

Effectiveness of different regional techniques of sphenopalatine ganglion blockade in improving surgical conditions during FESS

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Pan Arab Journal of Rhinology
2019, 10:34-38

Background: Facial pain and headache of various etiologies can be treated by sphenopalatine ganglion block (SPGB) using local anesthetic; with the aid of endoscopy during functional endoscopic sinus surgery (FESS).

The objective of this study was to compare the efficacy of injection of lidocaine with epinephrine in the sphenopalatine ganglion endoscopically just posterior to middle meatus and transoral greater palatine foramen injection at the start of endoscopic sinus surgery (ESS) for surgical field hemostasis and control of surgical conditions.

Methods: A prospective, double blinded, randomized clinical trial of 30 patients diagnosed to have chronic rhinosinusitis (CRS) undergoing FESS under general anesthesia. All patients received injection of 2 mL 2% lidocaine with epinephrine regardless the technique Group 1 one side injected trans-oral technique while group 2 the other side trans-nasal injection and a piece of gauze soaked with lidocaine and adrenaline was passed along the middle turbinate.

Intraoperative vital signs in the form of heart rate and mean arterial blood pressure were measured over the operative time every 2 minutes. Postoperatively, patients were hospitalized for the first 24 hours. Pain was asked for and documented 6 and 24 hours after surgery and documented using a 10-cm visual analog scale (VAS). The need for postoperative rescue analgesia was recorded for all patients.

Results: There were statistically significant differences in blood pressure measurement and heart rate between the 2 groups over the operative time. None of the patients had severe pain postoperatively. No complications were encountered in either group.

Conclusion: SPGB at the beginning of surgery can be considered as safe, simple, noninvasive, and effective method for controlled surgical conditions as well as short-term pain control for sinus surgery.

Keywords: Endoscopic sinus surgery; pain; analgesia; lidocaine; epinephrine; sphenopalatine ganglion block

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Introduction

Functional endoscopic sinus surgery (FESS) is an effective minimally invasive surgical technique commonly used to treat chronic rhinosinusitis (CRS) and nasal polyposis. Although the majority of research on FESS studied quality of life improvement regarding symptoms of the disease, indications and extent of the surgical field, as well as description of surgical techniques modifications. Limited studies included surgical field conditions related to intra-operative proper analgesia and control of postoperative pain (POP). Inadequate Pain control can delay recovery, necessitate rehospitalization, thus increasing healthcare costs, reduce patient satisfaction, and above all, increasing the risk for pulmonary and cardiovascular complications. Although there is a consensus that there is undersupply of adequate pain management after surgery, there are no guidelines for POP management after FESS. [1–4]

Non-steroidal anti-inflammatory drugs (NSAID) have been proved to reduce the severity of POP in the first 24 hours after FESS; however, these agents are associated with several adverse effects including gastrointestinal, neurological, and

hematological side effects that may cause postoperative bleeding. Systemic opioid and nonopioid analgesics are commonly used to control pain intraoperatively during FESS, though their adverse side effects include nausea, vomiting, urinary retention, sedation, paralytic ileus, and respiratory centre depression are encountered with their systemic use. [5]

Regional anesthetic techniques can decrease postoperative noxious stimuli and therefore reduce the use of systemic analgesia. [6] Moreover, Adequate intraoperative surgical conditions control can be obtained without delaying recovery. The sphenopalatine ganglion (SPG) provides the main sensory innervations to the mucosa of the nasal cavity and sinuses. [7]

This study was designed to compare the efficacy of direct endoscopic SPGB using 2% lidocaine with epinephrine to trans-oral greater palatine foramen injection at the start of endoscopic sinus surgery (FESS) in controlling surgical field conditions intraoperatively, POP, the need for analgesia and incidence of postoperative complications after FESS.

Patients and Methods

The study has been done in Cleopatra hospital between January 2019 and June 2019. A written informed consent was obtained from all consecutive adult patients who are according to American Society of Anesthesiologists (ASA) physical status I or II, undergoing general anesthesia for elective bilateral FESS.

Patients under 16 years of age and those having a history of severe renal, hepatic, respiratory, cardiac disease or a neurological condition, drug or alcohol abuse, chronic pain requiring major analgesics, sedatives, or corticosteroids and known hypersensitivity to other drugs used in the study were excluded. Patients who met the inclusion criteria had 1 mL 2% lidocaine with 1:100,000 epinephrine injection in the greater palatine foramen through trans-oral approach in one side (Group 1) and same volume and preparation in the SPG region on the other side (Group 2) at the start of FESS surgery. A piece of gauze soaked with lidocaine and adrenaline was passed along the middle turbinate and kept for 10 minutes.

Preoperatively patients were instructed for the use of Visual Analog Scale (VAS) for pain (0 = no pain, 10 = most severe pain). Patients and investigators who collected the data were blinded to the performed technique as the investigator of both techniques is not the surgeon operating the FESS procedure.

No preoperative medications were given. When the patient arrived to the operating room, baseline hemodynamic data were recorded after placement of routine monitors. Anesthesia was induced by intravenously administering 2.0 to 2.5 mg/kg propofol 1% and 2 µg/kg fentanyl. Endotracheal intubation with an oral endotracheal tube under muscle relaxation with 0.6 mg kg⁻¹ rocuronium was done.

Anesthesia was maintained with sevoflurane (1–2%) in 50% air with oxygen. Ventilation was controlled mechanically and adjusted to keep an end-tidal concentration of CO₂ between 33 and 36 mm Hg.

After induction of anesthesia, SPG injection was performed by injecting 1 mL 2% lidocaine with 1:100,000 epinephrine in the greater palatine foramen through trans-oral approach on one side (Group 1). On the other side, under direct endoscopic view (Group 2), the flanges of 18 G intravenous cannula were cut and the cannula was passed through the nasal cavity into the mucosa just posterior and over the middle turbinate tail. After negative aspiration, 1 mL of the preprepared solution was injected on one side. After that, a piece of gauze soaked with lidocaine and adrenaline is passed along the middle turbinate and kept in place for 10 minutes.

In both group, patients were put into 15 degrees head-up position. All surgeries were performed by one of the authors while assessment was done other authors who were blinded to the randomization process. The hemodynamic control was maintained by adjusting sevoflurane concentrations. Hypotension (a 20% decrease in relation to the baseline value) was obtained.

Bilateral middle meatal antrostomy and total sphenoidectomy were performed in all patients. Frontal sinus was not opened in all patients. Surgeons evaluated the quality of the surgical field in relation to bleeding. Suction pipe was washed with 100 ml saline at the end of the surgery. Total amount of bleeding on the suction pipe saline was recorded excluding added.

Quality of intraoperative surgical field during FESS

0–1 No bleeding; excellent to outstanding surgical conditions.
 2–3 Slight bleeding; surgery fairly easy. No stops for hemostasis and/or suctioning are required.
 4–5 Slight bleeding; surgery mildly difficult. One stop for hemostasis and/or suctioning is required.
 6–7 Moderate bleeding; surgery moderately difficult. Occasional stops for hemostasis and/or suctioning are required.
 8–9 Moderate to severe bleeding; surgery very difficult. Multiple stops for hemostasis and/or suctioning are required.
 10 Surgery terminated due to severe bleeding in the surgical field.

If neuromuscular activity was observed as inadequate, residual neuromuscular blockage was reversed with 0.04 mg/kg neostigmine and 0.02 mg/kg atropine was administered at the end of the surgery and patients were extubated. All patients stayed in hospital overnight. Visual Analog Scale (VAS) was used for the evaluation of postoperative pain Nausea was assessed by a verbal descriptive scale as 0: no nausea, 1: mild nausea, 2: moderate nausea, 3: severe nausea and vomiting. The scale rates were noted. One gram paracetamol IV infusion administered to patients whose pain scores was VAS 3 and above, ondansetron IV 4 mg administered for severe nausea and vomiting.

The hemodynamic differences among groups, amount of operative bleeding, and postoperative complications such as nausea and vomiting, headache, visual disturbances, sore throat and swallowing difficulty during the first 24 h were recorded.

Postoperatively, patients were observed in the post anesthesia care unit (PACU). During the observation period, arterial blood pressure, heart rate, and respiratory rate were continuously monitored. Patients meeting PACU discharge criteria were transferred to the surgical ward. Vital signs were reported every 4 hours except when the patients were asleep. All patients were prescribed 1 g oral acetaminophen every 6 hours. Tramadol was used as rescue analgesia. POP was assessed with a 10-cm visual analogue scale (VAS) (0 = no pain, 10 = most severe pain) in the PACU, at 6 and 24 hours after surgery. Pain severity was divided into 3 groups: mild, score of <4; moderate, score of 4 to 6; and severe, >6.

Sample size calculation was performed to avoid type II error. Twenty-eight patients in each group were required to provide more than 80% power to demonstrate reduction of 1 point on VAS, when the level of statistical significance was set to 5%. Parametric data were analyzed using the unpaired t test. Nonparametric data were analyzed using the Mann-Whitney U test. Categorical data were analyzed by the chi square test or the Fisher's exact test, as appropriate. A p value of <0.05 was considered significant.

Results

Thirty patients completed the study. The mean age (in years) was 37±12, and regarding gender we had 11 females and 15 Males. Mean weight (kg) was 77±15. Height (cm) was 171±11. Duration of anesthesia (minutes) was 107±25 and Duration of surgery (minutes) was 88±24.

There was no significant difference in the pre-injection and post-injection average mean arterial pressure as well as heart rate in both groups. There were statistically significant differences in blood pressure measurement and heart rate between the 2 groups over the operative time (2 minutes intervals). None of the patients had severe pain. Twelve patients required analgesic rescues. The average dose of tramadol was 27.5mg. No intra operative complications were

observed in either group.

Pain score in PACU were 3.4 ± 2.3 , 6 hours postoperative 3

± 1.7 , 24 hours postoperation 1.6 ± 1.4 . Amount of bleeding during surgery (ml) were 220 (100–400) in G1 and 175 (100–322) in G2, P value 0.594.

Table 1. Systemic hemodynamic parameters.

	Group 1	Group 2
Heart rate Pre injection (bpm)	81.5 ± 10.5	86 ± 13.8
Heart rate Post injection (bpm)	81 ± 10.6	86.3 ± 14.4
Mean Arterial Blood pressure Pre injection (mmHg)	76.5 ± 11.9	76.6 ± 13.3
Mean Arterial Blood pressure Post injection (mmHg)	77 ± 13	76.4 ± 14.2

aValues are mean \pm SD. SD=standard deviation.

Surgical field assessed during surgery had a higher mean score of 5.75 ± 0.37 for group 1 than 5.14 ± 0.36 assessed by the blinded investigator when comparing it in group 2, however the difference was statically insignificant with a p value of 0.196

The mean Lund Mackay scores was 21 ranging from 16 to 24. There was no significant difference between both groups where group 1 scored 10.5 ± 4 while group 2 scored 11 ± 3.2 with p value 0.7.

FESS was done in both sides to treat CRS. All patients underwent middle meatal antrostomy and anterior ethmoidectomy in both sides. Regarding the need for frontal sinusotomy, 14 patients in group 1 and 17 in group 2 underwent frontal sinusotomy which is not a statistically significant difference (p value=0.7). Posterior ethmoidectomy was needed in 13 patients in group 1 and 12 patients in group 2 while sphenoidotomy done in 6 patients in group 1 and 9 patients in group 2 which are also not a statistically significant difference (p value=0.8 and 0.4 respectively).

Discussion

In this study, we examined two different techniques for regional analgesia during FESS for controlled hypotension aiming at suitable operative field and we found lower MAP values, less amounts of surgical bleeding and better surgical field conditions in Group 2. However, recovery time after extubation was not abnormally prolonged.

Multiple investigators have tried to address the postoperative pain that occurs after functional endoscopic sinus surgery (FESS). Their study designs have been either retrospective or prospective surveys or purely observational. [8,10–12] Although FESS is now one of the most common head and neck surgical procedures, the incidence and severity of postoperative pain in patients undergoing FESS have not been comprehensively evaluated in randomized, controlled prospective studies. Preemptive analgesia is based on the idea that systemic or regional analgesic regimens initiated before the onset of surgery can prevent both peripheral and central sensitization, thereby attenuating the postoperative amplification of pain sensation. [9,13–16]

The sphenopalatine ganglion block (SPGB) with local anesthetic is used to treat facial pain and headache of various etiologies, and it has been widely used during FESS. [11,17–20] Some investigators studied the preemptive analgesic effect of different nerve blocks on the intensity of pain after FESS, which provided encouraging results. [21,22] The purpose of this study was to investigate

whether preemptive SPGB may decrease postoperative pain and discomfort and improve patient functional outcomes after FESS. We hypothesize that performing SPGB prior to the beginning of FESS will effectively block or significantly diminish postoperative amplification of pain sensation. Again, the intensive nerve supply of the nose makes regional block very demanding technique.

Clearly, different described techniques need clinical validation. This study compared two different techniques in terms of not only post-operative pain but also surgical field conditions.

However, different anesthetic medications have been implied in controlled hypotension, most of these techniques either delay patient recovery or improperly control surgical field.

There are some studies that report remifentanyl and inhalation anesthetics together were found to be effective in achieving controlled hypotension and optimal surgical conditions during FESS, tympanoplasty and septoplasty operations. [12,13,15]

Today it is also used for the purpose of anesthesia and analgesic-sparing effects or controlled hypotension in general anesthesia. [19–20] Ayoglu et al. [23] compared dexmedetomidine and saline infusion and found low amount of bleeding, the surgical field condition score and intraoperative consumption of fentanyl during septoplasty operations but the main limitation is the absence of evaluation of recovery and scores of postoperative sedation. In another study, during septoplasty and tympanoplasty operations 0.5 μ g/kg/h infusion of dexmedetomidine and placebo were compared, bleeding score; isoflurane and fentanyl consumption, intraoperative and post-extubation MAP and HR were demonstrated lower index made to midline group, and time to response to verbal stimulus, recovery time were statistically longer in dexmedetomidine group [24].

This study comes with a proper technique that provide proper surgical field with direct endoscopic sphenopalatine blockade.

Conclusions

In summary; we compared transoral greater palatine foramen local anesthetic injection to direct endoscopic sphenopalatine submucosal injection during FESS and we found that control of hypotension, the amount of bleeding, and the quality of surgical field were more attained in G2. We concluded direct endoscopic injection provides better surgical field conditions in FESS in terms of controlled hypotension and amount of bleeding in the surgical field.

Conflict of interest

All authors declared no conflicts of interest. There was not any financial support.

Informed consent

Informed consent was obtained from all individual participants included in the study.

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