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EVALUATION OF INTRAVENOUS ADMIXTURE PRACTICE IN SOME MAJOR HOSPITALS OF TRIPOLI CITY

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ABSTRACT
The practice of adding drugs to intravenous fluids has many advantages; however, there exist one major disadvantage that is potentially dangerous to patients' health, this is the phenomenon of incompatibilities between the added drugs themselves and/or between the added drugs and the intravenous fluids used as vehicles. The aim of this study was to evaluate the intravenous admixture practice in some major hospitals around Tripoli city, the awareness of the personnel involved with the good practice of this type of services and, how for pharmacists were involved. The study involved field visits along with the distribution of questionnaire form to a group of physicians, nurses and pharmacists in the evaluated hospitals which were; Tripoli Medical Center (T.M.C, hospital A), Tripoli Central Hospital (T.C.H, hospital B), Jalaa Children Hospital (J.C.H, hospital C), Burn and Plastic Surgery Hospital (B&P.S.H, hospital D) Abu-Seta Chest Hospital (A.C.H, hospital E). The questions revolved around, which personnel involved with this practice and their level of knowledge about the good I.V. admixture practice, the procedures, tools, and the environmental conditions used for admixture preparation, in addition, reviewing some examples of routinely added drugs and types of I.V. fluids used, for any potential of incompatibilities. The results revealed that, I.V. admixture preparation and handling, as well as, I.V. admixture practice in the surveyed hospitals were not up to the recommended standards.

KEYWORDS: Intravenous admixture, incompatibilities.

INTRODUCTION
An IV admixture is a preparation of a pharmaceutical mixture of two or more drugs into a large bag or bottle of I.V. fluids mainly Normal saline Solution (0.9% NaCl) or Dextrose (5%) alone or in combination ordered by a physician monitored by nurses and controlled by trained pharmacists.[1]

I.V. incompatibility is an undesirable reaction that occurs between the added drugs themselves and, or the I.V. solution or the container. This undesirable reaction can be phase separation, turbidity, precipitation, evolution of gas and, a chemical degradation with no visible sign[2], such reaction renders the solution unsafe for administration to patients.[3]

I.V. admixture incompatibilities can lead to local redness, phlebitis, thrombophlebitis, thrombosis, local allergic reaction, minor organ dysfunction, respiratory difficulties, myocarditis, local embolus, systemic allergic reactions, organ failure, toxic shock, severe liver dysfunction, and multi organ failure.[4,5] Large amount of particulate matter in injections is considered as a potential life threatening health hazard.[6]

Recognizing the compatibility is not just a function of the drugs themselves, but it also depends on a variety of factors, including concentration, temperature, storage vehicle, infusion solution, order of mixing, and administration technique.[7]

The number of I.V. medications continues to expand and the need to administer different I.V. drug combinations is increasing day by day.[8]

Intravenous therapy is a complex and critical health care technology. In general; nursing staff prepare and administer intravenous drugs prescribed by physicians. Due to increased availability of number of drug combinations, the knowledge regarding the incompatibilities of intravenous drugs is limited. Sometimes this will result in severe adverse drug reactions in patients.[9] It is not possible to predict all incompatibilities that may arise, hoping that their occurrence can be minimized by presence/ alertness of a clinical pharmacist in the ward rounds, clinical review about the possible incompatibilities and by making the nurses aware of the incompatibility problems will enhance the patient safety to a substantial degree.[7,10]

Investigations have shown that mixing an I.V. drug with the wrong diluents can occur in up to 80% of the cases. This is alarming especially in the ICU where 25% of the I.V. incompatibilities are highly significant and 26% are life-threatening.[11]

The study revealed that, I.V. admixture preparation and handling, as well as, I.V. admixture practice in the surveyed hospitals were not up to the recommended standards set in a previous study which was conducted in 2009 and published recently.[12] For these reasons, most hospitals with good hospital pharmacy practice have centralized I.V. admixtures through intravenous service division of the pharmacy, with which the pharmacist has a major role in ensuring safe administration and appropriate utilization of medications to patients.

2. MATERIALS AND METHODS

This 2014 retrospective field study was carried out to determine if there was any improvement with I.V. admixture practice in light of the recommendation set by a previous study conducted in 2009. The study involved visits with interview to some clinical departments of 5 major hospitals across Tripoli city. Tripoli Medical Center (T.M.C, hospital A), Tripoli Central Hospital (T.C.H, hospital B), Jalaa Children Hospital (J.C.H, hospital C), Burn and Plastic Surgery Hospital (B&P.S.H, hospital D), Abu-Seta Chest Hospital (A.C.H, hospital E), along with distribution of questionnaire form to a group of physicians, nurses and pharmacists containing twenty two questions:

Hospital……Department……Unit ……

Participant: Physician ( ) Pharmacist ( ) Nurse ( ) Other ( ) …..

Years of experience……Specialty (physicians only)……

1. Personnel usually performing I.V. admixture is: Physician ( ) Pharmacist ( ) Nurse ( ) Other ( )
2. Are you aware of the term "I.V. or Parenteral Admixture? NO /Yes
3. Are you aware of the term "I.V. or Parenteral Admixture Incompatibility? NO / Yes
4. List the available I.V. solutions
5. List commonly used I.V. Solutions for drug admixtures?
6. List the drugs that are routinely added to I.V. solutions
7. Do you add more than one drug at a time? NO… Why? / Yes: How many drugs in average?
8. Is there a base or a reference (s) if any, on which you assign a particular I.V. solution (s) to a particular drug (s), or it is done randomly? NO / Yes
9. For your choice, do you consider the potential for?

a- Drug instability: NO / Yes example(s)

b- Incompatibility between the drug and the I.V. solution: NO / Yes example(s)

c- Incompatibility between the drugs themselves in the I.V. solution: NO / Yes example(s)

d- Therapeutic incompatibility: NO / Yes example(s)

10. For your choice, do you consider the pH of both the drug and the I.V. solution?

NO, why not? / Yes: why?

11. For your choice of an electrolyte I.V. solution, do you consider the type of the electrolyte(s)? NO, why not? Yes: why and how?
12. Are there medications you avoid adding them to I.V. solutions?

NO /Yes what are they and reason for each?

13. Are there I.V. solutions you avoid adding drugs to them? NO / Yes what are they and reason for each?
14. Do you change the flow rate of the I.V. admixture solution relative to the flow rate of the same I.V. solution but without the drug? NO, why not? / Yes why?
15. Do the following physical appearance changes of the admixture bother you?

NO, why not? / Yes: what is your action for each case?

a- Color change (including disappearance of the drug color)…….

b- Cloudiness or haziness…….

c- Cooling or warming…….

d- Micro bubbles on the inner surface……..

e- Slight precipitation……..

16. Is there any reference (s) or standard you follow for the addition of a single or multiple drugs as well as, the evaluation of the admixture?

NO / Yes these are……..

17. Do you assign a particular room or area with special conditions for the admixture operations?

NO /Yes: identify it, what is (are) the special conditions provided, if any?

18. Under what environmental conditions, the admixture operations take place?

a- In an ordinary nursing room

b- At patient bed side

c- Under laminar air flow hood

d- In restricted specially assigned clean room.

19. Do you, or do you not find it necessary to disinfect the area, wash the hands, or wearing gloves for the admixture preparation? NO, why not? / Yes: why?
20. As a pharmacist, do you check and revise the physician's admixture order for any potential of incompatibility problem? NO, why not? / Yes
21. As a pharmacist, do you notify the physician or the nurse about the potential for an incompatibility problem with ordered admixture and suggest alternative approach (s)?

NO, why not? Yes

22. As a pharmacist do you have any role, what so ever, in the I.V. admixture operations?

NO ( ), why not? / Yes ( ): what is your role?

The questions revolved around the personnel involved and their level of knowledge about the good I.V. admixture practice and, the procedures, tools, and the environmental conditions used for admixture preparation, in addition, reviewing some examples of routinely added drugs and types of IV fluids used, for any potential of incompatibilities.

3. RESULTS AND DISCUSSION

The total number of questionnaires collected was around 70 out of 96; the following histogram; figure (1) shows the number of questionnaires distributed, received, and uncounted for.

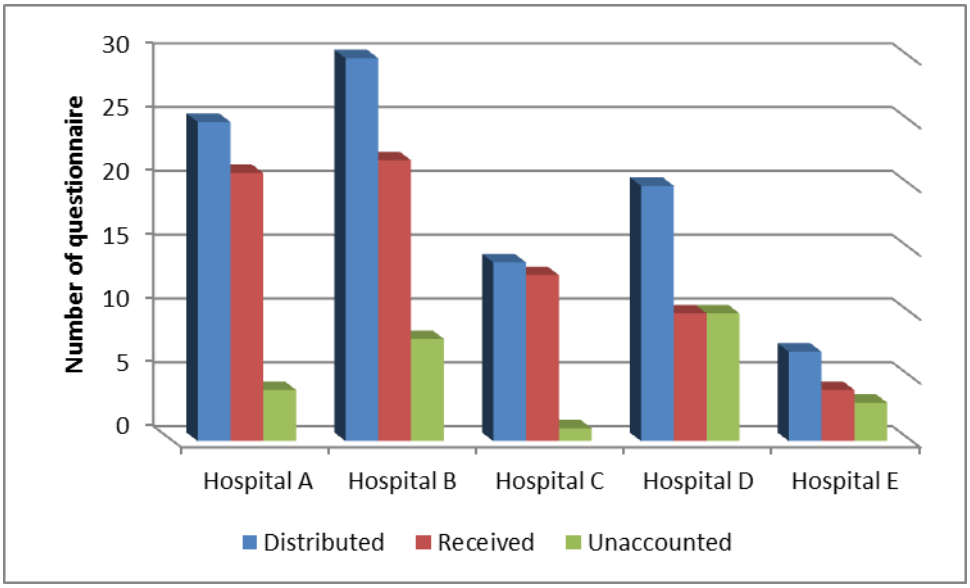

Figure 1: No of distributed and received questionnaire.

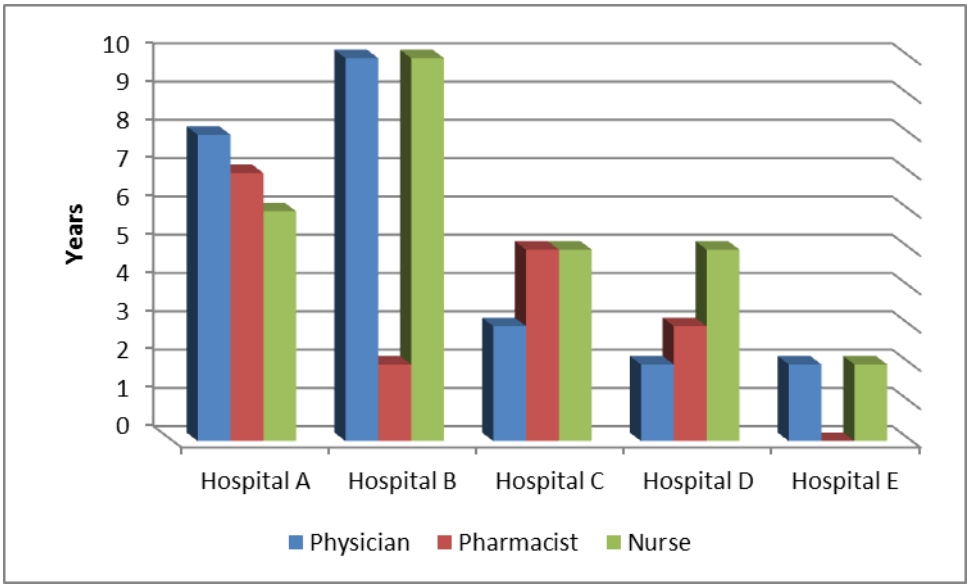

Figure 2: Average years of experience of personal involved.

Table 1: Availability of I.V. fluids.

Common name	Concentration %	Availability in hospitals
Sodium chloride	0.9%	A,B, C, D, E
Dextrose 5	5%	A, B, C, D,E
Dextrose 10	10%	A,B,C,D
Dextrose	15%	A
Dextrose	20%	A,B,C,
Dextrose	50%	A,B,C,
Dextrose saline	0.18%	A, B, C, D, E
Dextrose saline	0.45%	A,B, C,D

Dextrans	40%	D
Hartmann's solution	Multiple electrolytes	A, B,
lactated Ringer	Multiple electrolytes	A, B, C, D
Sodium bicarbonate	8.4% 4.2%	A, B, C, D
Mannitol	20%	A, B, C, D
Human albumin	25%	A, B, C, D
Plasma protein fraction	5%	A, B, C, D
Total parenteral nutrition	Lipid emulsion 20%, Amino acids 5.5%, Multiple electrolytes, Glucose 20%	B, D
Sodium chloride	10%	A, B, C, D
Sodium chloride	3%	A, C
Glucose	10% 50%	D
Intralipid®	10%	A, C

Table 2: I.V. fluids commonly used for drug admixtures.

Common name	Concentration	Availability
Sodium chloride	0.9%	A,B,C,D,E
Dextrose	5%	A,B,C,D
Dextrose	10%	C, D
Dextrose saline	0.18%	A,B,C,D,E
Dextrose saline	0.45%	A,B,C,D,E
Ringer lactate	Multiple electrolytes	A,B,D
Mannitol	20%	A
Human albumin	25%	D
Plasma protein fraction	5%	D

Table 3: Selected admixtures with potential incompatibilities in the studied hospitals.

Hospital	Added drug	I.V. fluid	Remarks
A	Furosemide	D_5W	It will precipitate at the acidic pH of dextrose
B	Filgrastim (for neutropenia)	Dextrose saline (not specified the conc.)	If it is diluted to a concentration below 15 mcg/ml, it should be protected from absorption to glass and plastic by the addition of albumin to a final concentration of 2 mg/ml.
D	Co-amoxiclave	NS	The reconstituted solution in WFI should be used or diluted immediately, within 20 minutes. Diluted for intravenous infusion (should be refrigerated; stability is for 2-3 hours at 25°C, or 8 hours at 5°C) & the infusion should be administered immediately after reaching room temperature.
A & D	Any Adding drugs	Mannitol 20 Human albumin Plasma protein	Drugs never added to these I.V. fluids
D	Colistin (colistimethate, polymyxine)	WFI	Stable in any one of the following: NS, D_5 W, D_5 ½ NS, LR, D⅕ NS However, they use only WFI, to avoid stability problem.
D	Flagyl (metronidazole)	NS	Reconstituted vials must be neutralized with 5 mEq sodium bicarbonate for each 500 mg used.
E	Voltaren (diclofenac)	NS	Must be diluted with NS or D_5W infusion solution buffered with sodium bicarbonate according to the instructions. P.S: In all other hospitals voltaren was injected intramuscularly only, on a wrong information that it is never be used intravenously

DISCUSSION

After analyzing and evaluating the feedback answers from the hospital personnel involved in the study, the following issues were revealed:

- Most (if not all) personnel involved with I.V. admixtures (physicians & nurses) either have wrong or unacceptable information on the components of good I.V. admixture practice requirements (area, policies & procedures, personnel, system and, storage).
- The I.V. admixtures were entirely carried out by nursing staff, with neither pharmacist involvement, nor supervision.
- No review, checking or follow up on flow rate and infusion period for I.V. fluid containing medicines.
- The preparation areas were simply ordinary rooms, i.e. none of standard clean room conditions, requirements or tools were there, figure (3).

Figure 3: Ordinary room for admixtures preparation.

- Neither cautionary label as to administer immediately, nor refrigerate for use within 24 hours.
- Neither laminar air flow cabinets (vertical or horizontal) were present in any hospital nor appropriate aseptic techniques or protocols were observed**;**

1- The nurses simply wash their hands with water; they only wear gloves for preparing IV admixtures in ICU areas.
2- They do not remove jewelry from their hands and wrists.
3- They neither visually inspect vials, ampoules, and I.V. solution containers for signs of cloudiness, particular matters, and cracks, nor they disinfect them or disinfect working surfaces.
4- They eat and drink in the nursing room where they prepare I.V. admixture, these rooms mostly were loaded, crowded, and poorly lighted, figure (4).

Figure 4: Overloaded preparation room.

- In one hospital, I.V. admixtures were prepared on a mobile medicine cart in the hallway (corridor), figure (5).

Fig. 5: Preparing I.V. Admixture on a mobile cart in the hallway.

- There was no, in any way, good practice of I.V. admixture program in all of the studied hospitals, that is because the basic rules and information on these matters are part of the pharmacist curriculum. Unfortunately, however, the pharmacists were not involved in I.V. admixture preparation!
- Who to be blame? Everybody: starting from the faculty as not enough emphasis to introduce and explain the pharmaceutical care concept and back ground of the graduates to higher health authorities, through union or the society or the association of the pharmacists.
- One can imagine from this study, what would be the benefits of the pharmacist presence with the health team as a partner not as a follower.
- The hospital pharmacy department in any hospital should play an active part in patient care by making pharmacists' expertise available to the clinical departments of the hospital.

- The area and aseptic techniques for intravenous admixture preparation and refrigeration must be available and professionally operated and monitored to ensure safety and efficacy of intravenous therapy.
- The pharmacists and nurses should keep reference file and charts of I.V. admixture dilution and compatibility to help in choosing proper fluid and conditions for each added drug.

CONCLUSION

There was no, in any way, good practice of I.V. admixture programs in all of the studied hospital, no enough emphasis and efforts done by the union, society or the association of the pharmacists on higher health authorities whether in hospitals or at the ministerial level, to apply good pharmaceutical care processes or systems, for this the faculty of pharmacy has a major role to play by making their expertise available to hospitals and health authority. The area and aseptic techniques for intravenous admixture preparation and the refrigerators must be available and professionally operated to ensure safety and efficacy of intravenous therapy, the pharmacist and nurse should keep reference file and charts of I.V. admixture dilution compatibility for choosing proper fluid and conditions for each added drug.

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