

## Assessing the Understanding and Perfection in Performing the Injection Techniques after Exposure to Mannequins

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<https://dx.doi.org/10.13005/bpj/2477>

(Received: 05 January 2022; accepted: 08 July 2022)

Unsafe injection practices put patients and healthcare providers at risk of infectious and other complications. Giving injection by correct technique is an important skill. In the present undergraduate curriculum, teaching is based on making the medical graduates, a competent doctors and giving injections safely is a must know competency. We have given them the exposure through different methods and tried to evaluate the impact of it. Objectives: To assess the knowledge of 2nd phase MBBS students about the proper techniques of injections and to assess confidence level and skill of performing these injections. Method: After obtaining the ethical committee approval, a cross sectional questionnaire based study was conducted in the Department of Pharmacology. Undergraduate students of phase 2 MBBS were included in the study. The background and purpose of the study was explained. Information about the correct methods of different injection techniques were already provided to them by different modules - Lecture, Routes display, videos and Demonstration on mannequins. The actual training of techniques on mannequins. A predesigned, validated, structured questionnaire was used for data collection. After hands - on training, the questionnaire was applied. Data obtained was analysed with Graph pad prism 6. Results-As per the students Intravenous (52.1%) and Intramuscular (30.3%) injections are most commonly used techniques. (97.5%) say aspiration is must to confirm the needle in vein and (95.8%) appearance of bleb for intradermal injection. Tuberculosis-(77.3%) spreads with unsafe injection. Only (45.4%) think injection file should be used for ampoule cutting. Conclusion: The Students definitely showed confidence in injection techniques on mannequins. Still small number of students look confused, require more practice sessions. Attention need to be given for understanding along with the practice to reduce the misconceptions.

**Keywords:** Demonstration; Injection techniques; Mannequins; Perfection; Understanding.

Giving injection by a correct technique is an important skill in the medical practice. As per WHO report, around 12 billion injections are administered every year worldwide, of which 50% are given by unsafe technique and 75% are not actually required.<sup>1</sup> In the traditional method of teaching more stress was theoretical aspects, so many undergraduate students remain

inadequately exposed to these techniques, resulting in lack of perfection in performing these injection techniques. In the current CBME curriculum lots of modifications are done to make the MBBS students a competent Indian Medical graduate (IMG).<sup>2</sup> Now it is a must know and certifiable competency for undergraduate students. For the preparation of the examination which is mandatory for admission of

post-graduation, undergraduate students do not properly use their internship postings to acquire proper skills like different injection techniques.<sup>3</sup>

The unsafe practices used in injection techniques by healthcare worker may include, reuse of syringe while administering medication parentally, contamination of medication vials or intravenous (IV) bags, failure to follow basic injection safety measures. Injection given by improper method can cause many complications in the patient like bleeding, hematoma formation, abscess formation, damage to nerves etc. Incorrect injection technique and improper waste disposal can lead to transmission of diseases like Hepatitis, AIDs due to needle-prick injury.<sup>4</sup> Training the medical students in injection technique is a very crucial step to minimize errors in the parenteral drug administration.

Training of the students to give injections, directly on patients will be associated with anxiety and apprehension. So if mannequins are used for training the students, their confidence level will increase and their anxiety of acquiring the skill will go down. Learning these injection techniques like subcutaneous(SC), intradermal(ID), intramuscular(IM), and intravenous(IV) actually on the mannequins made the practical class interesting and students enjoy learning.<sup>5</sup> The important aspect of learning and to sustain it, is the repeated practice of the technique which is easily possible on mannequins.<sup>6</sup> Simulation

provides a safe and controlled environment to teach various injection techniques. Therefore, providing simulation for training of the injection skills to medical students is helpful.<sup>7</sup> Present study was undertaken for assessing the understanding and perfection in performing the injection techniques after exposure to mannequins.

### Objectives

- 1) To assess the knowledge of 2<sup>nd</sup> phase MBBS students about the proper techniques of SC, ID, IM and IV injections.
- 2) To assess confidence level and skill of performing these injection techniques.

## METHODOLOGY

Cross sectional questionnaire based study was conducted in the Department of Pharmacology, Bharati Vidyapeeth (Deemed to be university) Medical college Pune. The undergraduate students of phase 2 MBBS were included in the study. Study was carried out in July -September 2021

After obtaining Ethical committee approval (BVDUMC/IEC/23B) was obtained, the study was conducted. The undergraduate students of phase 2 MBBS were included in the study. The background and purpose of the study was explained and students were encouraged to participate without any undue pressure before the administration of questionnaire.

The information about the correct methods of different injection techniques was already

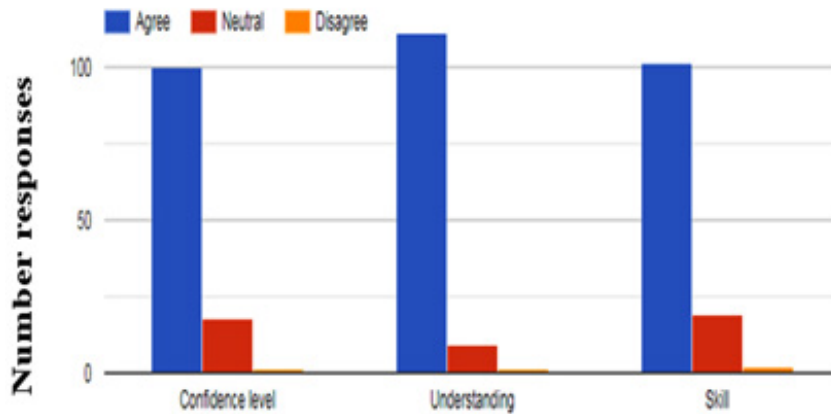
**Table 1.** Knowledge - Practical aspects

|                      |                                    |             |            |
|----------------------|------------------------------------|-------------|------------|
| Injection angle      | 15°                                | 35°         | 90°        |
| Intradermal          | 119 (100%)                         | 0           | 0          |
| Intravenous          | 1(0.84%)                           | 118(99.15)  | 0          |
| Intramuscular        | 0                                  | 1 (0.84%)   | 118(99.15) |
| Confirmation of site |                                    |             |            |
| Intradermal          | Pain                               | 2 (1.68%)   |            |
|                      | Swelling                           | 3 (2.52%)   |            |
|                      | Oedema                             | 0           |            |
|                      | Bleb                               | 114 (95.8%) |            |
| Intravenous          | Aspirate                           | 116 (97.5%) |            |
|                      | Feel with the finger               | 2 (1.68%)   |            |
|                      | Push the fluid                     | 1 (0.84%)   |            |
|                      | From visual impression             | 0           |            |
| Disinfection         | Washing the area with soap & water | 0           |            |
|                      | Cleaning with spirit swab          | 117 (98.3%) |            |
|                      | Applying antiseptic cream          | 1(0.84%)    |            |
|                      | Applying antiseptic lotion         | 1(0.84%)    |            |

provided to the students by different modules like - the Lecture on routes of administration, Routes display, Presentation of videos of the proper injection techniques and Demonstration of the correct injection techniques (SC, ID, IM, IV) on mannequins. After giving all the information, the actual training of proper techniques on mannequins

was given to the students. A predesigned, validated, structured questionnaire was used for data collection. Returning of the completed Google form was accepted as a consent by the participating students.

They were exposed to all these teaching methods  
Lecture on routes of administration



### Impact of training to students on mannequins

Fig. 1. Impact of training to students on mannequins

Table 2. Knowledge – Theoretical aspects

|                              |                             |             |
|------------------------------|-----------------------------|-------------|
| Inj. technique commonly used | Intradermal                 | 1 (0.84%)   |
|                              | Subcutaneous                | 20 (16.8%)  |
|                              | Intramuscular               | 36 (30%)    |
|                              | Intravenous                 | 62 (52.1%)  |
| Most difficult inj technique | Intradermal                 | 18 (15.1%)  |
|                              | Subcutaneous                | 5 (4.2%)    |
|                              | Intramuscular               | 4 (3.3%)    |
|                              | Intravenous                 | 92 (77.3%)  |
| Common sites for IM inj      | Gluteus Maximus muscle      | 1 (0.84%)   |
|                              | Deltoid muscle              | 3 (2.52%)   |
|                              | Vastus lateralis in Infants | 5 (4.2%)    |
|                              | Biceps                      | 110 (92%)   |
| Glass ampoule opened with    | With scissor                | 13 (10.9%)  |
|                              | With injection file         | 54 (45.4%)  |
|                              | With blade                  | 37 (31.09%) |
|                              | With bare hands             | 15 (12.60%) |
| Imp of use of tourniquet     | Create pressure             | 8 (6.72%)   |
|                              | Make the vein prominent     | 109 (91.6%) |
|                              | For patients satisfaction   | 0           |
|                              | To reduce pain              | 2 (1.68%)   |
| Drug given by SC route       | Insulin                     | 105 (88.2%) |
|                              | Ampicillin                  | 2 (1.68%)   |
|                              | BCG vaccine                 | 11 (9.2%)   |
|                              | Gentamicin                  | 1 (0.8%)    |

Routes display (Small group activity)

Presentation of videos – We prepared the videos of all four techniques with audio demonstration and a checklist.

#### **Demonstration of the correct injection techniques was given on mannequins**

After completion of all these teaching methods, 3 session of hands -on training were given. The questionnaire was applied to the students for assessment of their confidence level and knowledge about the injection techniques.

#### **Statistical Analysis**

Data was entered in a Microsoft Excel spreadsheet, analysis done with Graph pad prism 6 using descriptive statistics. Categorical variables are presented as percentage (%)

### **RESULTS**

The hands on training of injection techniques on Mannequins increased Confidence level in 100, Understanding in 111 and skill in 101.

Out of 119 students 84.03 % (100) students said that their Confidence level increased after hands on training of injection techniques on Mannequins. 93.27% students agreed that there was an improvement in the understanding of the injection techniques. 84.87% students said that their skill was improved after hands on training of injection techniques on Mannequins. (Figure 1)

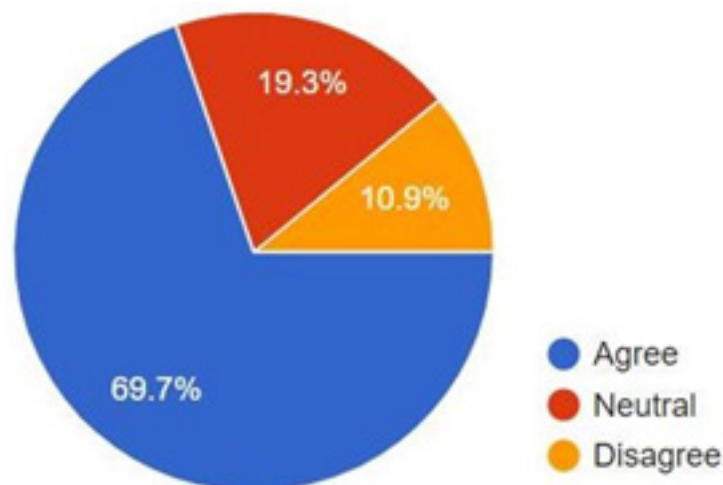
69.7% students said that they could give injection boldly because there was no anxiety of

reaction from the mannequins, but 10.9% students disagree. (Figure 2)

Correct angle of ID injection- all correct responses. Confirmation of site-4.2%- ID 2.5%- IV Injection wrong.1.7% students unable to point out correctly about disinfection of site 100% students gave correct angle of intradermal injection. Only 1 student gave wrong answer to the angles of Intravenous and Intramuscular techniques. 95.8% students wrote correctly that the formation of bleb is the indicator of the right technique of intradermal injection. 97.5% students told correctly that aspiration is the important step to confirm that the needle is in the vein in the technique of intravenous injection. 98.3% students correctly gave the answer that before giving injection the site should be cleaned with spirit swab. (Table 1)

Intravenous injection is the most difficult technique. Maximum Students know that Insulin given by subcutaneous route. 8.4 % did not know use of tourniquet 54.6% students don't know injection file used for ampoule cutting.

According to 77.3% students', Intravenous injection is the most difficult technique and 15% students say that intradermal injection is the most difficult. 88.2% students know that Insulin is the example of subcutaneous route.11.8% students gave the wrong example. According to 91.6%, tourniquet is used in the technique of intravenous injection to make the vein prominent. As per 92.4% Biceps is not the site for giving the intramuscular injection. Only 45.4% students know that a glass



**Fig. 2.** Mannequins use in confidence boosting

ampoule for giving injections should be opened with injection file. 31.1% students say that blade should be used to open the glass ampoule. 12.6% students tell that the glass ampoule should be opened with bare hands. (Table 2)

Only 77.3% students are aware of the diseases transmitted through unsafe injection practices. 22.6% students did not know about it. (Figure 3)

## DISCUSSION

Unsafe injection practices include unnecessary injections, reusing needles and syringes, using a single dose medication vial for multiple patients, giving an injection in an environment that is not clean and hygienic, and incorrect sharps disposal.<sup>8</sup> Injections with improper care can result into spread of the diseases like hepatitis B virus, hepatitis C virus, HIV and other pathogenic conditions. It also can cause nerve and other tissue damage, which can lead to paralysis and can cause abscesses and injuries.<sup>9</sup> Injuries causing nerve palsy are easily preventable by proper training and understanding of the anatomy of the nerves and vessels.<sup>10</sup>

The World Health Organization (WHO) defines a safe injection to be one that does not harm

the recipient, does not harm the health care worker, and does not harm the community.<sup>11</sup>

Competency-based medical education (CBME) curriculum is recently introduced in all the medical colleges with the aim to produce the competent MBBS doctors.<sup>12</sup> Competency is defined as “the ability to do something successfully and efficiently,” Modifications done to observe certain essential skills in the actual settings. Giving injection is an essential and must know skill and a certifiable competency in this curriculum.<sup>13</sup>

Different teaching methods like Lecture, Routes display, Presentation of videos and Demonstration of injection techniques SC, ID, IM, and IV on mannequins are used in present study. The actual training of proper techniques on mannequins was given to the students.

The hands on training of injection techniques on Mannequins increased the confidence level, Understanding and skill. Practicing on the mannequins definitely improves the practical knowledge but few students says that it doesn't gives the experience of real patients. Use of mannequins definitely reduces the risk and inconvenience to patients also practice in the standardized atmosphere where repeated training can be given to improve performance.<sup>14,15</sup> Most of them were able to answer the correctly about

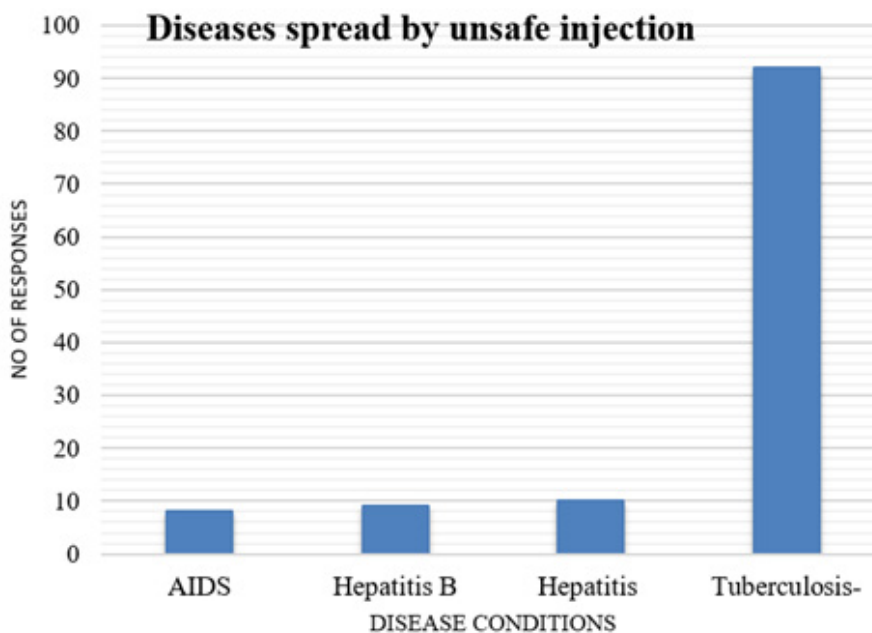


Fig. 3. Diseases spread by unsafe injection

the angles of the needle in different injection techniques. Still 4.2% of the students were unable to confirm the key observation bleb for intradermal administration but maximum of them knew aspiration to confirm needle is in the vein.

Majority students feels that intravenous injection as a difficult technique but most commonly used. Though intramuscular injections used commonly, as per the students it is not difficult. But there is always a gap between the theory and practical. Practically study carried out by DJ Hanson the complications, which may be disastrous, not only causes increased morbidity and disability for the patient but may also provide bases for malpractice suit after the unsafe intramuscular injections<sup>16,17</sup> So proper training is necessary even though the students says that it is an easy technique.

Disinfecting the injection site with spirit swab, the basic concept was clear to all. Few students were unable to specify the use of tourniquet for making the vein prominent and injection file for cutting the ampoule. These are the supplementary measure to control the handling and infection spread. As per the Yvan Hutin, availability of best infection control practices for intradermal, subcutaneous, and intramuscular injections will provide a reference for global efforts to achieve the goal of safe and appropriate use of injections.<sup>18</sup> After the exposure to the multiple module's students were able to answer correctly the questions related to theoretical aspects but they were failed in interpreting the diseases spread by the unsafe injections. One study was conducted by Bhatiya *et.al* in third year MBBS students in which the confidence and skill of students in giving IM and IV injections on patients of casualty was assessed. The author recommends the use of dummies for achieving the skills in injection techniques.<sup>19</sup>

Positive aspect of this study is that there is dramatic improvement in the confidence, understanding and skills of the students. Very small number of students will require the remedial measures. Therefore, providing appropriate simulation for medical training is a major path compliant with best educational standards and ethical principles in the process of medical education.<sup>20</sup>

As per the study by Bharat Kumar *et.al*. Assessment of the skills of the 2<sup>nd</sup> year students in the Injection technique on mannequins was done

after demonstration. 31% of the students failed to load the syringe with drug properly. 30% of the students forgot to pull back the plunger to see any blood aspirate before injecting the medication. When the study participants were exposed to only one method of teaching.<sup>21</sup>

Our results are more convincing in this aspect, since the exposure was given to the students by different teaching methods increased their knowledge, skill and confidence level in performing

## CONCLUSION

Drastic increase in confidence of performing skill on mannequins was seen with combined approach. Still small number looks confused, require some remedial measures. Attention needed for improving understanding along with the practice to reduce the misconceptions.

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