Comparative Study for the Effect of Bupivacaine Vs Bupivacaine plus Dexmedetomidine as Analgesia in Nasal Surgeries.

Thesis presented for partial fulfillment of Master degree in anesthesiology

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Abstract

Local anesthetics are used to induce anesthesia and analgesia for surgical procedures and for pain management.

Complications of local anesthesia may range from localized reactions such as edema, urticaria and dermatitis to systemic absorption resulting in severe cardiovascular collapse and neurological toxicity.

Continuous monitoring of the patient is mandatory when using local anesthetics.

There are many guidelines for prevention and management of local anesthetic toxicity.

Dexmedetomidine is the most recent α 2-adrenoceptor agonist approved by FDA in 1999 for use in humans for analgesia and sedation.

Keywords

Bupivacaine, dexmedetomidine, septoplasty, nasal surgery

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List of abbreviations

ACLS: advanced cardiac life support

ACTH: adrenocorticotrophic hormone

ADH: antidiuretic hormone

ASA: American society of anesthesia

BLS: basic life support

BP: blood pressure

CNS: central nervous system

CVS: cardiovascular system

Dex: dexmedetomidine

ECG: electrocardiography

ETCO2: endtidal CO2

FDA: food and drug administration

GA: general anesthesia

ICB: infraclavicular brachial plexus block

IV: intravenous

LAST: local anaesthetic systemic toxicity

Lc: locus coeruleus

MAC: Minimum alveolar concentration

NE: norepinephrine

NTG: nitroglycerin

p value: probability value

PaCO2: Arterial carbon dioxide tension

pKa: dissociation constant

SD: standard deviation

SNS: Sympathetic nervous system

SpO2: oxygen saturation

α: Alpha

β: beta

δ : delta

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Introduction

Pain is particularly common after nasal surgery, especially when bone manipulation and periosteal irritation are involved. Appropriate pain control is an important consideration in the post-surgical management of patients. [1]

Multiple researches and clinical observations suggest that pain reduction can be achieved in nasal surgery through use of local anesthesia[2].The combination of local anesthetic infiltration, directly in the surgical field, with general anesthesia provides beneficial analgesic effect by blocking nociceptive pathways, and there by it reduces the need for systemic analgesics[3].

The use of α-2 Adrenergic receptor (adrenoceptor) agonists in anesthesia have been the focus of interest for their sedative, analgesic, and perioperative sympatholytic and cardiovascular stabilizing effects with reduced anesthetic requirements[4]. On the local effect of α-2 agonists, they inhibit substance P release in the nociceptive pathway at the level of the dorsal root neuron, in addition, α-2 adrenergic receptors located at nerve endings may have a role in the analgesic effect of the drug by preventing norepinephrine release. [5]

Dexmedetomidine, a potent α-2 adrenoceptor agonist, is approximately 8 times more selective toward the α-2 adrenoceptors than clonidine. Dexmedetomidine has been shown to decrease anesthetic requirements by up to 90% and to induce analgesia in rats, volunteers, and patients[6].

Numerous studies performed in different countries have demonstrated an advantage of topical administration, local injection, and nerve blockade with bupivacaine or lidocaine versus saline. Other studies have shown an advantage of bupivacaine over lidocaine with regard to pain control and duration of pain control.[7-9]

In this study, we investigated the combined effect of dexmedetomidine with bupivacaine as local anesthesia in nasal surgery (septoplasty) in order to determine the optimal procedure for pain control and reduction of analgesic use post surgery. Also to determine the optimal procedure for a bloodless field of surgery providing better visibility.

Aim of Work

This is prospective randomized study designed to assess the effect of local infiltration of bupivacaine vs bupivacaine plus dexmedetomidine as analgesia in nasal surgeries (septoplasty) in order to determine the optimal procedure for pain control and reduction of analgesic use post surgery. Also to determine the optimal procedure for a bloodless field of surgery providing better visibility.

Anatomy of the Nose

I. External Nose:

A) Parts:

The external projection of the nose approximates a pyramid. The superior attachment at the forehead is known as the root. The inferior angular portion is known as the tip. The dorsum nasi is the intervening ridge. The nares are the paired openings to the nasal cavity each bounded medially by the septum and laterally by the alae.(10)

B) Skeleton:

1. Bony components: the nasal part of the frontal bone, the nasal bones, and the portions of the maxillae bordering the piriform aperture provide a firm foundation for the cartilaginous components of the nose. (11)

2. Cartilaginous components:

a. *Lateral process of the septal cartilage:* triangular plate supporting the side of the nose; articulates superiorly with the nasal bone and fuses to the septal cartilage in the midline.(10)

b. *Alar cartilage:* U-shaped plate; composed of lateral crus that supports the ala and medial crus which forms the antero-inferior part of the nasal septum with its fellow of the opposite side.(10)

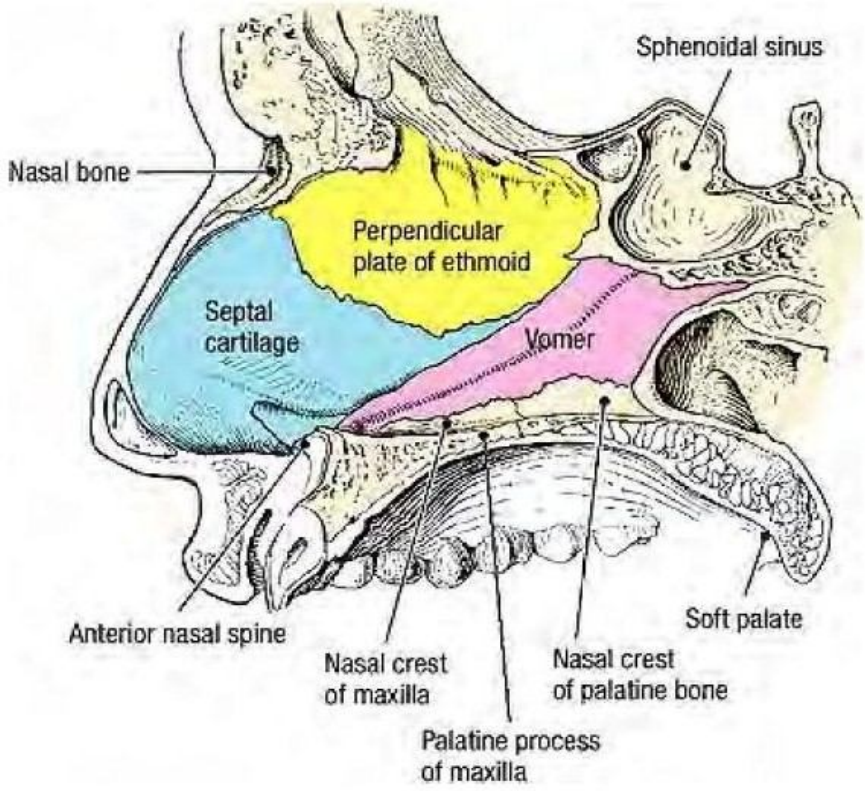

Fig-1: Medial wall of the nose.[12]

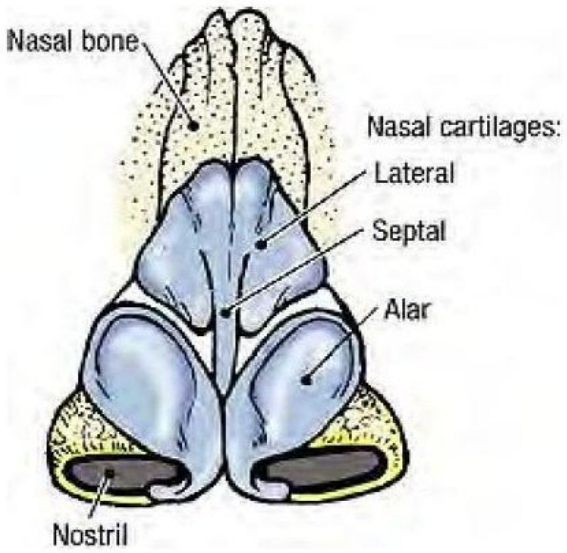

Fig-2: Cartilaginous components of the nose.[12]

II. Nasal Cavity:

A) Regions

1. **Vestibule:** dilated region adjacent to the nostril; lined with hairs.[10]
2. **Olfactory region:** narrow region inferior to the cribriform plate (between a superior nasal concha and the nasal septum); lined by a mucosa containing olfactory neurons. [10]
3. **Respiratory region:** comprises most of the nasal cavity; lined by a glandular, vascular mucosa. [10]

B) Walls

1. **Medial wall (Nasal septum)**

   The nasal septum is formed by both bone and cartilage. The perpendicular plate of the ethmoid bone forms much of the posterior and superior portions of the nasal septum. The anterior portion is formed by the septal cartilage. Inferiorly lies the bony plate of the vomer, which rests on the nasal crests of the maxilla and the palatine bones. Variation in the anatomy, or deviation of the septum, can be attributed to the presence of bony protuberances, or septal spurs arising from the bony structures. [13]

2. **Lateral wall** is much more complex in both its anatomy and its functions of respiration and drainage of the paranasal sinuses. It is the medial border of the paranasal sinuses and holds the projecting ridges of bone known as the conchae or turbinates which are *Superior, middle, and inferior nasal conchae* that are described as the following:

- Ridges of bones comprising most of the lateral nasal wall; covered by mucosa that cleanses, warms, and humidifies the air.
- The superior and middle nasal conchae are processes of the ethmoid bone; the inferior nasal concha is a separate bone of the skull.
- The spaces below the superior, middle, and inferior nasal conchae are the superior, middle, and inferior meatuses, respectively; the space above and behind the superior nasal concha is the sphenoethmoidal recess.
- The structure of most importance in the inferior meatus is the opening of the nasolacrimal duct.
- *Ethmoidal bulla* Large, rounded elevation lateral to the middle nasal concha. The semilunar hiatus is the curved slit anterior and inferior to the ethmoidal bulla; anteriorly, it leads into a dilated channel, the ethmoidal infundibulum.
- *Atrium of the middle meatus:* expanded region anterior to the middle meatus. (13)

3. **Roof:** composed of the cribriform plate anteriorly and body of the sphenoid posteriorly. (13)
4. **Floor:** formed by the hard palate. (13)

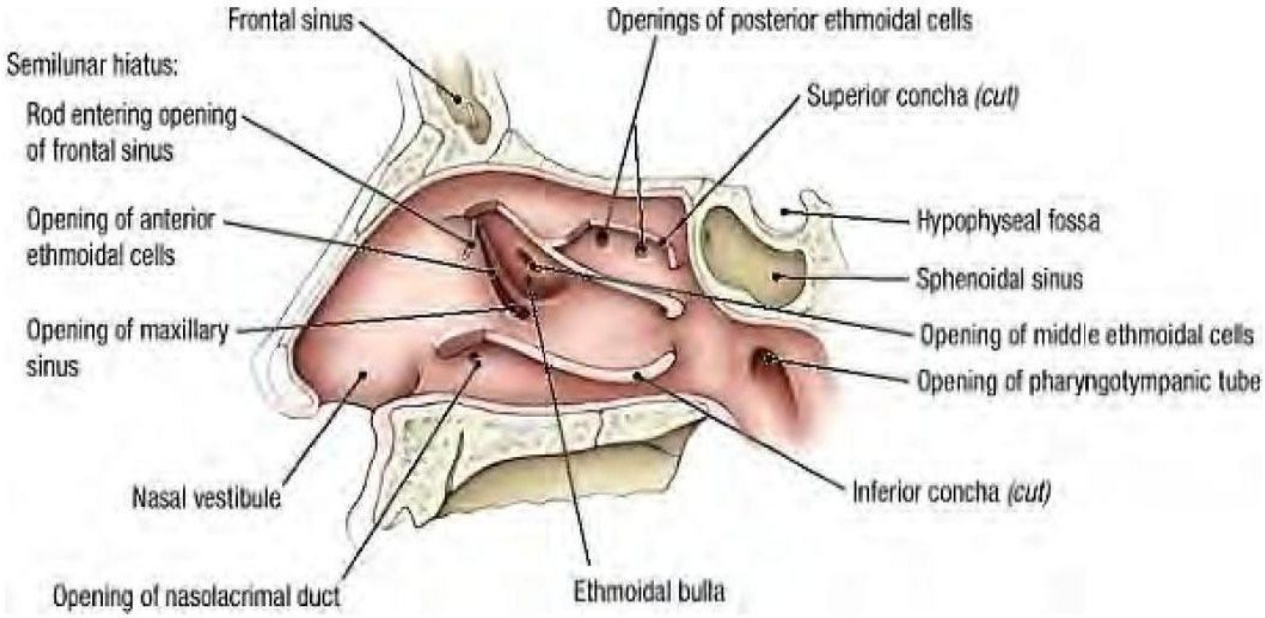

Fig-3: Lateral wall of the nose[12]

C) Nerves[10]

1. **Olfactory nerve:** supplies the specialized olfactory zone of the nose, which occupies an area of 2 cm^2 in the uppermost parts of the septum and lateral walls of the nasal cavity.
2. **Supratrochlear and infratrochlear nerves:** supplies the root, bridge, and upper portion of the side of the nose.
3. **Anterior ethmoidal nerve:** (a branch of the nasociliary branch of the ophthalmic nerve) enters the nasal cavity through the cribriform plate and divides into the internal and external nasal nerves; the internal nasal nerve provides sensory innervation to the anterosuperior parts of the lateral nasal wall and nasal septum, and the external nasal nerve exits the nasal cavity between the nasal bone and lateral process of the septal cartilage to supply the dorsum and tip of the nose.
4. **Maxillary nerve:**