

EFFECTS OF BILATERAL SPHENOPALATINE GANGLION BLOCK IN FUNCTIONAL ENDOSCOPIC SINUS SURGERY UNDER GENERAL ANESTHESIA

By

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ABSTRACT

Background: Functional endoscopic sinus surgery (FESS) is considered as one of the most common surgical procedure. General anesthesia (GA) is usually required during FESS. Regional analgesic techniques can use during GA that is inhibits the intra- and the post-operative detrimental stimuli.

Objective: To evaluate the effects of bilateral sphenopalatine ganglion block (SPGB) in FESS by using different types of local anesthetic agents.

Patients and Methods: A double-blinded, randomized, controlled-trial study was performed on 80 patients undergoing FESS with bilateral SPGB under GA. This study was conducted at departments of Otorhinolaryngology and Anesthesia & Intensive care, Al-Jafel International Hospital, Riyadh, KSA. The current study was conducted since May 2018 till January 2020. The patients were categorized into 4 groups; group I using (bupivacaine 0.5%), group II using (ropavacine 0.75%), group III using (xylocaine 2%), and group IV using (saline) as a control group. Observed variables included hemodynamic parameters, surgical field visibility, intra-operative blood loss, post-operative analgesia use, and complications related to the used technique.

Results: Averages of the heart rate, mean arterial blood pressure, bleeding, operative time, and visual analogue scale (VAS) in the three groups were statistically significant different from the controls (P=000). The clarities of the operative field and bleeding amount in the three groups separately were statistically significant different from the controls (P=0.000). The differences in the post-operative complications in the three groups and the controls were statistically insignificant except for group III. The differences in the analgesics usage in the three studied groups and the controls were statistically insignificant except group I.

Conclusion: Using of bilateral SPGB in FESS under GA is proved to be of great importance in reducing the heart rate, arterial blood pressure, bleeding, operation time, and VAS in the studied groups. Further, xylocaine 2% is significantly reducing the post-operative complications. Also, bupivacaine 0.5% is significantly reducing the analgesics usage.

Keywords: Bilateral SPGB, FESS, Bupivacaine 0.5%, Hemodynamics, Complications.

INTRODUCTION

Functional endoscopic sinus surgery (FESS) is currently a prevalent surgical technique in Rhinology specialty. It has a

high success rate for symptomatic enhancement in patients with medically refractory chronic rhinosinusitis and chronic polypoid rhinosinusitis (*Huang et al., 2015* and *Di Mauro et al., 2018*).

General anesthesia (GA) is often needed during FESS, especially complex and prolonged cases. Local anesthetics, regional block, could be used as alternates to high-dose of analgesics to decrease their amount and side-effects (*Ekici and Alagöz, 2019*). Also, it's reasonable to prevent peri-operative rise in sympathetic tone by using a sufficient anesthetic depth and analgesia. These achieved using abundant narcotics that has significant post-operative drawbacks including reduced alertness, insufficient spontaneous breathing and increased nausea and vomiting (*Shamil et al., 2018*).

Regional analgesic procedures use during GA inhibits intra- and post-operative detrimental stimuli (*Robbins et al., 2016*), and, so, can be used as a superior alternate to increase the doses of narcotics avoiding their inappropriate drawbacks (*Shamil et al., 2018*). The sphenopalatine ganglion block (SPGB) was used efficiently as a single anesthetic procedure before removal of nasal packing, post-operative pain might be correlated with late functional recovery and it much contributes to dis-satisfaction with the procedure, late in returning to work and re-admission after surgical operations (*Robbins et al., 2016* and *Ekici & Alagöz, 2019*). Post-operative analgesia after FESS can be achieved through opioids, NSAIDs, topical/infiltration of local anesthetics and regional procedures like SPGB; SPGB is suspected to supply peri-operative analgesia after FESS (*Xiong et al., 2017*).

Combination of regional anesthesia with GA procedure could present as a best hemodynamic control standards, low peri-operative opioid-use, minimize bleeding

loss, and induce the highest levels of patients' satisfaction (*Cho et al., 2011* and *Al-Qudah, 2016*). Reducing in surgical bleeding in FESS could be, also, enhance surgical field and surgeons' contentment and a reduced opioid-use may be transferred to a low post-operative nausea and vomiting, early- and recovery and -hospital discharge (*Shamil et al., 2018*).

The aim of this study was to evaluate and compare the effects of bilateral SPGB by using different types of local anesthetic agent on the hemodynamics, surgical field, intra- operative blood loss, post-operative pain relief and analgesia usage, and post-operative complications.

PATIENTS AND METHODS

The current study was conducted since May 2018 till January 2020, after approval of the study protocol by the Local Ethical Committee. Furthermore, an informed consent was taken from each patient. A double-blinded, randomized controlled, clinical-trial, design was chosen to conduct this study. The study was carried out at Departments of Otorhinolaryngology and Anesthesia & Intensive care, Al-Jafel International Hospital, Riyadh, KSA. Eighty adult patients from both sexes were recruited for this study. The patients were chosen according to American Society of Anesthesiologists (ASA) I-II (*Mayhew et al., 2019*). The patients' ages ranged from 18 to 60 years. The patients had different nasal sinus pathologies including chronic sinusitis and nasal polyposis.

Patients were scheduled to undergo FESS and randomly categorized into four equal groups. **Group I** using (bupivacaine 0.5%): Received pre-emptive transoral

bilateral SPGB after induction of GA, **Group II** using (ropavacine 0.75%), **Group III** using (xylocaine 2%), and **Group IV** (control group) using normal saline. The randomization was performed using randomized allocation software technique.

Exclusion criteria:

Pregnant and lactating women, patients with clinically significant cardiovascular, pulmonary, hepatic, neurologic or metabolic diseases and those with hypersensitivity to local anesthetic agent were excluded.

All patients received 2mg of midazolam intra-venously as a premedication 10min before the induction of GA with standard monitoring. GA was induced intra-venously with 2-3mg/kg - 1% propofol and 2µg/kg fentanyl, and the trachea was intubated with a cuffed endotracheal tube under muscle relaxation with 0.5mg/kg -atracurium. Anesthesia was maintained with sevoflurane 2% in 50% N₂O in O₂ with positive pressure ventilation then followed by ganglion block.

The intra-oral greater palatine canal approach to block the sphenopalatine ganglion was used (*Wormald et al., 2005*). The greater palatine foramen has a constant location posteromedial to the third maxillary molar and anteromedial to the maxillary tuberosity and pterygoid hamulus. The instruments required were a 5mL syringe and a 25-gauge needle. The needle was bent about 60 degree, approximately 25-30mm from the tip. After using finger palpation to determine the location of greater palatine foramen, the needle was pushed through the mucosa until bone was encountered. With slight

exploratory movements to localize the foramen, the needle slipped up the canal with ease. A negative pressure with aspiration ensured the correct position. Air bubbles or a bloody aspirate indicated entry into the nasopharynx or a vessel, in which case. The needle was withdrawn and repositioned. Thereafter, 2mL of local anesthetic or saline was injected in each side of greater palatine canal. Standardized anesthetic management in this study was the maintenance of enough hypotension for producing an optimal surgical field.

Sevoflurane concentration in a stepwise fashion until a mean blood pressure of 65- 70 mmHg was achieved or the end-tidal concentration of sevoflurane reached 3%. If blood pressure control was not achieved with a 3% sevoflurane concentration, incremental boluses of 1µg/kg fentanyl were administered up to a total dose of 3µg/kg. When both drugs failed to achieve good surgical field, a bolus 0.5mg/kg of esmolol, followed by 0.5mg/kg/h infusion a selective (B₁-adrenoreceptor antagonist), was given to induce the required hypotension. Bradycardia (heart rate <50 beats/min) was treated with atropine (0.5mg).

At the end of surgery, sevoflurane and N₂O were discontinued. Residual neuromuscular block was antagonized with neostigmine (0.04mg/Kg IV) and atropine sulphate (0.01mg/Kg IV). The trachea was extubated when adequate spontaneous ventilation and patient response to verbal commands were established. After surgery, the patients were admitted to the post-operative care unit (POCU).

The following parameters were recorded:

1. The heart rate (HR) every 15 min during surgery.
2. Mean arterial blood pressure (MAP) was measured every 15 minute during surgery.
3. Assessment of surgical field: It was classified as clear, moderate-, and little-clarity.
4. Blood loss was measured in milliliters.
5. Duration of surgery (minutes).
6. Pain intensity was evaluated with a 10 visual analogue scale (VAS) scores (where 0 is defined as no pain at all and 10 as the worst possible pain) at 2, 6, 12, and 24 hours post- operatively.
7. The time to first rescue pain medication and analgesic requirements were assessed. The patients received 30mg of ketolac intra-venous and 50mg of pethidine intra-muscular as required for

post-operative supplemental analgesia, on request.

8. Complications including bleeding, nausea, vomiting, dental numbness, headache, and sense of retro-ocular pressure were recorded.

Statistical analysis:

Data were verified, coded, and analyzed using IBM-SPSS 20.0 (IBM-SPSS Inc., Chicago, IL, USA). Data were presented as mean and standard deviation (SD) for quantitative variables, and frequency and percentage for qualitative variables. For quantitative groups' comparison analysis of variance (F-test) were used followed by Post-hoc test. While, for qualitative variables, chi-square (χ^2), Yates chi-square, or Fischer's exact (FE) tests, as appropriate, were used. P-value was considered significant at level <0.05 .

RESULTS

The differences in averages of the heart rate, arterial blood pressure, amount of bleeding at operation, operation time, and visual analogue scale in the three studied groups [group I (bupivacaine 0.5%),

group II (ropavacine 0.75%), and group III (xylocaine 2%)] were statistically significant; $P < 0.001$ for each of them (**Table 1**).

Table (1): Average of the heart rate, arterial blood pressure, amount of bleeding at operation, operation time, and visual analogue scale in the three studied groups

Variables	Group I M±SD	P- Value	Group II M±SD	P- Value	Group III M±SD	P- Value	Control group
Average heart rate (beat/min)	71.4 ± 0.36	0.00	74.4 ± 0.0	0.00	74.8 ± 0.2	0.00	81.4±0.03
Average arterial pressure (mmHg)	71.0 ± 0.0	0.00	72.1±0.08	0.00	75.5 ± 0.0	0.00	78.0±1.5
Average amount of bleeding (ml)	84.0 ± 0.0	0.00	78.0 ± 0.0	0.00	83.0 ± 0.0	0.00	116.0±0.00
Average operation time (min)	93.0 ± 0.0	0.00	95.0 ± 0.0	0.00	95.0 ± 0.0	0.00	99.0±0.00
Average visual analogue scale (VAS)	1.96 ± 0.0	0.00	2.28 ± 0.0	0.00	2.48 ± 0.0	0.00	3.6±0.00

The difference in the clarities of the operative field regarding bleeding amount (little-, mild-, and much-bleeding) in each of the three studied groups [group I

(bupivacaine 0.5%), group II (ropavacine 0.75%), and group III (xylocaine 2%)] was statistically insignificant (P= 0.273-**Table 2**).

Table (2): Clarity of the operative field regarding bleeding amount in the three studied groups

Operative field	Group I		P-value	Group II		p-value	Group III		P-value	Controls (IV)	
	No.	%		No.	%		No.	%		No.	%
Clear (little bleeding)	12	60.0	0.000001	8	40.0	0.0001	8	40.0	0.000001	0	0.0
Moderate clarity (mild bleeding)	4	20.0		4	20.0		8	20.0		0	0.0
Little clarity (much bleeding)	4	20.0		8	40.0		4	40.0		20	100.0

The difference in the post-operative complications between the three studied groups [group I (bupivacaine 0.5%),

group II (ropavacine 0.75%), and group III (xylocaine 2%)] was statistically significant (P=0.01-**Table 3**).

Table (3): Post-operative complications in the three studied groups

Post-operative complications	Group I		P-value	Group II		P-value	Group III		p-value	Controls (IV)	
	No.	%		No.	%		No.	%		No.	%
Absent	12	60.0	0.300	12	60.0	0.300	4	20.0	0.0005	16	80.0
Present	8	40.0		8	40.0		16	80.0		4	20.0

The difference in types of the post-operative complications between the three studied groups [group I (bupivacaine

0.5%), group II (ropavacine 0.75%), and group III (xylocaine 2%)] was statistically significant (P=0.0003 -**Table 4**).

Table (4): Types of post-operative complications in the three studied groups

Types Of complications	Group I		p-value	Group II		p-value	Group III		p-value	Controls (IV)	
	No.	%		No.	%		No.	%		No.	%
Headache	0	0.0	0.0003	0	0.0	0.0003	12	60.0	0.106	8	40.0
Nausea	4	20.0		4	20.0		4	20.0		0	0.0
Vomiting	0	0.0		4	20.0		0	0.0		0	0.0
Dental numbness	4	20.0		0	0.0		4	20.0		0	0.0

The difference in the analgesics early usage between the three studied groups [group I (bupivacaine 0.5%), group II

(ropavacine 0.75%), and group III (xylocaine 2%)] was statistically significant (P=0.00001- **Table 5**).

Table (5): Distribution of analgesics early usage in the three studied groups

Analgesics using	Group I		Group II		Group III		Controls (IV)		P- Value
	No.	%	No.	%	No.	%	No.	%	
No	12	60.0	4	20.0	2	10.0	0	0.0	0.00001
Yes	8	40.0	16	80.0	18	90.0	20	100.0	

DISCUSSION

FESS is a safe technique and the ideal treatment for a variety of cases such as nasal polyps and rhinosinusitis (*Fetta et al., 2017* and *Rezaeian 2017*). Further, it's crucial to maintain a clear, non-bloody field of surgery. Simultaneously, SPGB is currently used in patients who undergoing FESS under effect of GA to reduce bleeding and for post-operative pain relieving (*Bhattacharyya et al., 2016*). Also, SPGB is a known comfort, efficient, effective, and safe technique for managing craniofacial type of pain (*Rezaeian et al., 2019*).

In the current study, we showed that the averages of hemodynamic parameters (heart rate, arterial pressure, and bleeding amount) were less with statistically significant different from the controls. Also, there is risk of hemorrhage due to the increase in venous and arterial pressures.

Bhattacharyya et al. (2016) reported that during the surgery, average of HR (74.1 ± 3.9 beats/min) in the SPGB group was statistically significant lower in the block group compared with the non-block group. Also, *Gaafar et al. (2019)* observed that the average of HR during all recorded times of surgery in the SPGB group were statistically significant lower in the block group compared with the control group. This could be explained, low HR permits more filling rate of the venous vessels, so, this lowering venous ooze in the field of surgery. Moreover, SPGB with local anesthetic agent could decrease the nasal sinuses' mucosal blood flow. This might be due to mucosal vasoconstriction and so a better clear field of the surgery (*Gaafar et al., 2019*). Meanwhile, *Bhattacharyya et al. (2016)* observed that during the surgery, average of blood loss in the SPGB group was statistically significant lower in the block

group compared with the non-block group. Also, *Gaafar et al. (2019)* showed that the average of blood loss in the SPGB group was statistically significant lower in the block group compared with the non-block group. Moreover, *Kesimci et al. (2012)* observed that amount of the blood loss was significantly less in the SPGB group. While, *Rezaeian et al. (2019)* clarified that blood loss was lower in the block group compared with the controls with in-statistically significant difference. Meanwhile, *Bhattacharyya et al. (2016)* showed that the intra-operative average of MAP in the SPGB group was statistically significant less in the block group compared with the non-block group. Also, *Gaafar et al. (2019)* found that the averages of MAP during all recorded times of surgery and post-surgery were statistically significant lower in the block group compared with the control group.

In the present study, we reported that means of the operation time in the three studied groups showed statistically significant differences from the controls. On the contrary, *Rezaeian et al. (2019)* found that surgery durations were higher in the block groups compared with the controls with non-statistically significant differences.

In the current study, we showed that means of VAS scores showed statistically significant differences. Also, the difference in-between the groups was statistically significant. Our results were accordant with *Cho et al. (2011)* and *Bhattacharyya et al. (2016)*. Recently, *Rezaeian et al. (2019)* showed that the VAS scores were observed promptly after surgery; during recovery, 6, 12, and 24 hour. VAS scores were significantly

smaller in the studied group compared with the controls. Also, they found that the difference in-between the groups were statistically significant.

Post-operative pain is a great important subject to deal with after all types of surgeries. Further, it's crucial to keep a satisfactory standard of analgesia after FESS (*Gaafar et al., 2019*). It is supposed that more than four-fifth (86%) of patients who underwent surgical procedures experienced pain. Furthermore, 75% of the patients suffered from moderate to severe pain (*Gan et al., 2014*). Also, *Shamil et al. (2018)* cleared that for the first three hours after operation, there is significant decrease in the pain after endonasal surgery in patients who done SPGB compared with the controls. So, the SPGB extend the post-operative analgesia (*Gaafar et al., 2019*).

A small number of researches, to the best of our knowledge, have been done to evaluate the effectiveness the SPGB. Almost of these researches have pointed that using of the SPGB could give significant results in reducing pain in patients who underwent FESS (*Rezaeian et al., 2019*). The researchers suspect that post-operative pain in patients underwent SPGB with GA group could be decreased compared to the controls without SPGB (*Al-Qudah, 2016*). *Cho et al. (2011)* pointed that using of bupivacaine in the SPGB plus general anesthesia during the FESS, post-operative pain could be reduced, but with in-statistically significant difference.

In the current study, we reported that the differences between percentages of post-operative complications were statistically insignificant among the

studied groups I and II, and the controls; while the differences between percentages in group III and the controls was statistically significant higher in the group III. At the time, we confirmed that headache (60.0%) was the commonest complication in group III, nausea (20.0%) and dental numbness (20.0%) in group I, and nausea (20.0%) and vomiting (20.0%) in group II. *Gaafar et al. (2019)* found that nausea, as post-operative complication, was significantly lower in SPGB group (13.04%) compared with the controls. Also, *Kesimci et al. (2012)* and *Rezaeian et al. (2019)* cleared that in the SPGB group the complications (nausea, vomiting, headache, and visual disturbance) were less than the controls, but with insignificant differences. Moreover, *Bhattacharyya et al. (2016)* observed that the post-operative complications in the SPGB group were dental numbness (13.3%) and retro-ocular pressure (6.7%) in SPGB group.

In the present study, we found that the studied patients in groups I (bupivacaine 0.5%), II (ropivacaine 0.75%), and III (xylocaine 2%) used post-operative rescue analgesics less than the controls. However, the only significant difference was the bupivacaine 0.5% group. *Rezaeian et al. (2019)* cleared that only 20.0% of their studied cases used saving analgesics compared with 60.0% of the controls with statistically significant difference. Also, *Bhattacharyya et al. (2016)* found that the first needed post-operative analgesic dose was required for pain relief after 12.3 ± 3.6 hour in the SPGB group with statistically significant low figure than that in the non-block group. *Gaafar et al. (2019)* found that time for first request of analgesia was

significantly longer in block group compared with the controls. Similarly, *DeMaria et al. (2012)* cleared that SPGB plus general anesthesia was suitable in reducing the need for opiates after the FESS.

CONCLUSION AND RECOMMENDATIONS

Bilateral SPGB in FESS under GA was proved to be a simple, easy, helpful and of great importance in reducing the heart rate, arterial blood pressure, intra-operative bleeding, operation time, VAS, and suitable operative field in the studied groups. Moreover, its drawbacks were minimum. Further, bupivacaine 0.5% was significantly reducing analgesics usage. Also, xylocaine 2% was significantly reducing post-operative complications. More studies are needed to be done on large number of patients and on other types of nasal surgeries.

Conflict of Interest:

Authors declare that there was no conflict of interest.

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تأثير تثبيت كتلة العقدة الوريدية بالجانبين فى جراحة الجيوب الأنفية بالمنظار الجراحى باستخدام التخدير العام

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خلفية البحث: تعتبر جراحة الجيوب الأنفية واحدة من أكثر العمليات الجراحية شيوعاً. والتي غالباً ما تتم باستخدام التخدير العام الذى يكون مطلوباً أثناء العملية، ونشير انه يمكن استخدام تقنيات المسكن الموضعيه أثناء استخدام المخدر العام مما يمنع المنبهات الضارة اثناء وبعد الجراحة.

الهدف من البحث: تقييم آثار تثبيت العقدة الوريدية بالجانبين فى جراحة الجيوب الأنفيه بالمنظار، و ذلك باستخدام أنواع مختلفة من عوامل التخدير الموضعي.

المرضى وطرق البحث: تم إجراء دراسة تجريبية مزدوجة التعمية وعشوائية على ٨٠ مريضاً يخضعون لعملية جراحة الجيوب الأنفيه بالمنظار مع تثبيت العقدة الوريدية بالجانبين تحت المخدر العام.

وتم تصنيفهم الى 4 مجموعات: المجموعة الأولى باستخدام بوفيفاكين ٥ ٪، المجموعة الثانية باستخدام روباواسين ٠,٧٥ ٪، المجموعة الثالثة باستخدام زيلوكايين ٢ ٪، والمجموعة الرابعة باستخدام (محلول ملحي) كمجموعة تحكم. وقد تم ملاحظة نسبة فقدان الدم أثناء العملية الجراحية، واستخدام المسكن بعد الجراحة، والمضاعفات المتعلقة بالتقنية المستخدمة.

نتائج البحث: كانت متوسطات معدل ضربات القلب، وضغط الدم الشرياني، والنزيف، ووقت التشغيل، وومقياس التناظرية البصرية فى المجموعات الثلاث ذات دلالة إحصائية. وكانت توضيحات المجال الجراحى وكمية

النزيف في المجموعات الثلاث بشكل منفصل مختلفة يعتد بها إحصائيا عن عناصر التحكم. وكانت الاختلافات في مضاعفات ما بعد الجراحة في المجموعات الثلاثة والضوابط ليس لها دلالة إحصائية باستثناء المجموعة الثالثة، والاختلافات في استخدام المسكنات في المجموعات الثلاثة المدروسة والضوابط ليس لها أهمية إحصائية باستثناء المجموعة الأولى.

الاستنتاج: استخدام تثبيط الغدة الوريدية بالجانبين في عملية الجيوب الأنفية بالمنظار تحت تأثير المخدر العام ذو أهمية كبيرة في تقليل معدل ضربات القلب، وضغط الدم الشرياني، والنزيف، ووقت العملية في مجموعات الدراسة إضافة إلى ذلك فإن الزيلوكاين يقلل بشكل كبير من مضاعفات ما بعد الجراحة، كما أن بوبيفاكين يقلل بشكل كبير من استخدام المسكن.