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Evaluation of Pain Management in Patients undergoing Septoplasty

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Introduction

Septoplasty is one of the most frequently performed operations by Ear, Nose, and Throat (ENT) Surgeons internationally.

Septoplasty involves correcting a deviated nasal septum to improve airflow bilaterally, and indications for septoplasty include deviated septum causing nasal obstruction, allergic rhinitis, recurrent sinusitis, and epistaxis. **[4]** Interestingly, the degree of septal deviation does not correlate with the degree of nasal obstruction symptoms experienced by the patient. This may suggest that additional factors may also be involved in patient symptomatology which could provide avenues of treatment and management adjuvant to septoplasty. **[1]**

Innervations of the nasal septum are supplied by the Trigeminal nerve (CN V), specifically the nasopalatine nerve (V2), as well as by branches of the nasociliary nerve stemming from the ophthalmic nerve (V1) and the olfactory nerve (CN I). **[1]** Autonomic activity also plays a role, with vasoconstriction and increased nasal airway patency resulting from stimulation of the sympathetic nervous system. Sympathetic nerve fibers arise from T1-T3, synapse at the superior cervical ganglia, and then course through the internal carotidplexus and finally join the deep petrosal nerve and the nerve of the pterygoid canal. The sphenopalatine ganglion in the pterygopalatine canal also contains sympathetic fibers to the nose and paranasal sinuses. **[18]**

The arterial supply of the septum arises from the internal and external carotid arteries, creating an "... extensive plexus along the septum bilaterally." During episodes of epistaxis, usually a region known as Kiesselbach's plexus is involved. **[1]**

Lymphatic drainage of the nasal septum mucosa flows through a capillary network from the mucosa into the lateral pharyngeal and retropharyngeal lymph nodes. **[14]** Lymphatic function of the nasal septum also affects the "nose-brain interface" where cerebrospinal fluid (CSF) may drain via the olfactory nerve through the cribriform plate into the nasal mucosa's lymphatic circulation, as occurs in other species. Reduced CSF drainage through the olfactory route has been hypothesized to be related to the genesis of Alzheimer's disease, normal pressure hydrocephalus, and other conditions. **[15]** Of note, a rare complication of septoplasty involved potential central nervous system effects, including meningitis and pneumocephalus. **[20]** There is a wide range of analgesic agents used to control post- septoplasty pain [e.g., Non-steroidal Anti-inflammatory drugs (NSAIDS), opioids, intravenous paracetamol, dexmedetomidine, ketorolac, etc.]. **[5,6,7]**

Post-surgical pain following a septoplasty is expected to be mild and limited to the first few days after surgery. Chronic pain following the procedure is rare; however, facial pain can be debilitating, and successful pain management can have a substantial effect on the patient's quality of life. Post-surgical pain and/or tenderness occurs on the front of the nose due to stiffness and swelling.

This is associated with moderate post-operative pain. **[1,2]** Additionally, nasal packing used in surgery to reduce post-operative bleeding is associated with pain on removal and increased analgesic requirements. **[52]** Pain and shivering are two of the most common complications after surgery under general anesthesia. Effective post-operative pain management is an essential component to enhance recovery after surgery. **[3]**

The primary post-surgical complications of septoplasty are incomplete septum correction with persisting symptoms, septal perforation, and external nasal deformity. **[1]** Generally speaking, post-operative complications could be described as continued patient symptoms or impaired healing. Ideally, treating the etiologies of patient symptoms that do not involve septal deviation, as well as supporting patient healing, should be the focus of care perioperatively to prevent complications. Furthermore, post-operative pain may respond to interventions that take place prior to, during, and after the operation, which will be discussed in this article.

Preoperative Strategies:

1.1 : Anxiety Reduction:

Several articles were found relating anxiety to operative pain. A study performed on sixty patients evaluated preoperative anxiety and its relationship to post-operative pain in patients undergoing septoplasty, which resulted in a significant relationship between the two. Thus, minimizing preoperative anxiety could affect the post-operative pain response. **[3]** In another study, 98 patients were evaluated to find out if arelationship existed between anxiety, pain level, and time of day that the operation took place. It concluded that septoplasties performed inlate afternoon hours had increased effects on short-term anxiety and post-operative pain, while there was no effect on long-term anxiety.

[21] One study evaluated the surgical procedure called Enhanced Recovery after Surgery (ERAS) for septoplasties. The system sought to minimize stress perioperatively and concluded that the patients in the ERAS group had reduced preoperative anxiety and post-operative pain in the 3 days post-surgery. **[22]** These studies all displayed that anxiety influences experienced post-operative pain and that, when addressed, there is a noticeable reduction in perceived pain.

1.2 : Opioids:

Two studies relating opioids to septoplasties were evaluated. In a study of 80 patients, 40 were randomly selected to receive a single preoperative dose of inhaled morphine (opioid). The researchers found that the time to first post-operative analgesia was significantly longer than compared to the control group. **[23]** In a study of 120 participants, 40 were selected to receive an injection of pentazocine (opioid) prior to the operation. It was found to provide preemptive analgesia without serious adverse effects; however, it did not provide different effects than that of parecoxib (NSAID). **[24]** Both studies were able to show that the use of opioids provides preemptive analgesia; however, the second study displayed how non-opioid analgesics were equally effective in septoplasties.

1.3 : Non-opioid Analgesics:

Several studies set out to determine if non-opioid analgesics, such as NSAIDS, gabapentinoids, local anesthetics, and combinations of analgesics, were effective in post-operative pain management. **[25,26,11,13,27,28,8,30,31]**

One study evaluated the preoperative administration of ketorolac (NSAID) for a decrease in post-operative pain. The article hypothesized that reducing the levels of prostaglandin production (a result of NSAIDs) would result in less post-operative pain. The results were statistically significant, and a correlation was made between prophylactic NSAID administration and decreased post-operative pain. **[25]** These results are comparable with another study in which parecoxib was administered prior to septoplasty and resulted in decreased post-operative pain. Furthermore, the use of parecoxib after surgery resulted in sufficient perioperative analgesia. **[26]**

In four separate studies evaluating the use of gabapentinoids (gabapentin and pregabalin), three used pregabalin solely, while the fourth used both. Administration prior to septoplasty resulted in reduced post-operative pain as well as decreased utilization of other analgesics. **[11,13,27,28]** A study conducted using pregabalin with dexamethasone resulted in a similar conclusion that pregabalin reduced post-operative pain when given preoperatively; however, the study group that included both pregabalin and dexamethasone together did not have increased benefits and was associated side effects. **[8]** Another study evaluated the post-operative analgesic effects of gabapentin with dexamethasone, which concluded similarly. Specifically, gabapentin or dexamethasone alone or gabapentin plus dexamethasone reduced post-operative pain and decreased additional analgesic therapy; however, dexamethasone by itself only yielded significant results in the first 4 hours post-surgery. **[29]**

One article utilized combined medication classes and found that subjects who received both an NSAID and gabapentinoid preoperatively had lower pain scores during recovery, as well as fewer opioid medications and less time in the hospital. **[30]** Only onestudy evaluated the use of the local anesthetic, tetracaine. Utilizing drops 15 minutes prior to the surgery, this study found that tetracainedecreased post-operative pain when compared to a placebo. **[31]** Theresults of non-opioid analgesic studies provided sufficient evidence that NSAIDs, gabapentinoids, or local anesthetics can decrease post-operative pain and analgesic requirements.

Intraoperative Strategies:

1.4 : Anesthetics:

The type of anesthetics and anesthesia for septoplasties contains a wide variety of choices. Post-operative pain can be altered depending on whether local, general, and continuous monitoring anesthesia was used, as well as what pain medications are utilized intraoperatively. There was one study on continuous monitoring anesthesia with dexmedetomidine or midazolam as the sedation drug. When either drug was used in combination with tramadol, it provided adequate analgesia in adult patients. Furthermore, the dexmedetomidine group required less rescue tramadol after surgery. **[32]** Another study focused on dexmedetomidine as the drug of choice for sedation in general anesthesia. It was found that, in comparison to propofol, dexmedetomidine provided a lower intra- and post-operative analgesic requirement. **[33]** Finally, in a study looking at local anesthesia with dexmedetomidine for sedation, there was less post-operative pain and a faster recovery time in comparison to a general anesthesia group. **[5]**

A study looked at the outcome of adding acetaminophen perioperatively in conjunction with general anesthesia. The study displayed that adding acetaminophen intra- and postoperatively decreased post-operative pain scores and the need for additional analgesics. **[34]** In another study of general anesthesia with an additional anesthetic, bupivacaine was used as a local anesthetic for

the sphenopalatine ganglion. The results showed that the addition of a ganglion block effectively reduced post-operative pain. **[35]**

Three studies evaluated the use of local anesthetics in septoplasty. In a study examining tetracaine versus cocaine, it was found that the tetracaine group reported significantly less pain postoperatively than the cocaine group. **[36]** In another study evaluating lidocaine versus articaine, the use of articaine as a local anesthetic resulted in less post-operative pain and fewer complications. **[37]** Finally, levobupivacaine was also found to have lower post-operative pain scores than lidocaine in a study with 112 patients who received septoplasties. **[56]**

Several studies explored the use of nasal packing soaked in anesthetics for post-operative analgesia. The first study, with 41 patients undergoing septoplasty, compared nasal packs soaked with levobupivacaine hydrochloride to nasal packs soaked in saline. The results showed that the levobupivacaine group had significantly lower post-operative pain. **[47]** Additionally, a study showed that bupivacaine provided better analgesia than lidocaine in the first 8 hours, as well as no changes in patient bleeding. **[2]** Another study evaluated nasal packs soaked in lidocaine with adrenaline, tetracaine, or articaine with adrenaline. It concluded that articaine with adrenaline had less post-operative pain and bleeding than the other groups. **[54]** Two studies evaluated opioid-infused nasal packs on post-operative pain. The first study found that fentanyl-infused packs resulted in decreased pain and no adverse effects. **[52]** The second study found that tramadol-infused packs resulted in less pain and decreased hospital stays. **[53]** If the bleeding risk infers the use of nasal packing, these studies show that infusion with levobupivacaine, bupivacaine, fentanyl, or tramadol reduces pain levels.

With the extensive options available regarding anesthetics, decisions for care should be made on a case-by-case basis to optimize patient comfort; however, it should be noted that utilizing local anesthesia was effective during septoplasty and thus mitigates side effects from general anesthesia. **[36,37]** However, if general anesthesia is to be used, adding an additional anesthetic can reduce post-operative pain.

1.5: Surgery Methods:

The surgical approach to septoplasty, whether open, endonasal (closed), conventional or endoscopic, is chosen by the surgeon based on the clinical case. In an evaluation of open versus endonasal approaches, there was no difference in post-operative pain. **[38]** However, in another study with 276 patients who underwent either endoscopic or conventional septoplasty, the endoscopic group reported significantly less pain. **[69]**

1.6 : Packing, Splints, and Sutures:

During the final steps of septoplasties, surgeons decide how to control bleeding risk and minimize damage to the surgical site by either utilizing nasal packing, splints, additional sutures, or nothing. Nasal packing is associated with discomfort, pain on removal, and increased analgesic requirements. **[52]**

Two studies looked to evaluate if inserted splints rather than packing led to decreased post-operative pain. One study found no significant difference between splints and packing on pain levels or analgesic requirements. **[61]** However, in a different study those with, splints were noted to have lower pain scores, nasal bleeding, and experienceddiscomfort. **[62]**

Evaluation of septal suturing versus nasal packing was done byseveral research teams, although methods varied in the suture type. Two articles concluded that trans-septal suturing reduced post- operative pain when compared to nasal packing. **[63,64]** Similarly, two articles reached the same conclusion but with the nasal septum suture. **[65,66]** Lastly, one article resulted in the same conclusion butwith quilting sutures and noted that packing should only be reserved for patients with high bleeding risk. **[67]**

In a study comparing nasal packing, nasal splinting, and no packing, it was found that patients without nasal packing or splinting had less post-operative pain, especially in the first days following the procedure. **[68]** In a study evaluating nasal packing vs. no packing, the group without nasal packing had significantly less pain,headaches, dysphagia, and sleep disturbances. **[32]** Both studies concluded that nasal packing after septoplasty was unnecessary and only caused more pain. **[68,32]**

1.7 : Intravenous Steroids:

One study looked at post-septoplasty pain in 90 patients who either received intravenous dexamethasone or a placebo at induction of anesthesia. The mean pain score of the dexamethasone group was 7.4 out of 100 compared to 10.3 out of 100 in the placebo group. **[59]** However, in another study, preoperative gabapentin was compared to preoperative gabapentin + intraoperative dexamethasone. The dexamethasone group was found to have an equally effective but less prolonged analgesic effect. **[29]** Overall, dexamethasone was not shown to be more effective than other intraoperative strategies for analgesia.

1.8 : Non-Traditional Methods:

Platelet-rich fibrin (PRF) has been studied as a non-traditional method to reduce post-septoplasty pain. In a study with 74 patients, the PRF group had their blood centrifuged to obtain the PRF for application at the end of the septoplasty. This group had lower pain scores in the 1st and 3rd week compared to the group without PRF application; therefore, it could be a useful method for post-operative analgesia. **[60]**

Another non-traditional method for analgesia includes electro-acupuncture (EA). A double-blind study of 90 patients measured the pain scores after elective septoplasty. The control group received morphine, while the other group received acupuncture beginning 5 minutes prior to surgery. This consisted of needles inserted in acupuncture points Li4 (Hegu), Li11 (Quchi), Ht7 (Shenmen), and HC6 (Neiguan), which were then connected to an EA system outputting dense-disperse frequency (f1:10 and f2:80) and an

intensity of 4 mA. Both groups had similar pain levels 6 hours post operation. **[57]** This study shows that EA has the potential to be an alternative to morphine.

Post-operative Strategies:

1.9 : PO Opioids:

As opioids are a common strategy for post-operative analgesia, four studies evaluated the use of various types of oral opioid analgesics after septoplasty or similar nasal surgeries. These articles found that opioids successfully controlled post-operative analgesia; however, it was of note that the articles concluded patients had been prescribed significantly more pills than necessary for pain management. **[40,41,42,43]** Specifically, a study of 64 patients who underwent endoscopic sinus surgery (ESS) only needed an average of 7.72 ± 7.6 opioid tablets when originally prescribed 30. Additionally, 93.1 % of patients in this study felt that they were prescribed too many narcotics. **[42]** In the second study with 14 patients who underwent septoplasty, only 4.1 ± 4.0 opioid pills were consumed on average, with the study concluding that as little as 11 doses would be sufficient for post-operative analgesia. **[40]** A third study had 134 patients who underwent a variety of ambulatory surgeries, including septoplasty, rhinoplasty, and ESS. In this study, patients have prescribed a median of 20 opioid pills and had a median of 17 pills left over, concluding that 90 % of patients required fewer than 15 doses. **[41]** Lastly, 364 patients underwent sinonasal surgery in a study that resulted in a mean of 25.3 tablets prescribed and 11.8 used out of the 32 % who responded to the survey. **[43]** Although opioids have been shown to control pain levels post-septoplasty, they are generally overprescribed and may be unnecessary given the levels of pain typically associated with septoplasties.

2.0 : Nonopioid Analgesics:

Four studies have compared NSAIDS to opioids as a form of post-operative analgesia. One study containing 74 patients undergoing ESS with or without septoplasty compared the efficacy of an NSAID, diclofenac sodium, to an opioid, hydrocodone/acetaminophen (APAP). Diclofenac sodium was found to be non-inferior to the opioid, indicating that it could act as an alternative. **[45]** The second study compared ibuprofen to hydrocodone/acetaminophen using 185 patients undergoing otolaryngology surgeries, including septoplasty. Patients were prescribed both medications, but one group used the opioid as their primary medication, while the other used mainly ibuprofen. The group that used ibuprofen as their primary medication recorded similar pain scores and lower use of their secondary analgesic, with a mean of 2 pills, compared to 4.5 in the opioid group. **[48]** IV ketorolac (IVKT) is another NSAID that has been studied as a non-opioid analgesic post-septoplasty. 34 patients were given IVKT or IV fentanyl (IVF) after ESS and septoplasty, resulting in no significant difference in pain scores or need for supplemental analgesia, making IVKT a useful alternative. **[49]** Lastly, 180 patients undergoing sinonasal surgery were instructed to take either oxycodone-acetaminophen, oxycodone-acetaminophen with budesonide nasal rinses, or meloxicam with acetaminophen. The meloxicam with acetaminophen had the lowest odds of calling the clinic for uncontrolled pain (0.18) with oxycodone-acetaminophen and budesonide rinses coming a close second (0.19). **[51]** These studies indicate that NSAIDS are comparable to opioids for reducing pain due to septoplasty and can act as an alternative.

NSAIDS have also been compared to acetaminophen in two different studies. The next study with 150 patients undergoing septorhinoplasty compared the effect of IV ibuprofen to IV paracetamol (acetaminophen) and found that IV ibuprofen had the greatest effect on pain management in the first 12 hours after surgery. It is also worth noting that both non-opioid medications resulted in a decrease in opioid consumption post-surgery. **[46]** Similarly, a study with 72 patients compared IV dexketoprofen trometamol to IV paracetamol and found that the IV dexketoprofen trometamol group had lower pain scores in the early post-operative period, as well as similar pain scores thereafter. **[50]** In both studies, NSAIDS are shown to have a greater reduction of post-operative pain compared to acetaminophen. Furthermore, in a double-blind study of 200 subjects undergoing septoplasty, lornoxicam was found to have the same efficacy in post-operative pain as other non-opioid analgesics, including diclofenac, ketoprofen, and dipyrone, while all significantly reduced pain levels compared to the placebo group. **[44]** All of these NSAIDS may be used for the successful management of post-operative analgesia.

2.1 : Non-traditional Methods:

Studies have also been conducted on non-traditional methods such as photobiomodulation therapy (PBMT) and decongestant nasal sprays. **[58,71]** A group of 62 patients underwent septoplasty and either received PBMT at 3, 6 and 24 hours by infrared pulsed laser radiation for 2 min at $\lambda = 0.890$ μm and P = 10 W or did not receive PBMT. Those who received PBMT had lower pain levels from 6 to 24 hours post operation. **[58]** A decongestant, xylometazoline hydrochloride 0.1%, however, was found to cause significantly more pain post-septoplasty compared to sterile physiological saline aerosol. **[71]** Out of the non-traditional methods for post-operative strategies, PBMT can be an option for pain management post-septoplasty

2.2 : Osteopathic Manipulative Medicine:

Osteopathic manipulative treatment (OMT) refers to a set of manual procedures used to treat pain and dysfunction. Overall, the goal of OMT in the craniofacial field is to promote the arterial, venous, and lymphatic flow of affected tissues. **[17]**

Several smaller studies have been performed to evaluate the effect of OMT on sinus function and pain, which likely would assist in nasal septal healing. In a study by Lee-Wong, et al., nasal passages were “milked” by manually placing the physician’s thumbs in a crossed manner over the bridge of the nose, with pressure applied alternately by each thumb, moving down the length of the nose repeatedly.

Of the 15 subjects, nine reported an immediate and significant improvement in symptoms. **[16]** Another small follow-up study (n=22) utilizing a more extensive OMT protocol on facial, cervical, thoracic, and upper extremity structures also reported significant symptom improvement postulated to result from the improved vascular, lymphatic, and neurologic function. **[19]**

Conclusion

There has been extensive research done on preoperative, intraoperative, and post-operative strategies to reduce pain post-septoplasty; however, there has not been much of a consensus about which methods are the gold standard. This review aims to point out which methods can be relied on and which have the potential for use if more studies are conducted.

Out of the preoperative strategies, anxiety reduction, NSAIDs, gabapentinoids, and local anesthetics have been shown to reduce post-operative pain. Placing surgeries earlier in the day can be the firststep to reducing septoplasty pain, as well as using the ERAS system. **[21,22]** More studies should be conducted to find other ways to successfully reduce preoperative anxiety since it has already been shown to reduce post-operative pain and may provide an alternative to medications. Parecoxib and ketorolac are NSAID options that can be given preoperatively to reduce pain levels post-septoplasty. **[25,26]** Opioids reduce post-operative pain as well; however, preoperative parecoxib has been shown to have an equal effect, so they may not be necessary. **[24]** Pregabalin and gabapentin have bothbeen shown to provide adequate analgesia compared to a steroid, dexamethasone, but it may be useful to conduct more studies comparing them to NSAIDs to see which strategy provides the best pain relief. **[11,13,27,28,8,29]** Lastly, a local anesthetic, tetracaine, reduces post-operative pain when given preoperatively, but has yet tobe compared to NSAIDs or gabapentinoids. **[31]** Therefore, preoperative NSAIDs, gabapentinoids, and anxiety reduction should be the first line to prevent pain post-septoplasty.

Intraoperatively, when looking at anesthesia options, dexmedetomidine is an effective drug for local and generalanesthesia; however, local anesthesia should be used, when possible,to decrease recovery time and post-operative pain. **[32,33,5]** If the provider determines that general anesthesia needs to be used, acetaminophen, bupivacaine sphenopalatine ganglion block, or alocal anesthetic such as articaine, tetracaine, or levobupivacaine, canbe added for better analgesia. **[34,35,36,37,56]** More studies should be conducted comparing these three options to provide a better understanding of which provides the best management of pain postoperatively. Local anesthetics can also be added to the nasal packs to reduce the pain that is caused by their insertion and removal,with the preferred option being levobupivacaine. **[47]** However, significant research shows that nasal packing is unnecessary and a large contributor to pain and discomfort after surgery, so it should be avoided altogether if possible. **[52]** Out of the alternatives, septal suturing is the most effective in reducing discomfort. **[63,64,65,66,67]** When deciding on other aspects of surgicalapproaches, endoscopic surgery should be the preferred method due to lower post-operative pain. **[69]** PRF and EA have both shown promising outcomes when used for post-operative pain management,warranting more research to be done to compare them to traditional methods. **[60,57]**

There has been significant research on post-operative non-opioid options in septoplasties. NSAIDs have had the most research conducted, with ibuprofen or meloxicam and acetaminophen being the most effective in having greater pain reduction than opioids. **[48,51]** Although not as effective, acetaminophen also reduces opioid consumption and can be used as an alternative if the patient is unable to receive NSAIDs. **[46]** PBMT has also been shown to reduce pain levels, but more studies should be done to observe its effect on a larger population as well as a comparison to NSAIDs. **[58]** OMT can be another alternative to medications, as it has been shown to reduce sinus pain and improve the lymphatic drainage of facial structures. **[16,17,19]** It would be valuable to conduct more studies on OMT, specifically after septoplasty, to observe its effects on pain and the healing process. Lastly, if opioids need to be given as a last resort, the number of pills prescribed should be reduced greatly to an average of 7-15 pills, depending on the patient. **[40,41,42,43]**

Clinicians can use a case-by-case basis for deciding which strategies to use based on relevant side effects and the needs of each patient. Pre, intra, and post-operative methods can be combined to provide themost comfort to patients experiencing pain after septoplasty.

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