

A study on the Aspiration Procedures in Syringes among Health Care Professionals

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Abstract

Aspiration during routine injection is meant to ensure that the injecting needle tip is at the anticipated location during this unsighted procedure. While injecting needle appears to be a simple procedure, it has produced a lot of controversy regarding the apparent benefits and indications. Keeping in view the huge number of injections given worldwide, it is observed that key questions regarding aspiration till now, remain unanswered. Due to very smaller number of studies and data in the literature there is no evidence of particular injecting procedure as truly beneficial or unjustified. The present integrative review was chosen to draw conclusions about the current state of knowledge and practice of aspiration and use of syringes among medical, paramedical and dental practitioners. On analyzing the questionnaire output data's, it was observed that most sound knowledge practitioners found difficulty in usage of syringes and forget to aspirate due to nervousness during injection resulting in positive aspiration ($p < 0.05$) during the procedure. Henceforth a new invention in the syringe for safer and easier use or a standard injecting technique with aspiration protocol have to be established to avoid complications due to difficulty in usage of syringes during minor or major surgical procedures.

Keywords: Syringes, Aspiration procedure, Injection, Injection technique.

Introduction

A safe injection is one that does not harm the recipient, does not expose the provider to any avoidable risks and does not result in surplus that is dangerous for the community. Apart from these in the recent years more focus have been shifted towards the practice of aspirating for blood before injection.¹

Injections are among the most common health care procedures, with at least 16 billion administered in developed as well as developing countries every year. 95% of injections are administered in therapeutic care, 3% are for immunization, and the rest for other purposes, such as blood transfusions. The practice of aspirating for blood before an injection has been discussed in medical journals since the early 1900s and is a tradition taught in paramedical curriculum for the past 40 years. Aspiration was performed as a protective or precautionary step by general physicians before injection to rule out intra-arterial placement of the needle tip. This precautionary technique ensures that an

artery or vein hasn't been penetrated inadvertently since embolism due to accidental intra-arterial injection can lead to serious complications. Injection of either needle or the solution into the vessels may occur accidentally in all intraoral injection techniques; nonetheless, when injecting into a highly vascular area as seen in case of pterygomandibular space during inferior alveolar nerve block injection, there is always the increased risk of an intravascular injection, vascular damage and hemorrhage with hematoma formation.^{2,3}

In clinical practice of dentistry carrying out aspiration prior to any anesthesia, is necessary to prevent inadvertent intravascular injection and also to reduce the incidence of adverse reactions attributed to the overdose. For Dental students, it is very necessary to understand and prevent the complications. Local anesthetics are medicaments that induce a transitory and completely reversible loss of sensation in a confined area of the body, caused by a depression of excitation in nerve endings or an inhibition of the peripheral nerve conduction. Local

anesthetic unit 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.^{4,5}

Literature and integrative reviews have specified that performing aspirating before injection has no basis in the scientific evidence. Conversely Accidental injection into the vessels may occur in all intra-oral injection techniques. The dentist often experiences the increased risk of injecting the vessels, vascular damage and hemorrhage with hematoma formation. Therefore, aspiration is necessary to avoid intravascular injection.⁶

For decades, aspiration has been added and eliminated based on narrative, hypothesis, and subjective choice. Currently, the American Academy of Pediatrics, The American Academy of Family Physicians (AAFP), the Advisory Committee on Immunizations Practices (ACIP), the United Kingdom's Department of Health, and the World Health Organization (WHO) have stated that aspiration is not necessary and serves only to prolong the injection procedure. A single use sterile syringe intended for the aspiration of fluids or for the injection of fluids (ISO 7886-1) is recommended currently for aspiration procedure apart from the routinely used disposable or auto disables syringes.⁷

In the present study an integrative review followed by questionnaire was chosen to draw conclusion about the current state of knowledge among diverse study population in the area of medical, paramedical and dentistry. Further comprehensive evidence review was obtained by combining diverse methodologies and response outcomes of targeted clinical question using a systematic search strategy and rigorous appraisal methods.

Materials and Methods

A total of 120 practitioners including 40 medical,

40 paramedical and 40 dentists were randomly chosen irrespective of their age and experience in their respective field. An integrative review in the previous literature followed by questionnaire containing 10 questions with multiple choice answers was selected. Each question was explained to individual participants and the data obtained were carefully updated and sent for statistical analysis. The 10 questions are answered with yes or no.

Q1. Have you ever experienced positive aspiration during injection?

Q2. Have you ever forgot to aspirate during injection?

Q3. Do you find difficulty while aspiration in the injection site?

Q4. Have you ever experienced needle breakage during injection?

Q5. Do you get nervous if there is positive aspiration during injection?

Q6. Will you change the needle if positive aspiration encountered?

Q7. Do you withdraw the air bubble in the syringe before giving injection?

Q8. Is your needle under tension during injection?

Q9. Method of aspiration during injection?

Q10. Are you ready to experience if there is any new invention in the syringe for easy use?

Result

The data obtained was tabulated and analyzed by SPSS statistics software Version 26.0 to obtain statistical report. Pearson Chi-Square test was performed to find the significance of the study. The level of significance was set at 0.05 as the p-value. Results of each question are tabulated below

TABLE 1: Quantitative analysis based on the above-mentioned questionnaire on syringe handling.

Q.NO	MEDICAL		PARAMEDICAL		DENTAL		TOTAL		P VALUE
	YES N (%)	NO N (%)	YES N (%)	NO N (%)	YES N (%)	NO N (%)	YES N (%)	NO N (%)	
Q1	20(50%)	20(50%)	24(60%)	16(40%)	29(72.5%)	11(27.5%)	73(60.8%)	47(39.2%)	0.1184
Q2	16(40%)	24(60%)	9(22.5%)	31(77.5%)	21(52.5%)	19(47.5%)	46(38.3%)	74(61.67%)	0.0214
Q3	18(45%)	22(55%)	24(60%)	16(40%)	22(55%)	18(45%)	64(53.3%)	56(46.6%)	0.3916
Q4	7(17.5%)	33(82.5%)	3(7.5%)	37(92.5%)	11(27.5%)	29(72.5%)	21(17.5%)	99(82.5%)	0.0562
Q5	6(15%)	34(85%)	8(20%)	32(80%)	20(50%)	20(50%)	34(28.33%)	86(71.67%)	0.00086
Q6	40(100%)	0(0%)	40(100%)	0(0%)	38(95%)	2(5%)	118(98.3%)	2(1.7%)	0.7721
Q7	40(100%)	0(0%)	40(100%)	0(0%)	40(100%)	0(0%)	120(100%)	0(0%)	NIL
Q8	11(27.5%)	29(72.5%)	11(27.5%)	29(72.5%)	6(15%)	34(85%)	28(23.34%)	92(76.67%)	0.3120
Q9	39(97.5%)	1(2.5%)	39(97.5%)	1(2.5%)	36(90%)	4(10%)	114(95%)	6(5%)	0.2061
Q10	39(97.5%)	1(2.5%)	35(87.5%)	5(12.5%)	33(82.5%)	7(17.5%)	107(89.5%)	13(10.9%)	0.0089

N= Number of responses(yes/no) for each question %= percentage of responses for each question p= statistical significance

The age wise distribution shows predominant of 20-25years of age among study population with equal participants 3-6yrs or more experience among them. All the 3groups were equally distributed to avoid calculating error. On analyzing the questionnaire output data's, it was observed that Q2 (0.0214), Q4 (0.0562), Q5 (0.00086) and Q10 (0.0089) were statistically significant and the remaining questions failed to show any significant correlation among the three groups under the study.

Discussion

However, greater concentrations (>1:50 000), or even the rapid intravascular injection of the cartridge of

anesthetic solution, may have dangerous hemodynamic effects in patients with cardiovascular disease.^{8, 9, 10}

Over the years various aspiration techniques for blood were followed. The most accepted being the rule of ten second that includes slow aspiration (5 to 10 seconds), slow injection (5 to 10 seconds) slow withdrawal, no rubbing. In this technique of routine injection involves the placement of the needle at its proper depth, aspirate, pulling the plunger of the syringe back slightly to determine whether the needle tip present within the lumen of a blood vessel. Followed by rotating the syringe a quarter turn and re-aspirate to ensure that

the needle tip was not laying against the wall of a vessel. If blood appears in the syringe at any time, withdraw the syringe from the tissue and prepare a different injection site.^{11, 12}

Gammel et al in 1927 in his study concluded Blood not obtained upon aspiration isn't an absolute safeguard and strictly recommends careful injection technique.¹³

Peragallo-Dittko et al in 1995 conducted a Quasi-experimental cross-sectional study of adults with and without diabetes to investigate rationale for blood aspiration of the insulin syringe. 102 subjects with 204 injections aspirated yielded no blood return. He concluded that aspiration isn't a reliable indicator of correct needle placement. Individualize insulin injection technique to decrease the risk of incorrect needle placement.¹⁴ In contrast to the above study the present study positive aspiration was observed among 15% medical, 20% paramedical and 20% dental practitioners.

Crawford et al verbally polled about 40 paramedical department staffs and found that about 50% of respondents supported the practice of aspirating for blood before injection. The final calculation of responses showed no correlation to their age, educational qualification, or other demographics included in the study.¹⁵ However in the present study method of aspiration was not statistically significant. The responses did seem to illustrate that how they were trained to give injections during basic education strongly influenced their views. For those who'd been taught to aspirate supported the practice while those who weren't taught to do so continued to omit this step.

Kirk H. Waibel conducted a study among experienced paramedical staffs to determine whether the practice of aspiration should be continued before administration of either an allergy shot or immunization and observed the absence of blood in the syringe during aspiration of more than 36,000 allergy shots and routine immunizations. The study concluded that injection without aspiration is a safe practice.¹⁶

Roger and King et al in 2000 concluded that literature is consistent in recommending the following rule of aspirate for blood, draw back plunger for 5-10 seconds, if blood is present, discard and repeat.¹⁷ Similarly in the present study no statistically significant observation was

found when questioned about the method of aspiration but it was noted that all the 3 groups change the needle immediately when positive aspiration was found.

Diggle et al in 2007 observed the theory behind injection techniques to determine best practices in immunization and concluded that aspiration before injection isn't necessary.¹⁸ Ipp et al in 2007 also observed most nurses who aspirate don't follow slow aspiration guidelines and they perform procedure too quickly.¹⁹ In the present study 17.5% medical, 7.5% paramedical and higher range of about 27.5% experienced needle breakage at the tip during their injection procedure. In the present study a significant correlation was observed when asked about the aspiration guidelines. Most of the practitioners failed to aspirate unintentionally and get nervous during the procedure particularly when aspiration was positive had resulted in further complications.

Mohan et al in 2014 conducted a study among Interns and postgraduates who performed inferior alveolar nerve block injections using conventional technique in 250 patients undergoing minor oral surgical procedures. The study observed 20% of inferior alveolar nerve block injections were aspiration positive. It was noted that of all the observations 15.8% were on the right side and 14.8% were on the left side intravascularly. The author concluded that Aspiration of blood was significantly more common in patients aged 9–19 years than in all others irrespective of the side of injection.²⁰

Trivedi et al in 2015 conducted a study on Direct Technique of the Inferior alveolar nerve block among interns posted in oral and maxillofacial surgery department. He observed that frequency of positive aspiration of the inferior alveolar nerve block by direct technique by the hands of interns was 13%.²¹ The present study showed positive aspiration of 15% among medical, 20% in paramedical and higher range of about 50% in dental practitioners, this may be attributed to the fact that facial including oral and Para-oral structures are highly vascularized areas. It should be considered that about 80-90% of the study populations are prepared to experience any new invention in the syringe for easy use.

Conclusion

Very few studies confirming or rejecting current

aspiration techniques can contribute to a standardized procedure, regardless of healthcare setting. Current injection practices vary throughout healthcare organizations and practice environments. Until obtaining an established standardization, injection techniques must be individualized to the patient, the equipment, and the medication being administered to decrease the risk of incorrect needle placement. Though the present integrated review is limited to relatively narrow focus on administration of local anesthetic, routine medications and not focusing exclusively on immunizations, insulin or heparin injections it can be concluded that the need for aspiration prior to administering an injection is dependent upon multiple factors. Further studies looking at the need for aspiration during injection and introduction of newer invention in the syringe for easy use have to established to avoid difficulties in usage of syringes in order to avoid complications during the same.

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Ethical Clearance

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