FREQUENCY OF POSITIVE ASPIRATION IN ANESTHESIA OF THE INFERIOR ALVEOLAR NERVE

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ABSTRACT
In clinical practice of dentistry carrying out aspiration prior to any anesthesia, is necessary to prevent inadvertent intravascular injection. Aspiration before administration of the local anesthetic reduces the incidence of intravascular injection of the anesthetic solution and thus the incidence of adverse reactions attributable to overdosing. For Dental students, it is very necessary to understand and prevent the complications. This study was carried out by interns in a calibration posted in oral and maxillofacial surgery department. Direct Technique of the Inferior alveolar nerve block was used. Result showed frequency of positive aspiration of the inferior alveolar nerve block by direct technique by the hands of interns was 13%.

Keywords: Positive aspiration, anesthesia, inferior alveolar nerve

INTRODUCTION
In clinical practice it is important for dental surgeons to carry out aspiration prior to any anesthesia, a procedure that prevents signs and symptoms resulting from inadvertent intravascular injection. Several authors have reported that aspiration is necessary to determine whether the needle has penetrated the blood vessel.1,3

Imperfections in the anesthesia and adverse reactions can be diminished with the use of aspiration syringes, since they are, for the most part, the result of the insertion of the needle into the blood vessel. The aspiration is considered positive when a reddish coloring appears inside the anesthetic cartridge.2,3 This may range from a weak rosy coloring to a vigorous spurt of blood.4 There is a significant association between the site of the injection and positive aspiration.2 Aspiration before the administration of the local anesthetic reduces the incidence of adverse reactions attributed to the overdose.5,6 Extremely raised levels of the drug may be reached in a short period, leading to the reactions of an acute overdose.4

Aspiration before administration of the local anesthetic reduces the incidence of intravascular injection of the anesthetic solution and thus the incidence of adverse reactions attributable to overdosing. Local anesthetic cartridge contains a vasoconstrictor in addition to the local anesthetic agent. High dose or accidental intravascular injection of local anesthetic agent with vasoconstrictor may result in cardiovascular and central nervous system toxicity, as well as tachycardia and hypertension.7 Primary signs and symptoms of overdose are hypertension, tachycardia, tachypenia, headache, and vertigo. Other symptoms that may occur later are vision or auditory disorders, anesthesia of tongue and perioral areas or chill. If the blood level of the drug continues to increase, it can lead to unconsciousness, breathing depression and arrest. A number of factors increase the toxicity potential of anesthetic agents including age, weight, pregnancy, hereditary deficiency of cholinesterase enzyme, blood vessel constriction, technique and speed of injection, the blood supply in area of injection, and vasoconstrictors which are added to anesthetics to slow down absorption and reduce bleeding.8,9

Accidental injection into the vessels may occur in all intra-oral injection techniques; however, when injecting into a highly vascular area, such as the pterygomandibular space during IANB, the dentist always faces the increased risk of an intravascular injection, vascular damage and hemorrhage with hematoma formation.10 Using aspirable syringes, avoiding needles smaller than 25 gauge, slow injection and aspiration in two different places can minimize incidence of injection into the vessels.8 Therefore, aspiration is necessary to avoid intravascular injection.

Successful local anesthesia is the bedrock of pain control in dentistry. Effective pain control is essential to reduce fear and anxiety associated with dental procedures. The inferior alveolar nerve block (IANB) is the conventional method for anesthetizing mandibular teeth.11 Inferior alveolar nerve block (IANB) is a technique used to produce anesthesia of the mandibular teeth, gingival of the mandible, and the lower lip. These procedures anaesthetize the inferior alveolar nerve (IAN) prior to entering the mandibular foraamen.12 Inferior alveolar nerve block or the mandibular nerve block is a common injection
in dentistry. Unfortunately, the failure rate of this technique even with accurate injection is 15 to 20%. Absence of appropriate bony landmarks and big differences in dimensions of the ramus and position of the mandibular foramen are the reasons for failure of this technique.13

The blood aspiration technique before the injection of a local anesthetic solution is an essential procedure, because it prevents the possible systemic complications resulting from the intravascular injection of local anesthetics.5,14-16 It is the obligation of the dentist to avoid the risks associated with such accidental injection. However, even when this safety measure is adopted, it is not absolutely certain that the needle is not located intravascularly. On the other hand, it is essential to perform several aspirations in the course of anesthetic infiltration to ascertain that the needle has not displaced and that local anesthetic is not being injected into a blood vessel.1-10 According to Malamed,17 truncal block of the inferior alveolar nerve is the technique with the greatest risk of accidental intravascular injection, with an estimated incidence of 10% to 15%. The percentage of blood aspirations reported in the literature is highly variable, however.18-21

The hazards of inadvertent intravascular injections have been stressed in numerous publications.22,23 In these studies the frequency of blood aspirate has been found to be as high as 10%, the highest incidence being associated with mandibular block injections.23,24 The need for aspiration prior to injection is generally accepted by the dental profession; however, in practice it seems that little attention is paid to this important procedure. Reasonable and simple as this requirement may sound, it is nevertheless far from easy to carry out aspiration when using conventional dental syringes.25

MATERIALS AND METHODS
A Prospective study was designed to evaluate the frequency of positive aspirations in anesthesia of the inferior alveolar nerve by direct technique after obtaining Ethics Committee Sumandeep Vidhyapeeth approval.

Sample of study:
This study consisted of a sample of 100 cases who required extraction of mandibular posterior teeth reported at Oral and Maxillofacial Surgery Department, K M Shah Dental College and Hospital, Piperia, Waghodia, Vadodara, Gujarat.

INCLUSION CRITERIA:
- Mandibular posterior teeth who require extraction were included

EXCLUSION CRITERIA:
- Mandibular anterior teeth
- Medically compromised patients
- Patients who were not ready to participate and sign consent form

SURGICAL ARMAMENTARIUM:
- Sterile 2ml syringes and needle
- 2% lignocaine with adrenaline 1:200000
- Tooth extraction forceps

METHOD:
The study was carried out by interns in a calibration posted in oral and maxillofacial surgery department. All the patients came to the department were given information regarding the procedure. All patients were operated using 2% lignocaine with 1:80,000 adrenaline. A long needle with syringe was used. Inferior alveolar nerve block was given using direct technique.

The point of greatest depression of the anterior edge of the ramus of the mandible was palpated with the index finger. The finger was maintained in this depression and the finger turned so that the nail faced the sagittal plane, touching its most anterior portion in the proximity of the oblique internal line. The centre of the nail represented the exact point of insertion of the needle, approximately 1 cm above the occlusal plane of the lower molars. The needle was inserted into the depression forming the mucosa between the fold of the pterygomandibular raphe on the inside and the internal oblique line on the outside, the body of the syringe being at that moment level with the premolars on the opposite side. The needle was sunk until bony resistance encountered. On touching the bone, the syringe was withdrawn 1 cm and aspiration was carried out. To aspirate, the operator, after reaching the point of anesthesia, applied a light pressure on the piston without moving it, creating a negative pressure with the syringe of anesthetic solution and relaxing the grip on the piston in order to produce a passive aspiration of the blood flow, a thin thread or spurt of blood was observed in the cartridge if the aspiration was positive. If aspiration was positive then the used syringe and needle were discarded and another new syringe was taken for the procedure and if no sign of blood was seen, the aspiration was considered negative and the anesthetic was injected normally and result was recorded. Then the extraction procedure was carried out and patients were given post extraction instruction, medication required and relieved.

All the data was collected on excel sheet, Mean and p value was collected as per Descriptive statistics.

Figure 1. Extraoral
RESULTS
In this study 100 patients were included. The frequency of positive aspiration was evaluated by age and sex group for frequency of positive aspiration, effectiveness of inferior alveolar block by direct technique and number of accessory block required.

Among the sample size of 100, 57 were male and 43 were female.

In the sex group there was 9 positive aspirations in males and 4 in females. (Table 1)

All the blocks were effective in females and 5 were not effective in males. (Table 2)

Number of accessory blocks required in males was 5. There was no accessory block required in females. (Table 3)

A result indicates that there is no significant difference between sexes for positive aspiration.

In the age group, 7 patients were in 0-20 age, 26 in 20-40, 44 in 40-60 and 22 were in 60-80 age group.

In 0-20 age group there was no positive aspiration, in 20-40 age group 1 positive aspiration, in 40-60 age group 6 and in 60-80 age group 6 positive aspiration.

The highest percentage was in 40-60 and 60-80 age group. Data indicated that incidence of positive aspiration increases with increase in age, being highest in 60-80 age group is 27.3%. (Table 4)

Effectiveness of block in age group decreases with increase in age as results indicates. (Table 5)

Accessory blocks required also high in 60-80 group being 13.6%. (Table 6)
DISCUSSION

Anesthesia is a process aiding dental treatment and, as such, should be calm and safe procedure as the dental surgeon’s major preoccupation has to be focused on the specific dental maneuver.26

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**Table 1** Frequency of Positive Aspiration - Sex

<table>
<thead>
<tr>
<th>Sex</th>
<th>Aspiration - Sex</th>
<th>Total</th>
<th>Chi-Square Test P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Positive</td>
<td>Negative</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>9 15.8%</td>
<td>48 84.2%</td>
<td>57 100%</td>
</tr>
<tr>
<td>Female</td>
<td>4 9.3%</td>
<td>39 90.7%</td>
<td>43 100%</td>
</tr>
<tr>
<td></td>
<td>13 13%</td>
<td>87 87%</td>
<td>100 100%</td>
</tr>
</tbody>
</table>

**Table 2** Block Effective - Sex

<table>
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<tr>
<th>Sex</th>
<th>Block Effective - Sex</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Positive</td>
<td>Negative</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>52 91.2%</td>
<td>5 8.8%</td>
<td>57 100%</td>
</tr>
<tr>
<td>Female</td>
<td>43 100%</td>
<td>0 00.0%</td>
<td>43 100%</td>
</tr>
<tr>
<td></td>
<td>95 95%</td>
<td>5 5.0%</td>
<td>100 100%</td>
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</tbody>
</table>

**Table 3** Accessory Block Required - Sex

<table>
<thead>
<tr>
<th>Sex</th>
<th>Accessory Block</th>
<th>Total</th>
<th>Chi-Square Test P Value</th>
</tr>
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<tr>
<td></td>
<td>95 95%</td>
<td>5 5.0%</td>
<td>100 100%</td>
</tr>
</tbody>
</table>

**Table 4** Aspiration - Age

<table>
<thead>
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<th>Age Group</th>
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</thead>
<tbody>
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<td></td>
<td>Positive</td>
<td>Negative</td>
<td></td>
</tr>
<tr>
<td>0-20</td>
<td>0 0.0%</td>
<td>7 100%</td>
<td>7 100%</td>
</tr>
<tr>
<td>20-40</td>
<td>1 3.7%</td>
<td>26 96.3%</td>
<td>27 100%</td>
</tr>
<tr>
<td>40-60</td>
<td>6 13.6%</td>
<td>38 86.4%</td>
<td>44 100%</td>
</tr>
<tr>
<td>60-80</td>
<td>6 27.3%</td>
<td>16 72.7%</td>
<td>22 100%</td>
</tr>
<tr>
<td>Total</td>
<td>13 13.0%</td>
<td>87 87.0%</td>
<td>100 100%</td>
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**Table 5** Block Effective - Age

<table>
<thead>
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<td>No</td>
<td></td>
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<tr>
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<td>7 100%</td>
<td>0 0.0%</td>
<td>7 100%</td>
</tr>
<tr>
<td>20-40</td>
<td>27 100%</td>
<td>0 0.0%</td>
<td>27 100%</td>
</tr>
<tr>
<td>40-60</td>
<td>42 95.5%</td>
<td>2 4.5%</td>
<td>44 100%</td>
</tr>
<tr>
<td>60-80</td>
<td>19 86.4%</td>
<td>3 13.6%</td>
<td>22 100%</td>
</tr>
<tr>
<td>Total</td>
<td>95 95.0%</td>
<td>5 5.0%</td>
<td>100 100%</td>
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</table>

**Table 6** Accessory Block Required - Age

<table>
<thead>
<tr>
<th>Age Group</th>
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<th>Total</th>
<th>Chi-Square Test P Value</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Accessory Block</td>
<td>Total</td>
<td></td>
</tr>
<tr>
<td>0-20</td>
<td>0</td>
<td>1</td>
<td>7 100%</td>
</tr>
<tr>
<td>20-40</td>
<td>27 100%</td>
<td>0 0.0%</td>
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In 1884, William S. Halsted and Richard J. Hall first achieved neuroregional anesthesia in the mandible by injecting a solution of cocaine in the vicinity of the mandibular foramen. Since then many techniques have been introduced. As a result of the difficulties and failures observed in achieving IANB, various methods of anesthesia have been suggested. The following anesthetic techniques are available to anesthetize mandibular or IAN, lingual and buccal nerves. Namely

1. Conventional IANB;
2. Gow-Gates mandibular nerve block;
3. Closed mouth block (Vazirani/Akinosi block);
4. Fischer 1.2.3 IANB;
5. IANB described by Malamed SF.

The conventional IANB is the most commonly used nerve block technique for achieving local anesthesia for mandibular surgical procedures. In certain cases, however, this nerve block fails, even when performed by the most experienced clinician. Unfortunately, this block has a comparatively high failure rate (15% to 20%). Some authors have estimated the failure rate of this conventional IANB to be approximately 20% to 25%. Aspiration before injecting local anesthetic in the IAN block is necessary to prevent intravascular injection of local anesthetic as it contains a vasoconstrictor adrenaline. Many authors believe that inadvertent intravascular injections may lead to conditions such as fainting, pallor, tachycardia, tremor, vomiting and diplopia. Lustig and Zusman reported cases of syncope, a feeling of shock, and pallor. Bartlett founded the greatest number of reactions (vomiting, nausea, loss of consciousness, diplopia and tremor).

Unintended intravascular injection from inferior alveolar nerve blocks can result in frustrating distant complications affecting such structures as the middle ear and eyes. Possible complications affecting the eyes include blurring of vision, diplopia, mydriasis, palpebral ptosis and amaurosis (temporary or permanent). Inferior alveolar nerve blocks can cause permanent alteration in sensation to the lingual nerve, inferior alveolar nerve or both nerves. In addition to altered nerve sensation, permanent loss of vision has been reported in one case.

Oculomotor disturbances can occur with local anesthetic injections. Rood reported a case in which 1.5 milliliters of lidocaine with 1:80,000 epinephrine was injected in an inferior alveolar nerve block. Immediate loss of vision developed in the ipsilateral eye, along with upper-eyelid ptosis and medial strabismus, which resulted in double vision. The patient also developed ischemia of the palatal mucosa. Within five to 45 minutes, all symptoms disappeared. Several other cases have been reported of complications of intravascular injection of LA.

So aspiration is positive or negative is very important before injecting LA. On aspiration if blood is seen in the syringe it is considered as positive. In earlier studies the appearance of blood in the injection solution has been considered proof of intravascular positioning of the needle point. Evers has suggested that there are two different types of positive aspirations. One type may be due to tissue trauma during penetration of the needle through the tissues and in this case the aspirate seeps into the solution with difficulty and is scanty in appearance. The other type represents true intravascular positioning of the needle which can readily be observed by the gushing of blood into the solution on aspiration. This view has been clinically verified to a certain extent by Rood, and experimentally it has been shown to be valid for the self-aspiring syringe unit. In this investigation no attempt has been made to differentiate between these two possible types of positive aspiration. However, a positive aspiration is not necessarily proof of intravascular position of the needle even if large vessels are penetrated. Blood in the cartridge should, in the authors' opinion, be regarded as a potential risk for subsequent inadvertent intravascular injection.

The total rate of intravascular needle entrance during IANB injections was higher. The frequency of positive aspirations in which injections were given via the conventional inferior alveolar injection technique has been reported to be 7.9%. According Thangavelu et al., the rate of intravascular needle entrance in inferior alveolar nerve block injections was 15.3%, which is a relatively high incidence. This notable finding emphasizes the necessity of aspiration before IANB injections. The percentages found in anesthesias of the inferior alveolar nerve by different authors were as follows: Bartlett; 11%, Rood (2); 8.2%, Persson, Keskitalo, Evers; 4.7%, Lehtinen, Aarnisalo; 15.4%, Bishop; 11.3%, Danielson, Evers, Nordenram; 3.2%, Kuster, Udin. According to Meechan, slight pressure should be applied on aspirating in order to prevent occlusion of the blood vein by the lumen of the needle or even the rupture of small veins by excessive force on aspirating, resulting, respectively, in false-negative and false-positive readings. Furthermore size of the needle is also has been considered in positive aspiration. Cohen et al. reported positive aspirations to be significantly more frequent with 25G needles than with 27G needles, though blood aspiration was also seen to occur with the smaller-bore needles. Some authors consider a needle with a gauge of at least 25G to be necessary for the production of hematic aspiration, in as much as a smaller gauge would supposedly block blood flow and prevent the passage of anesthetic solution. Malamed suggested using 25G needles for injecting into highly vascularized areas, where the risk of needle deflection is greater (because of the long needle distances covered, increased soft tissue resistance, etc.), or in situations of high blood aspiration risk, as in blocks of the IAN, the anterior palatine nerve, and the mental nerve. However, some in vitro studies have found that 30G needles can also produce hematic aspirations. In this study 27G needle was used which showed 13% of positive aspiration.

Watson and Colman have made a number of recommendations for securing a good aspiration technique during mandibular blockade, including (1) the use of a syringe that can be manipulated with a single hand to facilitate aspiration and (2) the establishment of needle-

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bone contact whenever possible to secure correct positioning. It is advisable to inject a few drops of anesthetic solution before aspirating to clear the lumen of any accumulated blood within the needle. A light aspirating force should then be applied, without movement of the needle point; a constant draw-back force should be maintained for 3 seconds, because a sustained rather than an intense force is important in deciding blood aspiration capacity.

Successful anesthesia is technique-sensitive. The greater success rate of IANB by the most experienced dentist was not unexpected. There are few studies that addressed the effect of practitioners experience in inferior alveolar nerve block. Operator in oral surgery showed most success (96%), and the lowest success was noticed by first year oral surgery residents. In this study the frequency of positive aspiration of the inferior alveolar nerve block by direct technique by the hands of interns was 13%.

ACKNOWLEDGEMENTS

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DECLARATION OF INTERESTSHIP

There is no conflict of interest

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