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An observational study of safe injection practices in a tertiary care teaching hospital

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Abstract
Introduction: Giving medicine is probably one of the most critical duties of nurses since the resulting errors may have unintended, serious consequences for the patient. Many diseases like Hepatitis-B, Hepatitis-C, and HIV/AIDS and up to some extent other blood borne diseases are transmitted by parenteral route also. People receiving and providing healthcare services are at increased risk of iatrogenic infections as more injectable drugs are being prescribed and in addition they are delivered by unsafe injectable practices.
Aims and Objectives: To observe the prevalent injection practice and to get information about knowledge and awareness among health workers regarding safe injection practice.
Material and Methods: An observational and cross-sectional study, including 10 healthcare providers to assess their knowledge and awareness about safe injection practice was conducted at injection room in tertiary care hospital. Questionnaire was prepared from WHO and other checklists and observations were taken accordingly. Data was analysed by using Microsoft Excel 2010, manual analysis was also done for some data. Results were expressed in percentage and were compared with various checklists.
Results: Reading of label was done prior to preparation of injection in 100%. Around 99.03% of total injections were prepared in clean are using aseptic technique. Two handed recapping of needle was done in only 9.35% of total injections. Multi-dose vials were kept in centralised medication area and were discarded as per schedule. Healthcare providers followed proper technique while administering drugs by intramuscular, subcutaneous, intradermal and intravenous route. Healthcare providers were immunised against hepatitis-B infection.
Conclusion: The study result showed that the knowledge of healthcare providers about safe injection practice is nearly up to mark. More emphasis should be put into the basic nursing education and in the introduction to medication procedures in clinical practice to improve the nurses' medication knowledge and reduce the risk of error.

Keywords: Safe injection practice, checklists, healthcare providers

1. Introduction
Injection safety is defined by WHO as 'an injection that is administered using appropriate equipment, does no harm to the recipient, does not expose the provider to any avoidable risk and does not result in any waste that is dangerous to other people'. [(1)]Since invention of the syringe in 1848, a new channel for pathogens to pass from one person to another was opened while over a period of time, health workers found more conditions to treat and more medications to inject. Injection therapy was first introduced to developing world population with the mass campaigns against Yaws and Kala-Azar in 1920s, and became wide spread after Second World War following the introduction of penicillin [1].
Over the last 50 years, scientists have continued to discover new blood borne pathogens associated with unsafe injection use. In 1967, the Australian antigen, now known as Hepatitis B Virus surface antigen (HBsAg) was first linked to viral hepatitis. In 1983, human immunodeficiency virus (HIV) was found in blood. In 1989, the hepatitis C virus (HCV) and antibodies were identified. Episodes of transmission of blood borne pathogens through injections are usually linked to the unsafe use of multi-dose vials or preparation of medications in areas potentially contaminated with blood or body fluids [1].
Every year some 16 billion injections are administered in developing and transitional countries [2]. Use of injection is done for curative and preventive purposes. Although there are various methods of taking drugs, injection will be favoured by some prescribers and users as the full effects of the drug are experienced very quickly. In India, it is reported that more than 93% of injections are unsafe and nearly 60% of cases of HBV infection are caused by

such practices [3]. In addition, unsafe injections can cause abscesses and lead to septicaemia. Less frequently, haemorrhagic fevers and malaria can also be transmitted. When the use of injection equipment exceeds beyond availability, it promotes reuse of the equipment. According to the WHO, the major cause of widespread unsterile injection practices is an insufficient supply of syringes and needles. Single patient single needle rule should be followed.

2. Aims and objectives

- To observe the prevalent injection practice
- To get information about knowledge and awareness among health workers regarding safe injection practice.

3. Material and Methods

Across-sectional and observational study was conducted at injection room of outpatient department in a tertiary care teaching hospital. After approval from institutional ethics committee the study was performed for a period of 2 months duration from December 2015 to January 2016.The investigator visited the injection room daily for one hour and observed the injections given by the nurses. 10 nurses involved in direct patient care at injection room of outpatient department were included in the study. A minimal sample was calculated using the Cochrane formula taking 77% prevalence of unsafe injection practice from a previous study [4]. Injections given were observed and were compared with the WHO definition of safe injections to verify their safety. The Tools for the study were observation checklists, designed to evaluate injection practices and waste management according to WHO definitions. WHO instrument 4"GUIDE TO INTERVIEW AND OBSERVE INJECTION PROVIDERS" [5], "INJECTION SAFETY CHECKLIST" [6] and "SAFE INJECTION PRACTICE 12 CRITICAL RULES TO FOLLOW" [7] Procedure checklist for administering intradermal injection [8] was used to assess the safe injection practice. Checklists were revised, and modified by the investigator. According to observation checklist, data was noted regarding aseptic precautions taken like proper cleaning of injection site, proper maintenance of hand hygiene during each injection, use of hand gloves, use of injection equipment (sterile, unsterile), and lastly proper disposal of the used injection equipment. Observation of healthcare provider during administration of injection was done using tool of "Use of Injection" from "Guide to good prescribing" by WHO [9]. Data were analysed manually and compared with WHO checklist and results were expressed in percentage for each observation.

4. Results

Ten health care providers (nurses) were observed giving injections at injection room of outpatient department for a period of 2 months. Total 310 injections were observed. Various indicators were observed as per the checklist formed and questions were asked to the nursing staffs to check their knowledge and awareness about safe injection practice.

Table 1: Observation of healthcare provider during preparation of injection

Indicators	Observations		
	Yes	No	Total
(1)Does the health care provider read the label over medication vial or ampoule?	310	0	310
(2)Injections are prepared using aseptic technique in a clean area free from contamination or contact with blood, body fluids or contaminated equipment	307	3	310
(3)The rubber septum on a medication vial is a disinfected with alcohol prior to piercing	140	-	140
(4) Aspirating drug from ampoule:	A-130	40	170
A. Was filling done around the neck of the ampoule? B. Ampoule was covered with gauze piece?	B- 0	310	310
(5)Needles and syringes are used for only one patient (this includes manufactured prefilled syringes and cartridge devices such as insulin pens)	308	2	310
(6) Two hands recapping	29	281	310
(7) Disinfection of area done by alcohol swab by using inward to outward direction?	257	53	310
(8) Medication vials are entered with a new needle and a new syringe, even when obtaining additional doses for the same patient?	140	-	140
(9) Multi-dose vials are dedicated to individual patients whenever possible	0	310	310
(10) Multi-dose vials to be used for more than one patient are kept in a centralized medication area and do not enter the immediate patient treatment area (e.g. operating room, patient room/cubicle)	140	-	140
(11) Multi-dose vials are dated by HCP when they are first opened and discarded within the time period provided by the manufacturer for the opened vial	140	-	140
(12)Presence of dirty sharps in place where they expose healthcare workers to needle sticks injuries.	49	261	310
(13) Immediate discarding of sharps in a sharp box	288	22	310
(14) Appropriate disposal / destruction of sharps.	308	2	310

As shown in Table-1, Observation of healthcare provider was done while they were preparing injections. Reading of label over vial or ampoule was done properly by healthcare provider before giving injections in 100% of injections given. Out of 310 injections, 140(45.16%) were collected from vial whereas 170 (54.83%) were collected from ampoule. Drug withdrawal technique from vials and ampoules were followed in 100% of total injections given. Vials used were multi-dose vials and they were kept in centralized medication area, away from direct patient contact. Hand recapping was done in 9.05% of total injections given. Disinfection of area of injection was done by spirit cotton swab in proper manner from inward to outward in 82.90% of total injections given; while it was not followed in 17.09% of total injections. Multi-dose vials are not dedicated to single patient. Presence of dirty sharps during injection preparation was observed in 15.80% of total injections given. Appropriate disposal of sharps were done in 99.35% of total injections given. They used electronic needle and syringe cutter to destruct needle and syringe. Immediate discarding of sharps in sharp box was done in 92.90% of total injections given.

Table 2: Observations of healthcare provider during Subcutaneous injection administration

Indicators	Observations (n=100)		
	Yes	No	Total
Disinfection of site of injection	100	0	100
Fold of the skin was pinched	100	0	100
Needle was inserted at the base of skin fold	100	0	100
Aspiration was done	100	0	100
Sterile cotton wool was kept onto opening. Fixed with adhesive tape.	100	0	100

As shown in Table-2, injections by subcutaneous route were given in 100 (32.25%) injections out of 310. Proper injection technique was followed in 100% of total injection given.

Table 3: Observations of healthcare provider during Intramuscular injection administration

Indicators	Observations (n=142)		
	Yes	No	Total
Disinfection of site of injection	142(100%)	0	142
The patient was told to relax the muscle	140(98.6%)	2 (1.4%)	142
Aspiration was done	140(98.6%)	2 (1.4%)	142
Injected slowly. (less painful)	142 (100%)	0	142
Sterile cotton wool was kept onto opening. Fixed with adhesive tape.	135(95.07%)	7(4.93%)	142

As shown in Table-3, injections by intramuscular route were given to 142 (45.80%) out of 310 injections. Steps of proper technique were followed in majority of injections given.

Table 4: Observations of healthcare provider during intradermal injection administration

Indicators	Observations (n=79)		
	Yes	No	Total
Disinfection of site of injection	79 (100%)	0	79
Needle was kept flat at the base of skin	79 (100%)	0	79
Drug was slowly Injected, waited for bleb formation (less painful)	75(94.93%)	4	79

As shown in Table-4, intradermal route was used in 79 (25.48%) out of 310 injections. Steps of proper technique were followed in majority of injections.

In 28 injections, out of 310, intramuscular route was followed by intradermal route, where intradermal injections were given as test dose prior to giving full dose of medicine (Benzathine penicillin).

Table 5: Observations of healthcare provider during Intravenous injection administration

Indicators	Observations (n=17)		
	Yes	No	Total
Disinfection of site of injection	17 (100%)	0	17
Stabilization of vein done	17 (100%)	0	17
Skin was punctured and needle was inserted in vein	17 (100%)	0	17
Aspiration was done	17 (100%)	0	17
Drug was Injected slowly	17 (100%)	0	17
Needle was removed swiftly	17 (100%)	0	17
Sterile cotton wool was kept onto opening. Fixed with adhesive tape	17 (100%)	0	17

As shown in Table-5, intravenous route was used in only 17 (5.48%) out of 310 injections. Steps of proper technique were followed in 100% of total injections given.

Table 6: Interview of healthcare provider

Questions
1. How many injections do you give in one day? - Vaccinations / Others
2. Could you name three diseases that may be transmitted through unsafe injections?
3. How many needle stick injuries have you had during the last 12 months?
4. How many doses of Hepatitis B vaccine have you ever received? - Doses
5. Do you have sufficient quantities of injection equipment to apply the one syringe and needle /one injection rule? – Yes/No Don't know
6. Do you have sufficient quantities of sharps boxes to dispose of sharps safely? Yes/No
7. Do you have access to a sharps waste disposal facility to dispose of your sharps waste? - Yes/No

As shown in Table-6, 10 healthcare providers were interviewed about their knowledge and attitude for injection practice based on the questionnaire prepared from WHO Guide to interview and observe injection provider. Majority of healthcare providers answered that injections given per day were in a range of 120 to 250. Mean injections per day were 194 injections (Mean±SD194±39.33). Majority of the respondent knew diseases transmitted by sharp injury and body fluid: (50%) Hepatitis B, (60%) HIV, (30%) Malaria, (10%) Hepatitis C, (10%) Phlebitis, (10%) Fever, (10%) abscess etc. Healthcare providers were asked whether they had needle stick injury or sharp injury in last 12 months period, they responded that the injury ranged from 10 times/year to maximum of 35 times/year. Mean number of needle stick injury per year was 27 (Mean± SD 27±8.40). Healthcare providers were immunized against Hepatitis-B, 70% had completed 3 doses (0,1,6), while 20% had completed 3 doses plus one booster dose, (0,1,6 and 1stbooster), 10% had completed 2 doses (0,1). All healthcare providers (100%) responded that they had sufficient quantities of injection equipment to meet one needle one syringe rule, had sufficient quantities of sharp boxes to dispose sharps safely, and they had access to sharp waste disposal facility to dispose of sharp wastes.

5. Discussion

This study assessed the prevalent injection practice, knowledge and awareness among health workers regarding safe injection practice in a tertiary care hospital. Observation of preparation of injections by healthcare provider shows that reading of label over vial or ampoule was done by healthcare provider before giving injections. Reading of label prior to giving injection is a good practice as it avoids wrong drug /dose/route of administration in patients. By reading the label healthcare provider gets assurance about the correct administration of drug. Thus, by administering the correct medicine with correct dose and route, medication error and subsequent adverse drug reactions can be prevented. Around 99.03% of injections were prepared in clean using aseptic precautions. The site where injections are being prepared is very important since it may harbour the source of infection from the blood or other body fluid soiled linen, cotton or other materials.

In 140(45.16%) injections, drug was withdrawn from vials. Rubber septum of multi-dose vial was cleaned with alcohol before withdrawing drug. It is a good practice as it avoids the contamination of drug from needle piercing the contaminated rubber septum. The rubber septum should be allowed to dry before piercing the needle otherwise needle may contain some amount of the disinfectant and patient may be harmed by injecting with that needle. Drug was given from ampoule in 170(54.83%) injections. Filing was done in130 ampoules only. Filing helps in proper demarcation of the breakage point in ampoule and prevents midway breakage of the ampoule and drug loss. In our study no gauze piece was covered over neck of the ampoule. Covering of neck of ampoule is recommended in "Guide to Good prescribing" by WHO with a purpose to prevent injury to the hands of health care provider from broken pieces of ampoule in case of mishandling of ampoule.

In our study one needle and one syringe was used for each injection. This result is also similar to the result obtained by study done at Egypt by Ismail N.A. *et al*. [10]. Sophie *et al*. reported that the observed injection providers consistently used newly opened syringes and needles for all injections in Mongolia [10, 16] In our study two handed recapping of needle was done by 9.05% of health care providersafter injection. Study done at Nigeria by Obi AI *et al* showed that 75.7% of the healthcare providers were engaged in two handed recapping after injection [11]. Study done by Ismail N.A. *et al* also showed that two hand recapping of the needle was the commonest cause of the experienced needle stick injuries. [10] The study done by Hauri *et al* also suggest that avoiding needle recapping and other hand manipulation is essential to prevent needle stick injuries [12, 13]. Two handed recapping of the needle should be avoided as it is the most common cause of needle stick injury encountered.

Disinfection of injection area was done in circular manner from inward to outward by alcohol cotton swab. This is a good practice as it prevents contamination of the injection site from the periphery of the limb. In our study, multi-dose vials are entered with new needle and new syringe even for obtaining additional doses for the same patient every time. It is a good practice as it prevents the contamination of drug by reused syringe. Study done by Yang Cao *et al* at China, 91.5% of injections from multi-dose vials, drawing needles were replaced by injecting needle before administration [14] In our hospital, multi-dose vials were kept in centralized medication area, away from patient treatment area for purpose of preventing the contamination of the vial. Multi-dose vials were dated by health care provider when it was first opened and was discarded within the time provided by manufacturer, generally 28 calendar days. Timely discarding of multi-dose vial is a good practice as it avoids the use of expired drugs and related side effects by using them.

In our study presence of dirty sharps were present in 15.08% of total injections. Presence of dirty sharps should be kept minimal to avoid the injury to health care providers and also the patients to whom injections are to be given. The presence of sharps, needles and syringes in open boxes or in other unsafe containers in the facilities indicate lack of compliance [15]. Safe handling and disposal of sharps must be strictly adhered to minimize accidental needle stick injury [3]. Immediate discarding of sharps like cut needle and syringes were done in non-compressible sharp box.

In our study most common route of administration of injection was intramuscular (45.80%) followed by subcutaneous (32.25%), intradermal (25.48%) and intravenous route (5.48%). Disinfection of injection site was followed in each technique. It is a correct practice as it matched with the steps provided by "Guide to Good Prescribing" under heading of "The use of injection" in Annexure 4.

Interview of healthcare providers was done to assess their knowledge and practice of safe injection. Unsafe injection practices throughout the world result in millions of infections, which may lead to serious disease and death. Scientists estimate that unsafe injections may cause about 8–16 million hepatitis B virus infections, 2.3–4.7 million hepatitis C virus infections, and 80,000–160,000 HIV infections each year worldwide [10]. Majority of the healthcare providers in our studyknew about the diseases transmitted by unsafe injection practice like hepatitis B, C, HIV, and other bacterial infections. This may be due to training of healthcare providers regarding safe injection practices. Healthcare providers frequently develop needle stick injuries which may occur during withdrawal of drug from ampoule and during two handed recapping of needle. In our study the needle stick injuries (NSIs) per year was 27(Mean± SD 27±8.40). In a study conducted in a tertiary care hospital of Pakistan, it was witnessed that most of the NSIs (more than 47%) were from disposable needles and most commonly (33%) occurred during recapping of needle. [15, 17] In our study all healthcare providers were immunized against Hepatitis B, while a study done at Pokhara city suggested that only 71% of healthcare providers received vaccination [18]. In our study sufficient supply of disposable needle and syringe is being provided to meet one needle one syringe rule. The healthcare providers demand additional injection equipment before the stock gets exhausted. Sharps are discarded in the sharp box after giving injections to patients. Electronic needle and syringe cutter is also available to cut used needles and syringes and final disposal is done by incineration. In another study done in many East African countries such as Kenya, Ethiopia, Rwanda and Zambia, incineration of used syringes was used for final waste disposal [10]

6. Conclusion

From our study it seems that knowledge and practice of healthcare providers are nearly up to mark. Proper health facilities in the form of sufficient supply of disposable needles and syringes and proper disposal facilities are available which significantly contributes in adhering to good injection practices by healthcare providers.

7. Limitations

- It is a single centric study; information about other injection centres cannot be obtained.
- Chances of Hawthorne bias as healthcare providers may alter their behaviour when they know that they are being observed.

8. Recommendations

- Frequent training of the healthcare providers should be done regarding infection control measures and safe injection practice, to improve their knowledge and practice.
- Medication errors at the level of administering the dispensed medicines can be avoided largely by providing training to healthcare providers, maintenance

of data regarding the actual and potential errors of administration for the purpose of continuous quality improvement.

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