# Evaluation of Superficial Cervical Plexus Block for Incision and Drainage of Facial Space Infections: A Prospective Clinical Study

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**Abstract**

**Background**: Odontogenic infections are the most common source for spreading facial space infections. The infections of these potential spaces in the facial planes include acute cellulitis of the soft tissue with or without true abscess formation. Aggressive incision and drainage (I&D) of all the involved spaces is considered necessary to assure fast resolution of the infection and to eventually maintain a patent airway. An adequate level of anesthesia has been a critical component of the treatment plan.
Skin in front of, above, below the ear and anterior aspect of neck is supplied by cervical plexus. A superficial cervical plexus block is an option worth considering in these cases. The injection site is usually far enough away from the intended area for I&D to be performed safely. **Material and methods:** The study protocol involved incision and drainage of facial space infection involving submandibular, submental, sublingual and/or pharyngeal spaces, performed under MAC and superficial cervical plexus block with concomitant inferior alveolar nerve block. Clinical parameters evaluated were intraoperative pain (During incision, drainage, drain fixation and immediately after the procedure in recovery room), amount of sedation required during the procedure and complications if any. **Results:** During incision 80% patients scored the pain on VAS to be 2, and rest two patients gave a score of 3 and four. During exploration and drainage of the involved spaces the average pain score was 4.4 where 60% patients scored it below 4, 30% scored it to be 5 and one patient had extreme pain and scored it to be 9. The pain scores during drain fixation was 2 or less in 90% cases and 3 in remaining 30%. Immediately after the incision and drainage all the patients had a significant pain relief in the recovery room and scored the pain to be 4 or less on VAS scale. 9 of 10 patients did not have any complications during the procedure. One patient had seizure and cardiac arrest during exploration of the space, emergency tracheostomy was done and I&D was completed successfully. **Conclusion:** Bilateral SCPB with inferior alveolar nerve block provides significant intraoperative pain control for drainage of submandibular, submental, sublingual and or pharyngeal space infections. It offers an effective alternate to general anesthesia which is easy to learn, has low complication rate and a high success rate, thereby reducing the total length of hospital stay and overall cost of the treatment.

**Keywords:** *Odontogenic Infection, Facial Space Infection, Superficial Cervical Plexus Block*

## 1. INTRODUCTION

The majority of infections that manifest in the orofacial region that is 90-95% are odontogenic in origin. Of these, approximately 70% present as periapical inflammation or abscess and arise in an otherwise healthy individual as a result of pulp necrosis caused by caries, trauma, periodontal infections or pericoronitis and account for the most common source for spreading facial space infections.

Most of the odontogenic infections are self-limiting and may drain spontaneously. However these infections may drain into facial spaces adjacent to the oral cavity and spread aggressively leading to more severe infection of these potential spaces in the facial planes, causing acute cellulitis of the soft tissues with or without true abscess formation. Later it may spread into respiratory passages, requiring a timely effort to establish a patent airway; in addition to the debridement, incision and drainage and appropriate antibiotic therapy.

This fast-spreading, indurated cellulitis occurring in the suprahyoid soft tissues leads to pain, dysphagia, trismus, swelling, and potential fatal airway obstruction[1]. Aggressive Incision and Drainage (I&D) of all the involved spaces is considered necessary to assure fast resolution of the infection and to eventually maintain a patent airway[2].

An adequate level of anesthesia has been a critical component of the treatment plan. Awake fiberoptic intubation is often the safest option, although this may be associated with its own complications[2]. Some other options available are inhalational induction and intubation without muscle relaxants, or tracheostomy under local anesthesia. Incision and drainage under local infiltration would be difficult as the anesthesia can be suboptimal, hence may not permit a thorough exploration of the wound.

A Superficial Cervical Plexus (SCP) block is an option worth considering in these cases. The injection site is usually far enough away from the intended area for I&D to be performed safely.[3] This technique of locoregional anesthesia lowers the cost of patient care, improves the effectiveness of treatment and patient comfort. Hence, the present study was undertaken to evaluate the use of superficial cervical plexus block annexed with an inferior alveolar nerve block for I&D of facial space infections.

## 2. MATERIALS AND METHODS

The study conducted was an observational study on patients with orofacial infections attending the Department of Oral and Maxillofacial Surgery, Faculty of Dental Sciences, MSRUAS, M.S. Ramaiah Memorial Hospital, and M.S. Ramaiah Medical Teaching Hospital Bangalore, from 01/01/2011 to 30/10/2012 with clinically diagnosed infection of submandibular, submental, sublingual and/or pharyngeal spaces. A total of ten cases satisfying the inclusion criteria were included and the patients were treated with incision and drainage under superficial cervical plexus block. The case history was recorded as per the proforma. The various parameters which were assessed were pain, amount of sedative required and complications.

### Inclusion Criteria

- Patients with the infection of facial spaces involving submandibular, submental, sublingual and/or pharyngeal spaces
- Patients with Ludwig's angina
- Patients with significant medical history contraindicated for general anesthesia

### Exclusion Criteria

- Patients with significant respiratory diseases
- Physically fit patients who are highly apprehensive for the procedure under local anesthesia
- Patients with known allergy to local anesthetic agents
- Facial space Infections involving deep neck and mediastinal spaces

### Surgical Technique

A. Patient Positioning: The patient was placed in a supine position, with his head turned to the side contrary to the one to be blocked

B. Equipment: The basic armamentarium to perform SCP locoregional anesthesia included sterile towels and gauze packs, 20-mL syringes with local anesthetic solution, 1.5″, 25 - gauge needles, sterile gloves, and a marking pen. $O_2$ pulse oxymeter, ECG, intubation and resuscitation equipment

C. Regional Anatomy and Landmarks: The cervical plexus is formed by the anterior divisions of the four upper cervical nerves. Situated on the anterior surface of the four upper cervical vertebrae, it rests on the levator anguli scapulae and scalenus medius muscles, and is covered by the sternocleidomastoid muscle. Emerging through the intervertebral foramen, the dorsal and ventral roots combine to form spinal nerves. The anterior rami of C2 through C4 form the cervical plexus (the C1 root is primarily a motor nerve and it is not blocked by this technique). The cervical plexus gives off both superficial (SCP) and deep branches (deep cervical plexus). The branches of the SCP emerge as four distinct nerves from the posterior border of the sternocleidomastoid muscle and supply innervation to the skin and superficial structures of the head, neck, and shoulder. The deep branches of the cervical plexus innervate the deeper structures of the neck, including the muscles of the anterior neck and the diaphragm (phrenic nerve). The third and fourth cervical nerves typically send a branch to the spinal accessory nerve, or directly into the deep surface of the trapezius to supply sensory fibers to this muscle (Fig.1 and 2).

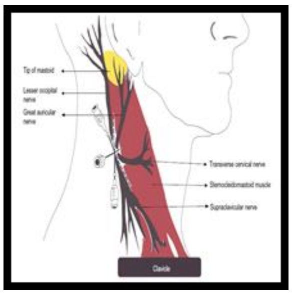

**Figure 1: Landmarks and technique of SCPB[4]**

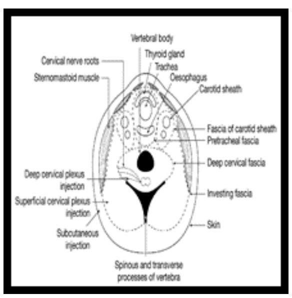


**Figure 2: Diagrammatic cross-sectional drawing of anatomy of neck at vertebral level (C4)[5]**

D. Landmarks: Mastoid Clavicular insertion of the SCM muscle; Sternal insertion of the SCM muscle Procedure: All patients were positioned in neck extension for the ease of surgery and for correct localization of landmarks. Oxygen was administered via a nasal cannula. Against gentle resistance from the anesthetist's hand, the patient was instructed to lift his or her head. A simultaneous slight Valsalva's maneuver was encouraged to help outline the sternocleidomastoid muscle and locate the external jugular vein. The midpoint of the posterior border of the sternocleidomastoid muscle was located and marked. This corresponds with the external jugular vein as it crosses the posterior border of the muscle (Erb's point). The needle was inserted perpendicular to the skin at Erb's point for all its length (1.5 cm), avoiding muscular (SCM) or vascular (external jugular vein) puncture, without looking for any bony contact (Fig.3). The volume of 15 ml (7.5ml 0.5% Ropivacaine + 7.5ml 2% lignocaine with 1:200000 adrenalin) local anesthetic was injected over 5 min with multiple aspiration tests and maintenance of verbal contact with the patient. An intraoral inferior alveolar nerve block was also given with 2ml 2% lignocaine with 1:200000 adrenalin by classical or Vazirani Akinosi technique. All the patients were given minimal sedation with 40µg Fentanyl+1mg Midazolam. Incision and drainage was performed under superficial cervical plexus block. If the intra operative pain control was inadequate additional 50µg Fentanyl and 1mg Midazolam was given intravenously.

**Figure 3: Localization of landmarks and direction for performing blockage of superficial branches of cervical plexus6**

The cervical plexus block was performed by the same technique and by same surgeon in all the patients and the primary outcome variable was pain which was assessed using a 10 point Visual Analog Scale (VAS) recorded during incision, exploration of the involved space, drain fixation and post-operatively in the recovery room. The heart rate, blood pressure and peripheral oxygen saturation was measured at all times. Clinical parameters measured were pain (during the incision, exploration of space, drain fixation, post-operatively in the recovery room), additional sedation required and complications if any.

## 3. RESULTS

A total of 10 patients with infection of odontogenic origin involving submandibular, submental, sublingual and or pharyngeal spaces satisfying inclusion and exclusion criteria who reported to M.S. Ramaiah Medical Teaching / Memorial Hospital, M.S. Ramaiah Dental College were included in the study.

Out of these ten patients, 30% (3) were female and 70% (7) were males and age ranging from 16-58 years. Mean age was 37.7 years. The most common source of the infection was 1st and 2nd mandibular molars in 60% cases and mandibular 3rd molars in 30% cases; in one case the etiology was found to be maxillary 3rd molar.

90% of the cases with submandibular space infection showed multiple space infection. With a predilection towards right side. 40% cases presented with right submandibular and submental space infection, three cases with Ludwig's angina where the etiology was right 1st or 2nd molar. Only 3 cases presented to the hospital with left submandibular and submental space infection.

50% of patients at the time of presentation were febrile. The total leucocyte count ranged from 10.2 ×103 -18.6 ×103. The mean TLC was 13.6 ×103. All the patients were started on empirical antibiotics (i.e. Inj. amoxicillin clavulanic acid and Inj. metronidazole) after admission and were continued postoperatively. In three patients of Ludwig's angina, additionally Inj. amikacin was given.

9 of 10 cases presented with swelling of the submandibular region with difficulty in swallowing and speech. One patient also had trismus along with these symptoms.

During incision 80% patients scored the pain on VAS to be 2, and rest two patients gave a score of 3 and 4. During exploration and drainage of the involved spaces the average pain score was 4.4 where 60% patients scored it below 4, 30% scored it to be 5 and one patient had extreme pain and scored it to be 9. The pain scores during drain fixation was 2 or less in 90% cases and 3 in remaining 30%. Immediately after the incision and drainage all the patients had a significant pain relief in the recovery room and scored the pain to be 4 or less on VAS scale. An additional 50µg Fentanyl and 1 mg midazolam was given to first three patients.

Amongst the ten patients, nine did not have any complications during the procedure. One patient had seizure and cardiac arrest during exploration of the space, emergency tracheostomy was done and I&D was completed successfully.

## 4. DISCUSSION

Maxillofacial infections are a public health concern that arise in otherwise healthy patients as a sequel to pulp necrosis caused by caries or trauma. Periodontal infections, pericoronitis, and surgery are other sources. Many odontogenic infections drain spontaneously, but drainage may need to be established.[7, 8] Predisposing factors such as alcoholism, immunosuppression, uncontrolled diabetes mellitus and multiple underlying medical conditions are reported to increase the risk of odontogenic infection.[8]

The anatomy of maxillofacial structures can influence the spread of odontogenic infection.[9] It is essential for the diagnosis and treatment to specify the cause and to evaluate the extent of infection.[10] Complications, such as retropharyngeal spread, suppurative mediastinal extension, airway obstruction, pleuropulmonary suppuration, and hematogenous dissemination to distant organs, clearly indicate the potentially serious nature of these infections.[11]

Successful treatment requires an understanding of the microflora, the regional anatomy, the disease process, treatment methods available, and interdisciplinary team collaboration.[12] Prolonged hospitalization can also become an economic factor for both the patient and society.

The management of odontogenic infections includes the use of high-dose intravenous bactericidal antibiotics. The recommended antibiotics are penicillin-metronidazole, ampicillin - sulbactum, or clindamycin. Certain cephalosporins may also be useful in selected patients. Early surgical intervention i.e aggressive incision and drainage of all of the involved spaces is necessary to assure early resolution of the infection. Continual airway monitoring and the establishment of surgical airways is the final portion of the treatment triad.[13]

In an exhaustive review of the literature, from 1945 to 1979, 75 cases of Ludwig Angina were treated, and the authors strongly advocated elective tracheostomy under local anesthesia. However, there may be good reason to avoid tracheostomy. Cellulitis of the neck involving the tracheostomy site makes it a more difficult procedure. Moreover, surgical dissection of the facial planes in the neck may actually open and contaminate the pathways, leading to life-threatening mediastinal invasion. Other options for airway management may include orotracheal, blind nasotracheal, and fiber optic intubation or cricothyroidotomy with jet insufflation.[14]

Nevertheless, general anesthesia has its down sides; high economic cost, a number of highly trained personnel required, morbidity and mortality, and high cost equipment.[2] Regional anaesthesia lowers costs of patient care because of the shorter duration of recovery and procedure.[3] The use of locoregional anesthesia of the Superficial Cervical Plexus (SCP) is commonly and frequently used in a variety of disciplines; that is, carotid endarterectomy, thyroidectomy and vocal cord surgery.[2]

The General Anesthetic versus Local Anesthetic (GALA) study tested the hypothesis that local anesthesia is safer than general anesthesia in a large population undergoing carotid endarterectomy.[4] The effective use of local anesthetics with sedative hypnotic- amnestic agents can provide both patient comfort and safety to perform deeper spaces I&D.[2]

The SCP, by way of the anterior rami of C-2, C-3, and C-4, distributes sensory innervation to the skin, starting at the base of the skull and covering the anterior and lateral neck from the mandible to the clavicle and the superficial aspect of the shoulder.[15]

The SCPB is simple and easy to perform. SCPB provides the same sensory (dermatome) anesthesia as the DCPB, which simply incorporates the motor component of the Cervical Plexus at the nerve roots before the sensory and motor aspects separate.[15]

Mukhopadhyay *et al.* in their study successfully used bilateral SCPB for excision of thyroglossal cyst and fistula or branchial fistula, lymph node excision or biopsy, thyroidectomy and other neck swellings like sebaceous cyst, lipoma and granuloma.[4]

A SCPB is an option worth considering for I&D of odontogenic infections. It is easy to perform and the success rate is high. The injection site is usually far enough away from the infected area for it to be performed safely. A SCPB alone may be adequate for most neck and face abscesses, but the auriculotemporal nerve can also be blocked if necessary.[3] For I&D of an abscess which is restricted to the submandibular area, there is need for a long buccal nerve block. Also if there is submental spread, an inferior alveolar nerve block is required.[2]

Shteif *et al.* also concluded that superficial cervical plexus block with concomitant mandibular nerve block has a high success rate, low complication rate and high patient acceptance rate for the drainage of submandibular and submental abscesses.[2]

Cervical plexus block is associated with a frequent incidence of patient anxiety, discomfort, and pain during carotid endarterectomy because of irregular innervation of the operative field. To improve patients' comfort and cooperation, supplemental IV analgesia and/or sedation is often administered, which may impair mental status evaluation and compromise respiratory and cardiovascular function,[16] if Ramifentanyl and Propofol are used at anesthetic doses. However, in our study Fentanyl and Midazolam were used and only in subanesthetic doses. We did not observe any impairment of mental function or compromised respiratory and cardiovascular function in our patients.

The present study included ten patients with infection of facial spaces involving submandibular, submental, sublingual and or pharyngeal spaces or Ludwigs Angina. Patients with significant respiratory diseases, who were highly apprehensive for the procedure to be performed under local anesthesia, with involvement of mediastinal spaces and with specific allergies to the local anesthetic agent were excluded from the study. Among these 30% (3) patients were female and 70% (7) were male with age ranging from 16 - 58 years and mean age of 37 years. This is similar to a study by Kannangara et al who reported a male predominance in his study, finding 40 (66%) males and 21 females (34%), with an age range of 6-79 years and most patients being between 20- 29 years old. A survey by Sethi and Stanley identified a slight predilection for males, but did not list exact numbers for each gender, also reported age range of 3- 87 years with an average of 45.5 years. In contrast, a study by Hunt et al noted a female predominance with 30 males (41%) and 43 females (59%).[17,18]

The submandibular space is considered to be important in odontogenic infection, as infection in this space is often accompanied by changes in other surgical spaces. Ariji et al reported that 75.8% patients of submandibular space infection also showed involvement in multiple spaces.[19] The findings of the present study corroborates with the above mentioned observations. In our study 90% of patients with infection of submandibular space also showed multiple space involvement. Involvement of the submandibular space causes severe symptoms such as neck rigidity, trismus, dysphagia, respiratory distress, sialorrhoea, and pyrexia.[19] and difficulty in speech.[2, 20] The most common clinical presentation in our study was pain, dysphagia, trismus, difficulty in speech and pyrexia.

In the present study, ten cases of submandibular space infection were included, nine cases presented with multiple space involvement. Of which these cases, three cases were diagnosed with Ludwigs Angina. A similar finding was reported by Labriola et al in their study wherein the most frequent single space infection was Submandibular (26%), followed by Buccal (21%), Masticator (15%), and Canine (13%).[18] In contrast, a five year retrospective study by Wang et al reported that in an adult population the most commonly involved site for odontogenic infection was maxilla (46%) followed by mandible (40%), and both in 4% cases.[8] Further, none of the above mentioned studies provided any information regarding multispace infections. In this regard, it is plausible to suggest that space infection of the perimandibular region constitutes a major percentage of maxillofacial infections; hence the knowledge and application of SCPB annexed with a local block of mandibular region may bring about significant pain relief in patients. In the present study the teeth involved (focus of infection) were 1st and 2nd mandibular molars in 60% cases and mandibular 3rd molars in 30% and maxillary 3rd molars in 10% of cases. Chow et al in their review reported mandibular molars to be the most frequently involved teeth in odontogenic infections[18]. All the patients included in the study presented with the chief complaint of pain and swelling in submandibular region with or without difficulty in swallowing. On admission 50% of the patients were febrile, routine blood investigations were sent and patients were started on empirical antibiotics i.e Inj Amoxycillin clavulanic acid 1.2gm and Metronidazole 100 ml. The total WBC count ranged from $18.7\times10^3/\mu L$ to $10.2\times10^3/\mu L$ with an average of $13.6\times10^3/\mu L$. I & D under SCPB and MAC (Monitored Anesthetic Care) was planned after a routine radiographic investigation to identify the causative tooth.

The I&D was planned after the first sign of nerve blockage i.e. the loss of pin prick sensation in the area of distribution of the representative components of superficial cervical plexus (5-10 mins after local anesthetic injection deep to superficial cervical fascia i.e the ICPB) with a mixture of 2% Lignocaine with 1:200000 adrenaline and 0.5% ropivacaine under MAC.

Ropivacaine was chosen as it is known to be less cardio toxic after intravenous administration than bupivacaine, even at an equipotent dose. This characteristic is an important advantage when relatively large volumes of local anesthetic are administered in a highly vascularized area.[21] Also Akerman et al reported Ropivacaine to have a more rapid onset of action in comparison with bupivacaine due to its weaker binding to extraneural fat and tissues and to its greater availability for transfer to the site of action in the nerve. Conversely, the long duration of action of Ropivacaine may be related partially to its vasoactivity, as a broad range of Ropivacaine concentrations can cause vasoconstriction. Addition of lignocaine was to reduce the potential toxicity of using a large volume of a local anesthetic agent and further hasten the onset of action.

In the existing literature various techniques / methods have been described to block SCP. Murphy, Scott, Prys-Roberts, and Katz have all described the superficial injection as being simply `subcutaneous'. However, Chaikof and colleagues have suggested it should be `intradermal' (i.e. even more superficial). In contrast, Yerzingatsian advised that the injection should properly be made into the body of the sternomastoid muscle, so that the solution is deposited below the investing fascia.[22]

A superficial plexus block should properly involve injection below the investing fascia of the neck, and it is only then that the injectate enters the deep cervical space.[5] Tonkovic et al in their study called such an injection as intermediate cervical plexus block, wherein the needle was inserted at the Erb's point or punctum nervosum, to a depth of 1–1.5 cm perpendicular to the skin until a loss of resistance (past the investing layer of the deep cervical fascia) was obtained. In his opinion, ICPB combined best features of traditional two regional techniques (SCPB and DCPB) simplicity, reliability and low complication rate.[23]

The simple subcutaneous injection for SCPB can either be performed by a two injection (caudal and rostral directions) or a three injection technique (caudal, rostral and a third subcutaneous transverse injection to ensure the block of the transverse cervical branches) as described by Herbland et al.[21] In the present study we used an Intermediate cervical plexus block with mixture of Ropivacaine and Lignocaine with adrenaline and intraoral inferior alveolar nerve block. In the operating room to alleviate anxiety, all patients were sedated with 40µg Fentanyl and 1mg midazolam. As per the initial study design SCPB was administered at Erb's point to a depth of 1.5 cm with a mixture of 2.5 ml 2% lignocaine with 1:200000 adrenalin and 2.5 ml 0.5% Ropivacaine unilaterally on the side of space involvement. Oxygen was administered to all patients via a simple nasal cannula. Monitoring of blood pressure and heart rate, electrocardiography, and pulse oximetry was done in the intraoperative period. The first patient scored the pain during incision as 4 on a 10 point VAS scale, however experienced extreme pain during exploration and scored it to 9. To successfully drain the involved space, an additional 50 µg Fentanyl and 2 mg Midazolam had to be administered.

Since the first patient experienced extreme pain during exploration, it was decided to give bilateral SCPB irrespective of the involvement of spaces (Unilateral/Bilateral) in the following cases. This was in accordance to the study by Krovvidi *et al*.[24] who reported that while achieving adequate analgesia in the cervical plexus region, several problems may arise due to innervation from the contralateral side, variant sensory fibers from the vagus or ansa cervicalis or high dissection of the carotid artery by the surgeon, which leads to pain in submandibular and dental region.

We observed that the pain scores with bilateral SCPB were better but the following two patients were still not comfortable during the procedure and scored the pain to be 3 and 5 during incision and drainage respectively. Therefore, additional sedation was required in these two patients. As the literature suggests we attributed this lesser pain control to the lesser amount of solution used. After first three patients it was decided to give bilateral SCPB with the local anesthetic volume increased to 15 ml of prepared mixture of local anesthetic (7.5 ml 2% lignocaine with 1:200000 adrenaline + 7.5 ml 0.5% Ropivacaine). The bilateral superficial cervical plexus block with 7.5 ml of solution on each side effectively reduced intra operative pain. Following 7 patients scored the pain to be below 2 and 4 on VAS scale respectively during incision and drainage. No patient in the present study thereafter received more than 40µg of Fentanyl and 1 mg of midazolam, indicating a sufficient level of pain control.

A wide variation ( 3.6 ml- 30 ml) exists between diverse authors regarding the amount of solution used for the bilateral SCPB.[6] This was the reason for our initial difficulty in choosing the volume of anesthetic. We observed that the pain score was higher in 30% patients (VAS -8) who received 10 ml of the anesthetic as compared to the rest 70% patients (VAS-3,4) who received 15 ml of the prepared solution. A study by NYSORA observed that a low concentration may suffice when the needle is ideally placed in the vicinity of the cervical plexus nerves, this is often not the case and the higher concentration results in both a higher success rate and a longer duration of blockade.

In our study we observed that the pain control was very good during incision and drain fixation but a higher pain score was recorded during exploration of the spaces (Figure 4) probably due to presence of infection or the fact that this block may not be able to cover the deeper compartments of the neck to alleviate pain during swallowing as suggested by Mukopadhyay *et al.*[4] in their study on thyroid surgeries. Therefore in our opinion, combining the SCPB with mandibular nerve block instead of inferior alveolar nerve block may further increase the patient comfort. To the best of our knowledge from the existing literature there are not sufficient studies in Oral and Maxillofacial Surgery on pain experienced by the patients during I & D of facial space infection with or without the SCPB for appropriate comparison for its effectiveness in pain control.

The pain score during drain fixation was 2 or less in 90% cases and 3 in remaining 10%, immediately after I&D, in the recovery room all patients had a significant pain relief, and gave a score less than 4 on VAS scale. The post-operative recovery was uneventful in all the patients. Although existing literature lists the possible complications of the block which includes infection, hematoma, phrenic nerve blockade, local anaesthetic toxicity, nerve injury and spinal anaesthesia, there are only isolated case reports of such complications. Mukhopadhyay *et al.*[4] describe that blockade of the phrenic nerve does not occur after superficial cervical plexus block, but is common with deep cervical plexus block. Thus highly stressed patients as well as patients with significant respiratory disease may be considered a contraindication for superficial cervical plexus block.[14]

In our study of ten patients, three patients presented with Ludwigs angina, two of whom had respiratory distress at the time of presentation. Of these three patients, two were managed successfully under bilateral SCPB and MAC whereas third patient had to undergo tracheostomy. This patient was a 55 year old male who presented with Ludwigs angina, with a history of empyema drained under general anesthesia 15 days ago. The patient started rapidly desaturating, so was taken up for emergency decompression under SCPB with tracheostomy setup standby. The patient seized and arrested during exploration of the involved space. Emergency tracheostomy was done and I&D was completed successfully.

Conversion to general anesthesia is considered as a complication of the SCPB but in this instance it cannot be directly attributed to the block or the technique. As multiple aspirations were confirmed before depositing the solution it is very unlikely for the solution to have been deposited intravascularly to have caused seizure and cardiac arrest. In our opinion patients preexisting respiratory condition along with longer period of desaturation might have triggered the event.

All except one patient in our study had an uneventful procedure and were discharged in 0 to 10 days of hospital stay. Peters et al in their study on maxillofacial infection suggested that LOS is best predicted by knowing the patient's status with respect to an underlying medical condition and the infection location. After accounting for these variables, if a patient actually requires operative management, only an extra day is added to the estimated LOS.[25] Sato *et al.* in their eight year retrospective study on maxillofacial infections reported the average length of hospital stay to be 3.69 days.[26] A similar observation was recorded in our study. The average length of hospital stay was 7.6 days ranging from 0 to 34 days. Longest LOS in the present study was seen in the patient who underwent tracheostomy whereas rest of the patients were discharged within 10 days (Figure 5)

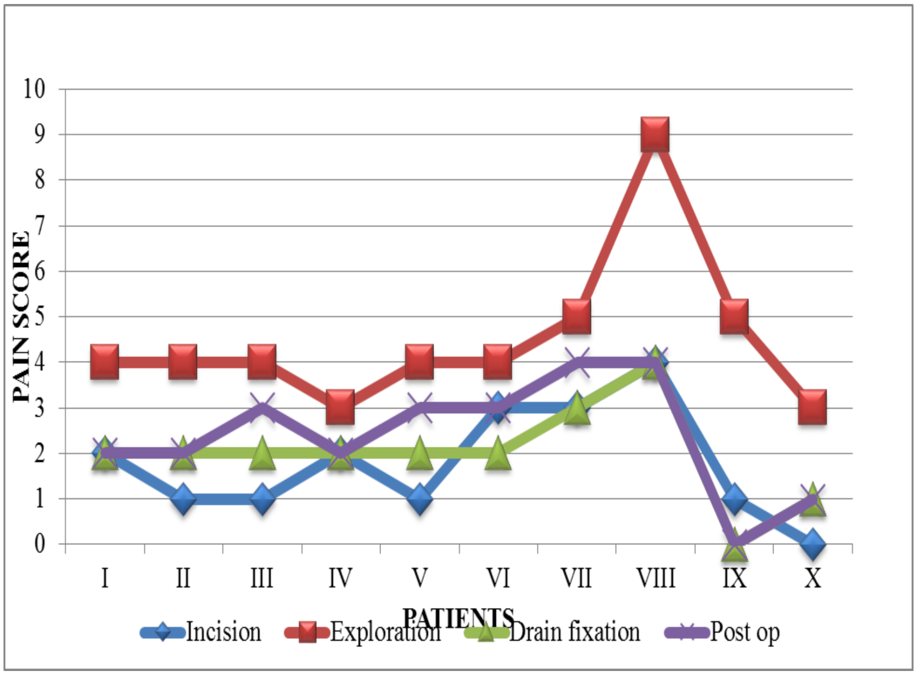


**Figure 4: Pain Scores on VAS Scale**

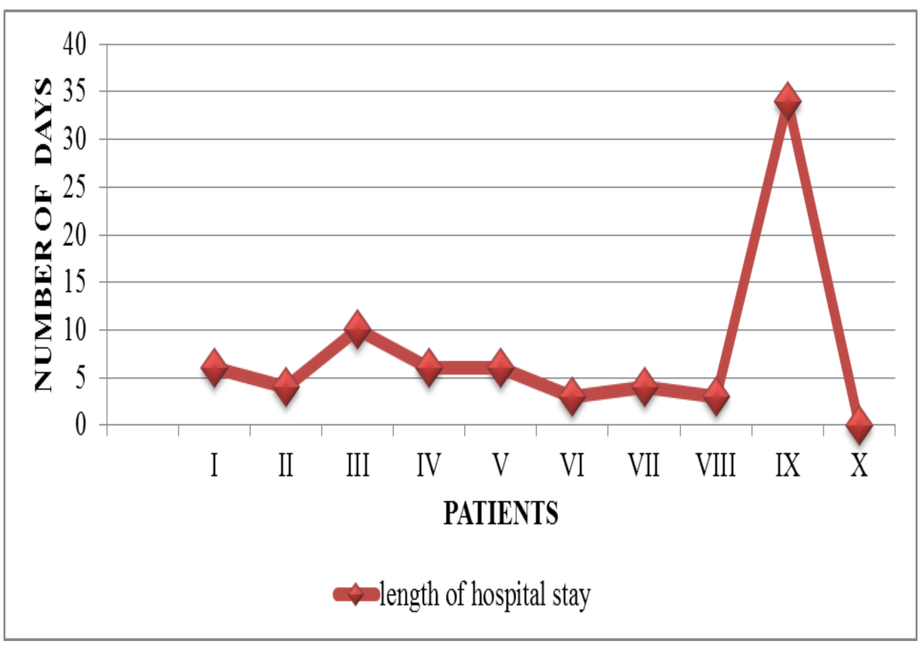


**Figure 5: Length of hospital stay**

In the present study on ten patients, we observed that the intermediate cervical plexus block combined with inferior alveolar nerve block with 15 ml of prepared anesthetic solution caused a significant reduction in the intraoperative pain during I&D of submandibular, submental, sublingual space infection.

By our understanding the SCP can be blocked by the following techniques- Superficial, intermediate and deep (Fig. 6). Pandit *et al.* in a cadaveric study reported that subcutaneous injection for the SCPB alone is unlikely to be clinically effective and concluded that a SCPB should properly involve injection below the investing fascia of the neck, and it is only then that the injectate enters the deep cervical space.[5]

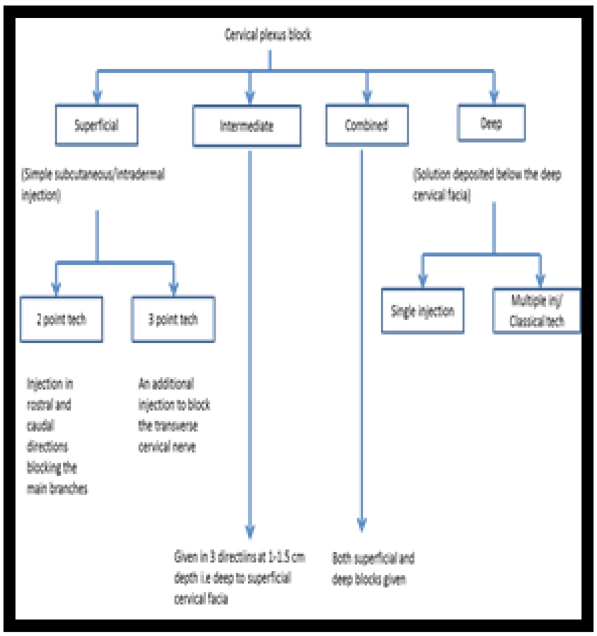


**Figure 6: Proposed method of classifying Cervical Plexus Block**

Various authors have used different concentration, type and volume of the anesthetic solution for the block, comparative studies show that the duration and onset of anesthesia produced by 0.5 and 0.75% Ropivacaine fails to show any significant difference.[21, 27] Addition of certain drugs like Clonidine or Fentanyl to the local anesthetic mixture can also be considered in future studies to increase the effectiveness and/or the duration of the block.

In our study we chose to give 0.5% Ropivacaine with 2% Lignocaine, and a total volume of 15 ml of local anesthetic for bilateral SCPB. In our opinion a volume greater than 15 ml of local anesthetic when injected might diffuse through the deep cervical fascia and also cause the blockade of deep cervical plexus as demonstrated by a cadaveric study by Pandit et al.[5] Bilateral SCPB is an easy to learn technique and provides sufficient anesthesia for the I&D of submandibular, submental, sublingual and or pharyngeal space infections to be performed with significant pain relief. It has a very low complication rate and a high success rate, although it is most commonly supplemented with sedation in our experience I&D of these spaces can be performed under SCPB with minimal or no sedation. It is an effective technique which avoids general anesthesia and its complications reducing the total length of hospital stay and the overall cost.

The limitations of the present study were the small sample size and the change in the protocol during the study period. This can be attributed to the existing confusion in the literature regarding the volume, concentration and type of anesthetic to be used for the block. Also, in our opinion use of mandibular nerve block would have provided better pain control during exploration close to the mylohyoid muscle and body of mandible. There is a need for further study with a larger sample and a study design suitable to compare the pain scores during incision and drainage with and without the block. Also randomized studies are required to determine the quantity of local anesthetic that should be used and technique to be used to block the SCP to perform incision and drainage successfully.

## 5. CONCLUSION

The SCPB provides adequate anesthesia for performing incision and drainage of submandibular, submental, sublingual and pharyngeal spaces. However, it is better to combine it with mandibular nerve block when exploration is close to the mylohyoid muscle. The patients' pain scores are significantly less with this block and therefore are more co-operative and allow complete drainage of the facial spaces.

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