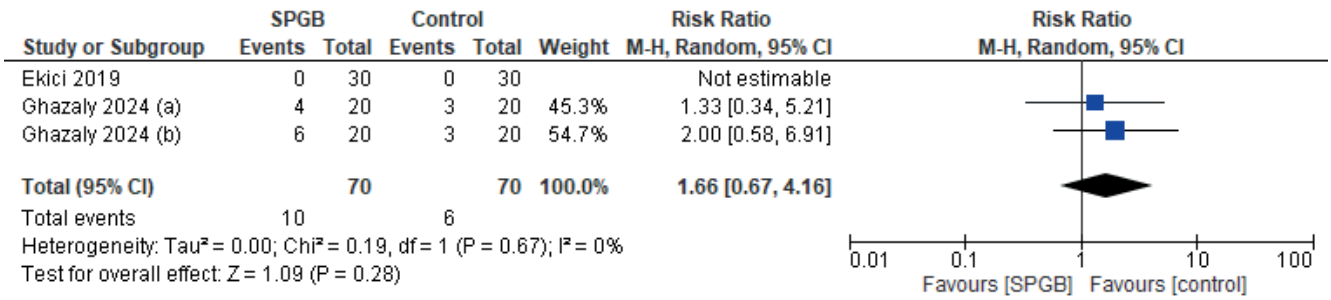
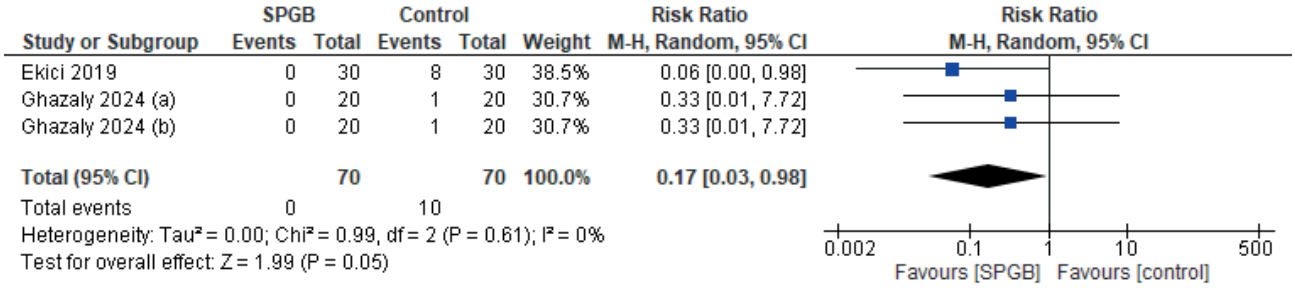
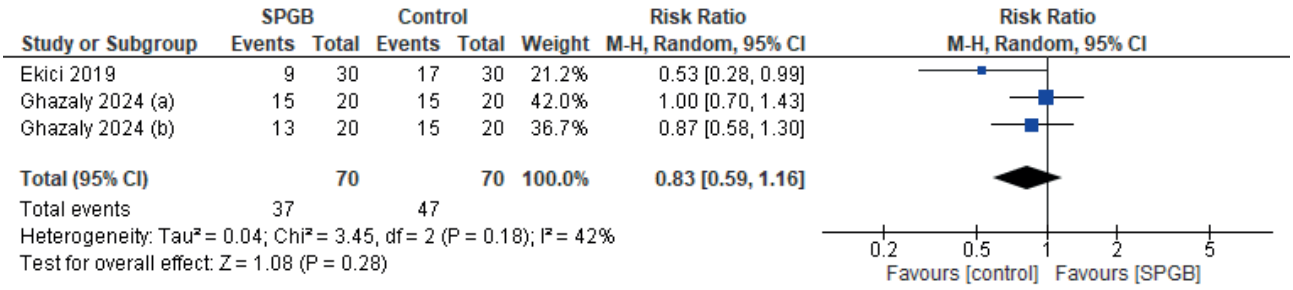


Figure S4. Meta-analysis of the rate postoperative nausea and vomiting (PONV).

(A)



(B)



(C)

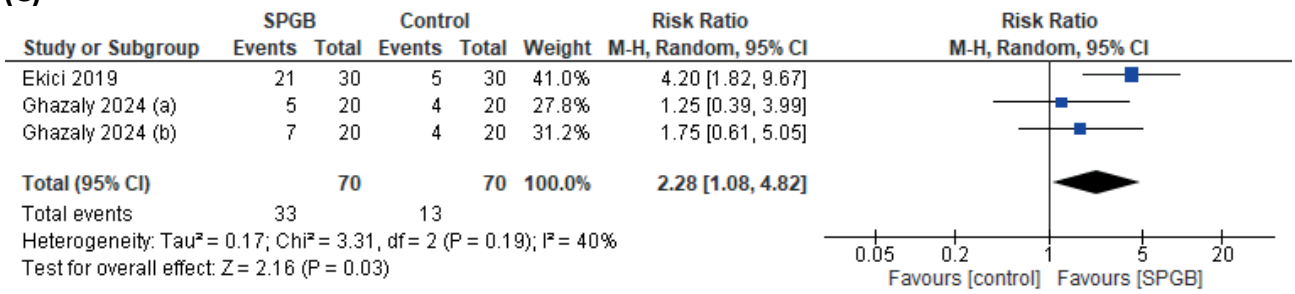


Figure S5. Meta-analysis of the patient satisfaction score [3-point], (A) poor, (B) good, and (C) excellent.

Table S1. The precise literature search strategy used in each database.

1. PubMed All Fields: (septoplasty OR septorhinoplasty OR "septal surgery" OR "nasal surgery" OR "septal deviation surgery" OR DNS OR "deviated nasal septum) AND ("sphenopalatine block" OR "sphenopalatine ganglion block" OR "sphenopalatine ganglion nerve block" OR "sphenopalatine ganglion blockade" OR "sphenopalatine ganglion" OR SPGB OR SGB OR "pterygopalatine fossa block" OR "pterygopalatine block" OR pterygopalatine).
2. Scopus Article title, Abstract, Keywords: (septoplasty OR septorhinoplasty OR "septal surgery" OR "nasal surgery" OR "septal deviation surgery" OR DNS OR "deviated nasal septum) AND ("sphenopalatine block" OR "sphenopalatine ganglion block" OR "sphenopalatine ganglion nerve block" OR "sphenopalatine ganglion blockade" OR "sphenopalatine ganglion" OR SPGB OR SGB OR "pterygopalatine fossa block" OR "pterygopalatine block" OR pterygopalatine).
3. Web of Science (WOS) All Fields: (septoplasty OR septorhinoplasty OR "septal surgery" OR "nasal surgery" OR "septal deviation surgery" OR DNS OR "deviated nasal septum) AND ("sphenopalatine block" OR "sphenopalatine ganglion block" OR "sphenopalatine ganglion nerve block" OR "sphenopalatine ganglion blockade" OR "sphenopalatine ganglion" OR SPGB OR SGB OR "pterygopalatine fossa block" OR "pterygopalatine block" OR pterygopalatine).
4. Cochrane CENTRAL Title Abstract Keyword: (septoplasty OR septorhinoplasty OR "septal surgery" OR "nasal surgery" OR "septal deviation surgery" OR DNS OR "deviated nasal septum) AND ("sphenopalatine block" OR "sphenopalatine ganglion block" OR "sphenopalatine ganglion nerve block" OR "sphenopalatine ganglion blockade" OR "sphenopalatine ganglion" OR SPGB OR SGB OR "pterygopalatine fossa block" OR "pterygopalatine block" OR pterygopalatine).
5. Embase All Fields: (septoplasty OR septorhinoplasty OR "septal surgery" OR "nasal surgery" OR "septal deviation surgery" OR DNS OR "deviated nasal septum) AND ("sphenopalatine block" OR "sphenopalatine ganglion block" OR "sphenopalatine ganglion nerve block" OR "sphenopalatine ganglion blockade" OR "sphenopalatine ganglion" OR SPGB OR SGB OR "pterygopalatine fossa block" OR "pterygopalatine block" OR pterygopalatine).

Table S2. List of excluded studies during the full-text screening phase.

Study ID	Title	Reason Of Exclusion
Demaria 2016	Bilateral sphenopalatine ganglion blockade improves postoperative analgesia after endoscopic sinus surgery	Did not meet our patients criteria – ess
Madesh R. 2020	Comparison of postoperative analgesia between greater palatine nerve block with local infiltration and local infiltration alone in septoplasty surgeries	Did not meet our intervention criteria – greater palatine nerve block
Fujiwara 2018	Perioperative local anaesthesia for reducing pain following septal surgery	Did not meet our study design criteria – review paper
Dadgarnia 2016	Epinephrine injection in greater palatine canal: an alternative technique for reducing hemorrhage during septoplasty	Did not meet our intervention criteria – greater palatine canal block
Borodulin 2016	The blockade of sphenopalatine ganglion through the palatal approach in the present-day rhinological practice	Did not meet our study design criteria – observational study and not english
Degirmenci 2020	The effect of sphenopalatine ganglion block on the postoperative pain in patients undergoing septorhinoplasty	Did not meet our study design criteria – observational study and septorhinoplasty
Sari 2021	Endoscopic sphenopalatine ganglion block efficacy in the management of periorbital edema and ecchymosis after septorhinoplasty	Did not meet our study design criteria – non-randomized trial and septorhinoplasty
Ahmadi 2023	Effect of sphenopalatine ganglion nerve block on bleeding and pain during and after rhinoplasty and septoplasty surgeries: a double-blind randomized clinical trial	Did not meet our patients criteria – septorhinoplasty
Gökçek 2023	Postoperative effects of bilateral sphenopalatine ganglion blockade in septorhinoplasty operations; double-blind randomized clinical trial	Did not meet our patients criteria – septorhinoplasty