Comparative Study of Bilateral Greater Palatine Nerve Block and Bilateral Suprazygomatic Maxillary Nerve Block for Perioperative Analgesia in Children Undergoing Palatoplasty

Thesis

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Abstract

IN this study The **SMN** block was done by a blind technique according to landmarks; this may explain the decreased efficacy compared to the **GPN** block. Safety and feasibility of the block can be increased by using a nerve stimulator, which could stimulate the temporal muscle. The pterygopalatine fossa is situated just behind the muscle; disappearance of the muscular response to direct stimulation with the block needle indicates its tip is in the infratemporal fossa. The pterygopalatine fossa could also be localized with ultrasound guidance. Moreover, the use of ultrasound imaging may be useful if the distance between skin and pterygomaxillary fossa were slightly modified by the presence of the cleft palate.

Keywords:- SMN – GPN- Suprazygomatic-AAG

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- **AAG**: α-1 acid glycoprotein.
- **ACTH:** Adrenocortico-trophic hormone.
- **ADH:** Anti-diuretic hormone.
- **ASA:** American Society of Anesthesiology.
- **ASICs:** Acid-Sensing Ion Channels.
- **BDNF:** Brain-Derived Neurotrophic Factor.
- **BT**: Bleeding Time.
- **CBC**: Complete blood count.
- **CNS**: Central Nervous System.
- **CVS:** Cardiovascular System.
- **COX-3**: Cyclo –Oxygenase 3.
- **CT**: Clotting Time.
- **CHEOPS:** The Children's Hospital of Eastern Ontario Pain Scale.
- **CP: C**left Palate.
- **CGRP:** Calcitonin Gene-Related Peptide.
- **EMLA:** Eutectic Mixture of Local Anesthetics.
- **FPS-R:** Faces Pain Scale-Revised.
- **FLACC**: Faces, Legs, Activity, Cry, Consolability**.**
- **GPN**: Greater palatine nerve.
- **GPF:** Greater palatine Foramen.
- **HR**: Heart Rate.
- **IF:** Incisive Foramen.
- **IASP:** International Association for the Study of Pain.
- **IL-1:** Interleukin-1
- **IL-6**: Interleukin-6
- **IL-8:** Interleukin-8
- **LTP:** Long-term potentiation.

- **LPN:** Lesser Palatine Nerve.
- **MAP**: Mean Arterial Blood Pressure.
- **MN:** Maxillary Nerve.
- **n:** Number.
- **NMDA:** N-methyl-D-aspartate.
- **NK1:** Neurokinin-1.
- **NRS:** Numeric rating scale.
- **NSAIDs**: Non-Steroidal Anti-Inflammatory Drugs.
- **NPN**: Nasopalatine Nerve.
- **OPS:** Objective Behavioral Pain Score.
- **PCA**: Patient Controlled Analgesia.
- **PAG:** Periaqueductal Grey.
- **PACU:** Post-Anesthesia Care Unit.
- **PT**: Prothrombin Time.
- **PC**: Prothrombin Concentration.
- **PTT**: Partial Thromboplastin Time.
- **RVM:** Rostroventromedial Medulla.
- **SMB:** Suprazygomatic Maxillary Nerve Block.
- **TRP:** Transient Receptor Potential.
- **VdSS**: steady-state volume of distribution.
- **VAS:** Visual analogue scale.
- **VRS:** Verbal categorical rating scores.

INTRODUCTION

Pediatric regional anesthesia continues to evolve. Education and attention to anatomical detail remain key elements to successful outcomes. New techniques, some adapted from adult practice, provide analgesia for pediatric surgical procedures such cleft palate or congenital hip dysplasia. [1, 2]

Congenital cleft palate (CP) occurs in children at a rate of about 1.5 per 10000 births, requiring early surgery, during the first months of life. The surgical procedure can be complicated by airway obstruction and respiratory complications. Administration of opioids, often needed for intra- and postoperative analgesia, increases the risk of airway obstruction and promotes ventilatory control dysfunction. CP is painful in the first 24–48 h following surgery. Morphine is usually used for postoperative analgesia, and as a consequence, a minimal 24-h stay in the recovery room or intensive care unit is often necessary. Recently there is an increasing awareness regarding the need for complete well being of the child in the postoperative period and not just a pain free state. [3, 4]

Sedation and other adverse events produced by opioids do not help in achieving such a goal. Local anesthesia with nerve blocks appears to be the answer in such circumstances. Moreover, regional and general anesthesia techniques are no longer considered as alternative but instead, as complementary. This is especially true in pediatrics where regional anesthesia is essentially performed under general anesthesia. The association of the two techniques has dramatically cut down the risks of both procedures. **Steven C. Hodges** and **Andrew M. Hodges**[5] while reviewing anesthesia for cleft surgeries stated that opioids are better avoided, and intraoperative and postoperative analgesia can be achieved by local infiltration with local anesthetics or by nerve block.

The Palate

The palate separates the nasal and buccal cavities and comprises:

1 the *hard palate*—which is vault-shaped and made up of the palatine plate of the maxilla and the horizontal plate of the palatine bone; it is bounded by the alveolar margin anteriorly and laterally, and merges posteriorly with:

2 the *soft palate*—hanging as a curtain between the naso- and oropharynx;

centrally it bears the *uvula* on its free posterior edge; laterally it blends into the anterior and posterior pillars of the fauces.

The hard palate is made up of bone, periosteum and a squamous mucosa in which are embedded tiny accessory salivary glands.

The framework of the soft palate is formed by the aponeurosis of the tensor palati muscle, which adheres to the posterior border of the hard palate. To this fibrous sheet are attached the palatine muscles covered by a mucous membrane, which is squamous on its buccal aspect and ciliated columnar on its nasopharyngeal surface.[6]

Nerve supply

The sensory supply of the palate is largely from the maxillary division of the trigeminal nerve (5^{th} cranial nerve).

Motor innervation to the palatine muscles is from vagus fibres (10^{th} cranial nerve) in the pharyngeal plexus. The tensor palati is the exception to this rule and is supplied by the mandibular division of the trigeminal.

In speaking, swallowing and blowing, the soft palate closes off the nasopharynx from the buccal cavity. If the palate is paralysed, as may occur in brain stem lesions or after diphtheria, the voice is impaired and fluids regurgitate through the nose on swallowing. [6]

The development of the face, lips and palate with special reference to their congenital deformities (Fig. 1)

Around the primitive mouth, or stomodaeum, develop the following:

1 The *frontonasal process* which projects down from the cranium. Two olfactory pits develop in it and rupture into the pharynx to form the nostrils.

Definitively, this process forms the nose, the nasal septum, nostril, the philtrum of the upper lip (the small midline depression) and the premaxilla —the V-shaped anterior portion of the upper jaw which usually bears the four incisor teeth. [7]

2 The *maxillary processes* on each side, which fuse with the frontonasal process and become the cheeks, upper lip (exclusive of the philtrum), upper jaw and palate (apart from the premaxilla).

3 The *mandibular processes* which meet in the midline to form the lower jaw.[8]

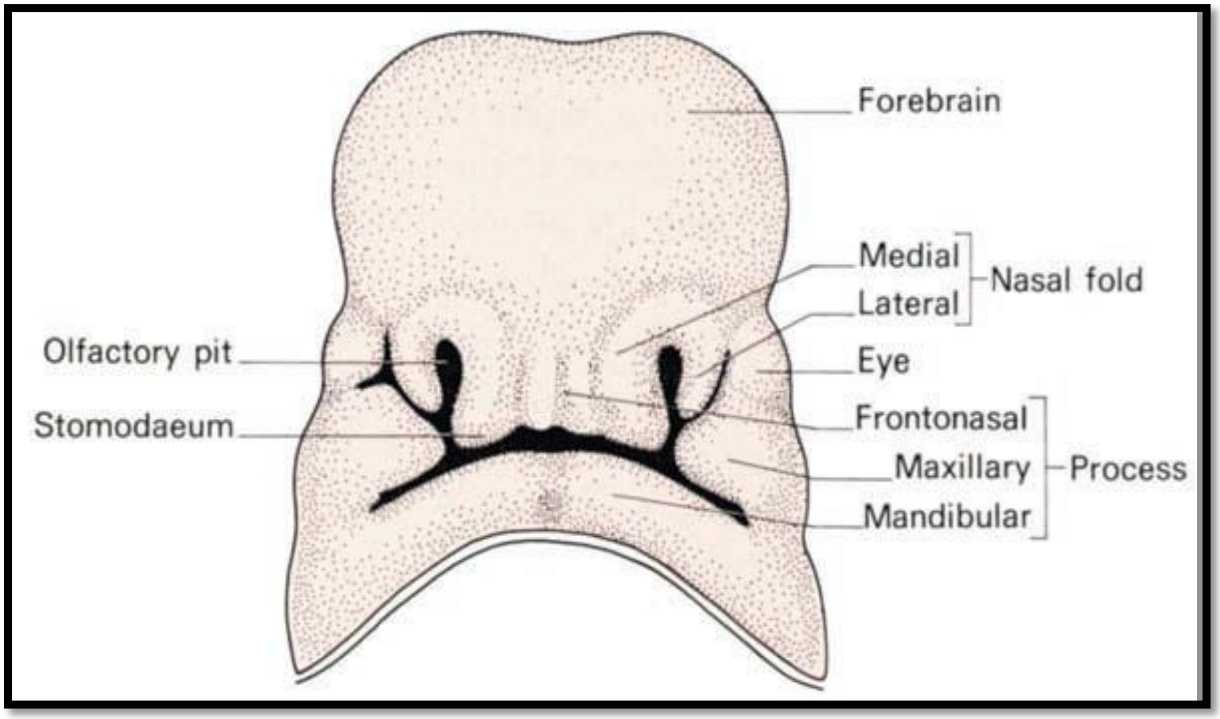

FIGURE 1: The ventral aspect of a fetal head showing the three processes, frontonasal, maxillary and mandibular, from which the face, nose and jaws are derived.[9]

Abnormalities of this complex fusion process are numerous and constitute one of the commonest groups of congenital deformities. [10]

Frequently, these anomalies are associated with other congenital conditions such as spina bifida, syndactyly (fusion of fingers or toes), etc. Indeed, it is good clinical practice to search a patient with any congenital defect for others.

The following anomalies are associated with defects of fusion of the face.

1-*Macrostoma* and *microstoma* are conditions where either too little or too great a closure of the stomodaeum occurs.

2-*Cleft upper lip* (or 'hare lip')—this is only very rarely like the upper lip of a hare, i.e. a median cleft, although this may occur as a failure of development of the philtrum from the frontonasal process. Much more commonly, the cleft is on one or both sides of the philtrum, occurring as failure of fusion of the maxillary and frontonasal processes. The cleft may be a small defect in the lip or may extend into the nostril, split the alveolus or even extend along the side of the nose as far as the orbit. There may be an associated cleft palate.

3-*Cleft lower lip* — occurs very rarely but may be associated with a cleft tongue and cleft mandible.

4-*Cleft palate* is a failure of fusion of the segments of the palate. The following stages may occur (Fig. 2): [9]

(a) Bifid uvula, of no clinical importance.

(b) Partial cleft, which may involve the soft palate only or the posterior part of the hard palate also.

(c) Complete cleft, which may be unilateral, running the full length of the maxilla and then alongside one face of the premaxilla, or bilateral in which the palate is cleft with an anterior V separating the premaxilla completely.

5-*Inclusion dermoids* may form along the lines of fusion of the face. The most common of these is the *external angular dermoid* at the lateral extremity.[6]

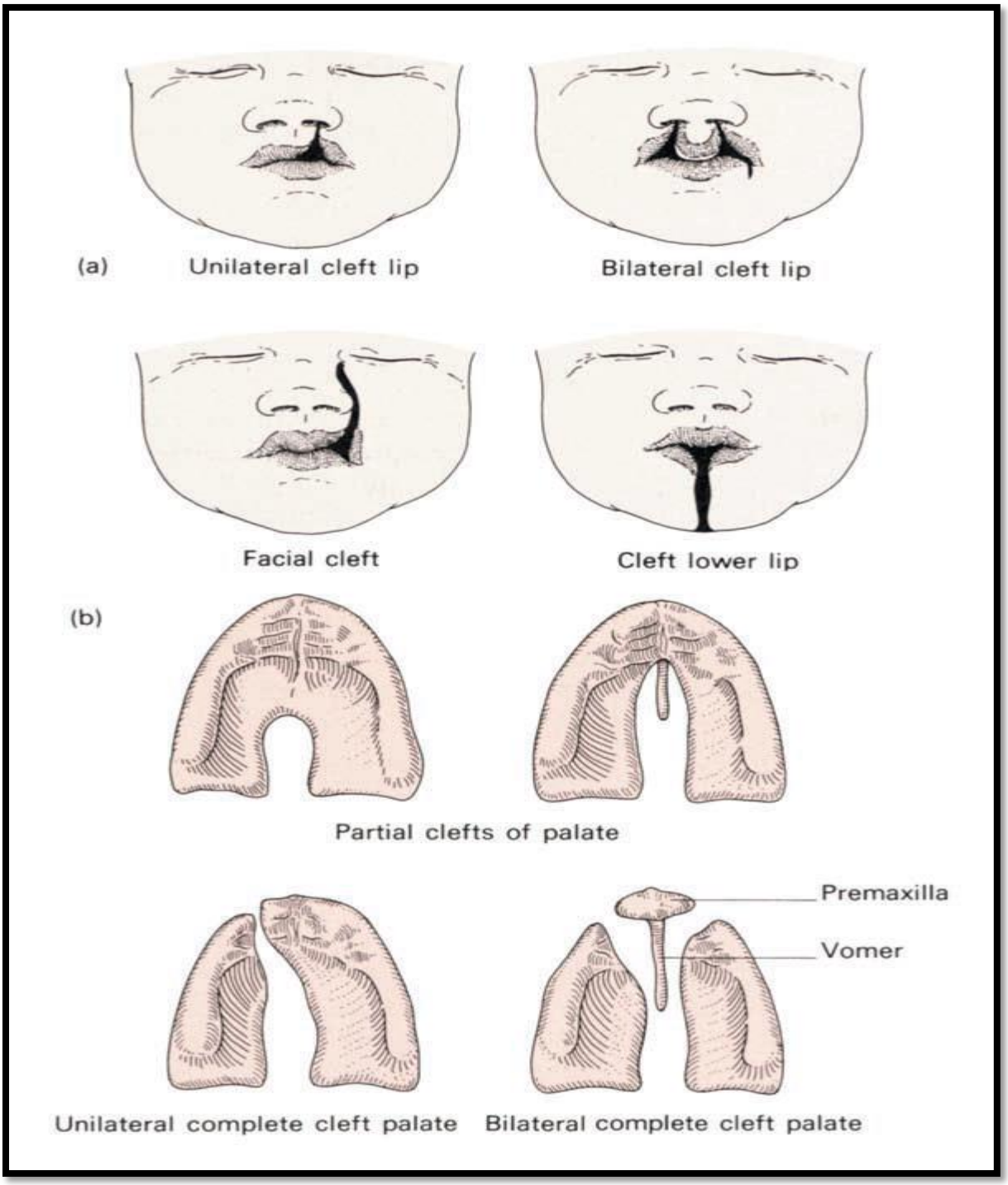

FIGURE 2: Different types of cleft lip and cleft palate [9]

The Trigeminal Nerve (V)

The trigeminal is the largest of the cranial nerves. It is the principal sensory nerve of the face, orbit, nose and mouth, and its branches are eminently suitable for accurate anaesthetic blockade. [11]

Nerve Roots

The trigeminal nerve has a large sensory and small motor root; in addition, it is associated with four autonomic ganglia. A summary of its distribution is as follows:

1- *Sensory* – to the face and the scalp back as far as the vertex; the mucosa of the nasal cavity, accessory nasal sinuses and much of the nasopharynx; the orbit and eyeball; the mucosa of the mouth, gums and ***palate***; the anterior two-thirds of the tongue and the teeth.

2- *Motor* – to the muscles of mastication, mylohyoid, the anterior belly of digastric, tensor palati and tensor tympani.

3- *Ganglionic connections* – to the ciliary, pterygopalatine, submandibular and otic ganglia. [11, 12]

Nerve Nuclei

The ***motor nucleus*** of the trigeminal nerve, which belongs to the branchial efferent column, is situated in the upper pons, immediately below the lateral part of the floor of the 4th ventricle. It receives corticobulbar fibres from both sides of the cerebral motor cortex, particularly the contralateral side. [13]

The ***sensory nucleus***, which represents part of the general somatic afferent column, is in three parts (Fig 3) [14]. Sensory fibres from the trigeminal ganglion on entering the pons divide into ascending and descending tracts; the ascending fibres pass to the *mesencephalic nucleus of the trigeminal nerve* in the central grey matter