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Article

Parenteral Drugs Administration Errors in Humans and the Complications Results from That in Al-Diwaniyah General Teaching Hospital

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Abstract: The current cross-sectional study included (94) cases, it was distributed into (43, 16, 15, 20) which resulted from the wrong injection of the treatment in the areas (IM, IV, SC and ID, respectively). The patients' ages ranged from 10 months to 70 years, with an average age of 28.92 years. The experiment was random. We analyzed the basic data to monitor the injection error. Samples were collected from Al-Diwaniyah General Teaching Hospital, Women and Children Teaching Hospital, Al-Iskan Health Center, and Al-Taqiyah Health Center, in the period from November 2021 to April 2022, most of the disease cases resulting from injection error varied in the genders of the infection between males and females, and the type of drug substance (ampoule, vial) had a clear effect on the changes and complications of the error at the injection site, and this appeared with statistically significant differences ($p < 0.05$). It was also noted the emergence of some signs accompanied by complications, the effect of which was clear in the difficulty of walking, pain, itching and redness accompanied by numbness and swelling, as well as cyanosis and stiffness at the injection site, and this led to the emergence of statistically significant differences ($p < 0.05$). The relationship between the types of treatments and the relationship between the types of treatments and the complications of injection error was also clear. It was noted that the used treatments are paracetamol, antibiotic drugs, decadron, heparin, filler, insulin, tuberculin test, sensitivity test, and the cannula, where changes appeared in the injection area accompanied by the previously mentioned complications. It should be noted that most cases recovered (26%), leaving only slight marks after recovery. Aims to identify the errors of the most important methods of injection and complications resulting from them to reduce medication errors. When feeling one of the signs of a therapeutic allergic reaction immediately after the injection, you should go to the doctor or seek health care immediately, and more research should be done to discover the causes of injection errors, as well as work on more research to discover the causes of injection error, monitoring health professionals , training them, and developing their practical and scientific skills to avoid error.

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1. Introduction

Injection is a method of introducing a drug, vaccine or other therapeutic substance into the body using a needle, as it is one of the most common healthcare procedures worldwide, and the most common types of injection are (subcutaneous injection (SC), intradermal injection (ID), intravenous injection (IV) and intramuscular injection (IM) [1]. IM means injection of a substance into a muscle [2]. In medicine, it is one way of introducing a drug into the body through muscles, and it is one of several alternative methods of drug delivery [3]. This method is preferred over some other methods such as subcutaneous or intradermal injections, because the muscle has a larger size and has many blood vessels, which accelerates the absorption of the drug, and the drug that is injected in this way does not pass the effect of enzymes Digestive as occurs in case of oral administration Common sites for intramuscular injection are the trigeminal muscle of the scapula, the gluteal muscle of the lower extremities, and in infants, the injection is usually done in the thigh muscle and intramuscular injection has a relatively long-lasting clinical effect [4].

Long-Acting injectable (LAI) that lasts from several weeks to several months. However, there are risks such as vascular damage, muscle spasm, and nerve injury due to incorrect intramuscular injection [5], [6] and injection site reactions. Redness and swelling, which may occur particularly with LAIs [7]. Given the safety aspects of injection such as prevention of nerve and blood vessel injury, and injection site reactions, obtaining correct injection technique is a major issue for doctors and nurses [8]. Intravenous injection, where the drug is given directly into the vein using a needle and tube, which makes it reach the bloodstream quickly, and this is important in emergency cases such as: heart attack, stroke, or poisoning that requires the patient to receive the drug very quickly [9] and gross patient outcomes are more responsible for parenteral drug administration errors than for other adverse events [10].

Research in the US has also shown that intravenous medication errors have a higher mortality rate. Much higher than the errors of other drugs [11]. Subcutaneous injection is one way of giving many types of drugs for different medical conditions, and in this type the drug is injected into the fatty tissue located just under the skin, because there are fewer blood vessels in the fatty layer of the connective tissue. It requires less depth compared to the muscle tissue [12], there are some drugs that cannot be taken orally, such as: insulin and heparin. It is also considered a useful and safe method, as well as it is the best place for subcutaneous injection, which depends on the person's sensitivity to pain and the location of some subcutaneous fat which is the layer between the skin (dermis) that contains adipose tissue ideal for insulin absorption, the dermis and subcutaneous region describe the depth of tissue from the surface of the skin to the muscles i.e. epidermis, dermis and subcutaneous tissue where this suction is used. A study was conducted to estimate the risks of intramuscular injection and the importance of choosing the correct needle length for injection in this area [13]. The rates of medication errors in hospitals have started to increase recently, which prompted us to collect data for primary care. It is difficult to estimate the prevalence of medication errors due to the different definitions and classification systems used, as they can differ according to the patient, the prescription, or a specific drug, and the challenge is exacerbated by differences in the organization. The health care system and the availability and use of accident reporting systems [13]. Because of the increasing prevalence of diabetes, a transition to insulin use earlier in type 2 diabetes and new classes of subcutaneously injectable non-insulin drugs is essential for diabetes management [14]. Therefore, an appropriate subcutaneous injection technique by individuals is necessary to reduce absorption variability and improve the effect of the drug and thus achieve the goals of the therapeutic substance in the blood [15]. Intradermal injection is the injection of the therapeutic substance directly under the epidermis, as this method has a longer absorption

time. Compared to subcutaneous and intramuscular injections. So it is used in allergy tests such as the tuberculosis test and allergy test, as well as in local anesthesia, where the body's reaction to the injected material is more noticeable because it is closer to the surface as well [16]. Medication error is a significant cause of preventable adverse drug reactions. It can occur in the form of administering the wrong drug, in the wrong dose, to the wrong patient, using an inappropriate method of administration, and thus damage to the intradermal hypersensitivity test with cloxacillin, leading to pain and skin necrosis as a result of medication error [17]. An intradermal drug test is performed to detect hypersensitivity to cloxacillin in low doses to check drug sensitivity or the error is caused by the wrong dilution of the medication by a trained nurse [18], [19]. The study aims to identify the errors of the most important injection methods and the complications resulting from them to develop strategies to reduce medication errors and give them.

2. Materials and Methods

2.1. Experimental data

The experiment was random, we analyzed the basic data of the injection error, so the study was to monitor the injections error in IM, IV, SC and ID. The samples were collected from Al-Diwaniyah General Teaching Hospital, Women's and Children's Teaching Hospital, the Health Housing Center and Al-Taqiyah Health Center, from November 2021 to April 2022. The study population included all available medications administered by nursing staff to patients. A total of 94 samples were obtained. The selection was based on the pathological changes observed in the pathological data collection form, depending on their relationship to the treatment used and the complications that occurred at the injection site. Observed complications included difficulty walking, pain, itching, and redness in the injection area. Numbness, swelling, and cyanosis or trauma were noted, in addition to stiffness at the injection site. The monitoring method was preferred over self-reporting and a medication error survey questionnaire to help provide the most reliable data. Thus, it was observed that monitoring nurses during drug administration didn't significantly affect administration errors. It should be noted that the study didn't intend to evaluate individual clinical practices or standards of care.

2.2. Statistical analysis

The statistical analysis of the data in this trial was carried out according to a completely randomized design [20] in order to determine the effect of frequency senses for each of the independent variables. (sex, age, type of treatment, place of injection, complications and their relationship to type of treatment) using the exact test for variables, where the data were tested randomly. The comparison between the means was done using Duncan test (Duncan 1955) at the level of probability of 5% or 1% to test. The significant differences between the means of the traits and the application of the statistical program SAS (2010).

3. Results and Discussion

3.1. Demographical study, ages and genders of patients

The current study is a cross sectional study, included (43, 16, 15, 20) which was caused by the injection error of the treatment in the (IM, IV, SC and ID regions, respectively). The ages of the patients ranged between 10 months to 70 years, with an average age of (28.92) years, as shown in Table 1. Most of the pathological cases resulting from the injection error of IM treatment in females were 51% and in males 49%, while the results of the injection error of IV treatment showed 50% for both females and males, and the results of injecting error the treatment SC in females were 60%, while in males was 40%. The results for injecting error the treatment ID were 40% for females and 60% for males, as shown in Figure 1, 2, 3, 4. Medication errors are a major problem in nursing because most cases of

medication errors are not reported by nurses [21]. The difficulty of obtaining accurate statistics on medication errors since previous studies, despite the many benefits and the ethical basis for detecting and reporting errors, is due to the nurses' reluctance to report their errors in order to protect themselves, or they may be subject to administrative penalties and the fear of patients' reactions to that [22]. The majority of physicians are involved in prescribing medications that can be given by intramuscular injection (such as vaccines, vitamins, steroid hormones, major analgesics and sedatives) [23]. Medication errors are also among the most common health-threatening errors affecting patient care and such errors are a global problem that increases mortality rates, length of hospital stay, and related costs [24]. Therefore, it was noted that the statistically significant relationships between medication errors, age of the patient, work shifts, and years of practical experience for the treated disease have a significant relationship with intravenous injection errors and gender, so medication errors can greatly affect patient safety and treatment costs, which leads to risks for patients and their families [24], [25].

Table 1. The age characteristics of the patients in different type of injection

Age Properties Injection types	Age range	Age rate (years)	Normative deviation (years)	Standard error	Total No.
Intramuscular	2-70 years	28.93	8.78	1.338	43 patients
Intravenous	25 days-68 years	30	11.77	0.16	16 patients
Subcutaneous	21-65 years	41	9.89	2.55	15 patients
Intradermal	10 months-68 years	29.21	15.9	21.27	20 patients
Total	94 patients				

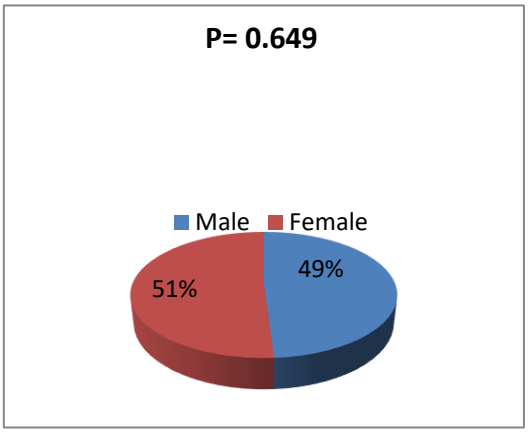

Figure 1. The percentage distribution of IM injection in pathological conditions by gender

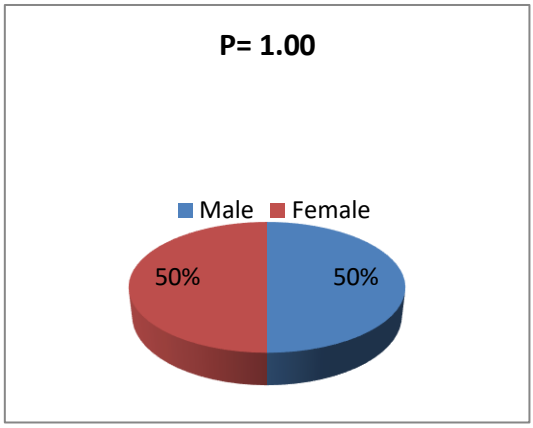

Figure 2. The percentage distribution of IV injection in pathological conditions by gender

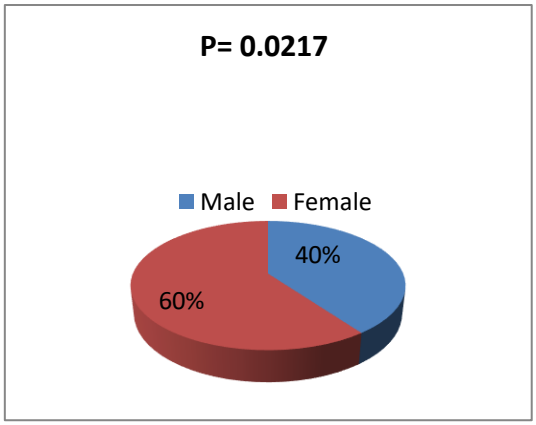

Figure 3. The percentage distribution of SC injection in pathological conditions by gender

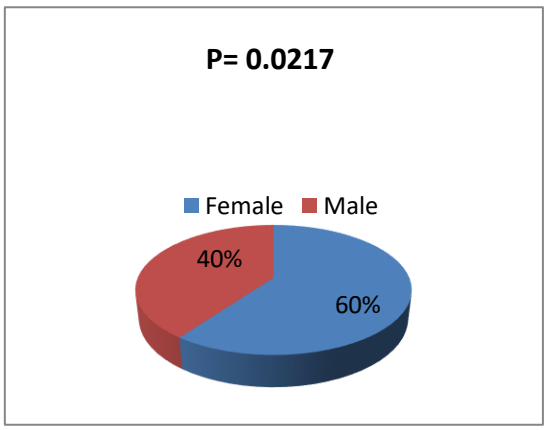

Figure 4. The percentage distribution of ID injection in pathological conditions by gender

3.2. Type of medication material and its complications

The current study showed that (86%) of the IM injection included the use of ampule for the treatment, while it was in the form of viale by (14%), and in the IV injection (63%) in the form of ampule, while in the form of viale (37%) and in the ID injection (80%) of doses in the form of Ampule and viale form (20%), and all doses were used in ampule form in SC injections. This led to the emergence of statistical differences ($p<0.05$), as shown in Figure 5, 6, 7.

Although medication error can also be caused by the health care team, injection errors are more common than with other methods of administering medication [26], [27], where previous studies noted this in the medical complications resulting from medication

errors, and according to previous research, it was also found that thousands of people die because of these errors every year [28].

Medication errors can lead to negative outcomes such as increased hospitalization time and increased medication [29], [30], where studies noted that medication errors because prolonged hospital stay and increased treatment costs [31].

In Table 2, we note that 26% of the injection cases were not accompanied by complications, and 15% were accompanied by difficulty walking, and 11% were suffering from pain, itching, and redness in the injection area, in addition to 15% who were accompanied by numbness and swelling in the injection area, and it was also noted that 17% of them were suffering from the blueness of the injection site, and also 16% suffered from hardness at the injection site, and this led to the emergence of statistical differences ($p < 0.05$), as shown in Figure 8.

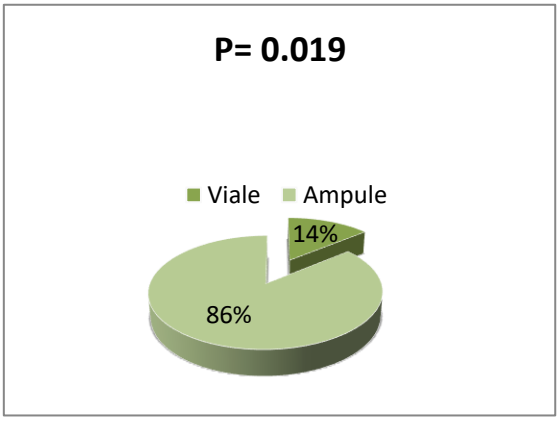

Figure 5. The complication associated with IM injection

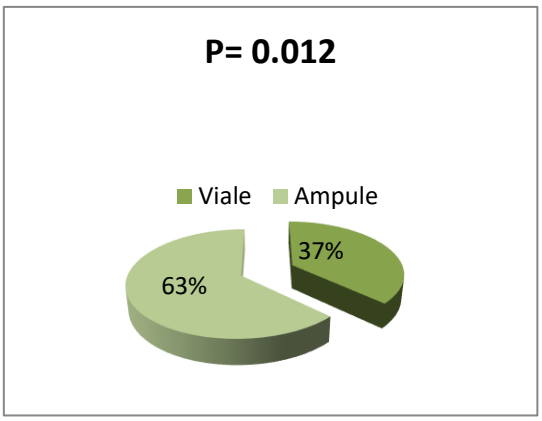

Figure 6. The complications associated with IV injection

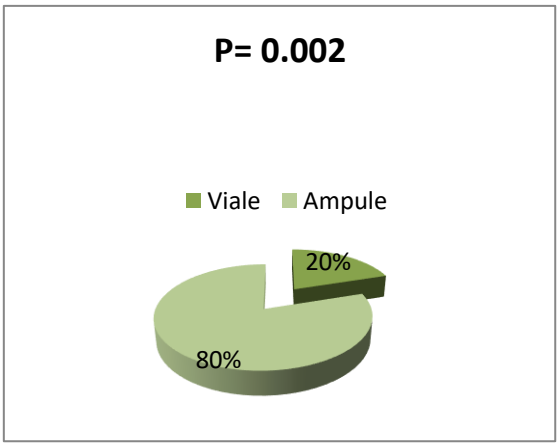

Figure 7. The complications associated with ID injection

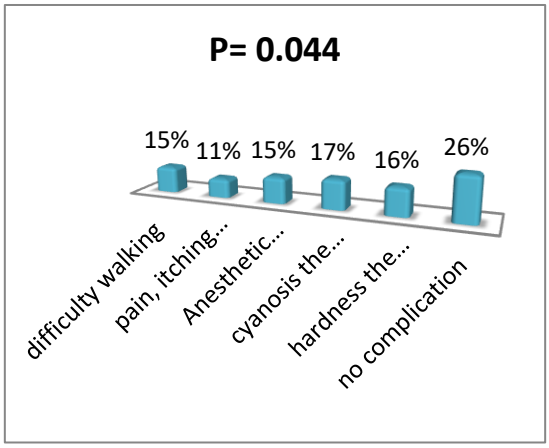

Figure 8. Injection error complication

Table 2. Injection error complication in types of injection

Complication	Total	SC	IV	ID	IM
Difficulty walking	15%	3%	1%	2%	9%
Pain, itching and redness	11%	1%	2%	5%	3%
Anesthetic area and swelling	15%	3%	9%	1%	2%
Cyanosis the injection site	17%	5%	3%	5%	4%
Hardness the injection site	16%	5%	2%	7%	2%
No complication	26%	8%	5%	7%	6%
Total	100%	25%	22%	27%	26%

3.3. Relationship between types of treatments and the complications of the injection error

The injections error with paracetamol, antibiotics drugs, decadron, heparin, filler, insulin, tuberclin test, allergy test and cannula as shown in Table 3. Showed in Paracetamol injection error (17 patients) swelling, Hardening and paresthesia in the injection area. While in antibiotics injection error (13 patients) caused pain, redness, and then Cyanosis as well as Swelling at the injection area. Also in Decadron injected error (9 patients) caused Hardening and paresthesia in the injection area, and when heparin injected error (11 patients) cause redness, pain, swelling and then Cyanosis of the injection site, and when filler injected error (19 patients), it was observed Hardening, Cyanosis and Swelling at the injection site. In insulin injected error (8 patients) it cause of pain, redness, and then Cyanosis of the injection area. The Tuberclin test injected error (5 patients) it was noted that caused redness, Pain and then Cyanosis of the injection area, but when a sensitivity test injected error (6 patients), it was noted cause Pain, redness and then Cyanosis of the injection area, and when Canulation injected error (4 patients) notice Cyanosis and pain in the injection area.

Third world countries and developing countries, it is almost impossible to find the exact number of medication errors caused by the lack of proper archiving and reporting systems as well as the lack of a data recording system. However according to the increasing number of complaints from the medical staff to the courts and the increase in judicial evidence, experts consider the rates of medication errors to be high in the countries mentioned [32].

Injection site reactions such as redness and swelling, which may occur in particular to therapeutic substances containing LAIs [5] and extended long-term indications for the number of treatments administered will result in an increased number of adverse events,

and that most adverse reactions. They can cause more serious adverse events, leaving patients with long-term or permanent functional and aesthetic defects. Some reactions occur immediately after treatment, while others have a delayed onset [33].

Table 2. Relationship of type of treatment to injection complications

Type of Treatment	No.	Complication	No.
Paracetamol	17	Swelling at the injection site	9
		Hardening and paresthesia in the injection area	8
Antibiotics	13	Pain, redness, and then Cyanosis of the injection area	10
		Swelling at the injection site	3
Decadron	9	Hardening and paresthesia in the injection area	9
Heparine	11	Redness and pain at the injection site	2
		Swelling at the injection site	4
		Cyanosis of the injection site	5
Filer	19	Hardening and Cyanosis at the injection site	12
		Swelling at the injection site	7
Insullin	8	Pain, redness, and then Cyanosis of the injection area	8
Tuberclin test	5	Redness of the injection site	3
		Pain, redness, and then Cyanosis of the injection area	2
Sesitivity test	6	Pain, redness, and then Cyanosis of the injection area	6
Canulation	4	Cyanosis and pain in the injection area	4
Total	94	Total	94

Figure 9. Girl one-month-old, intravenous injection in the hand with antipyretic treatments Paracetamol, and we notice the injection site turning blue

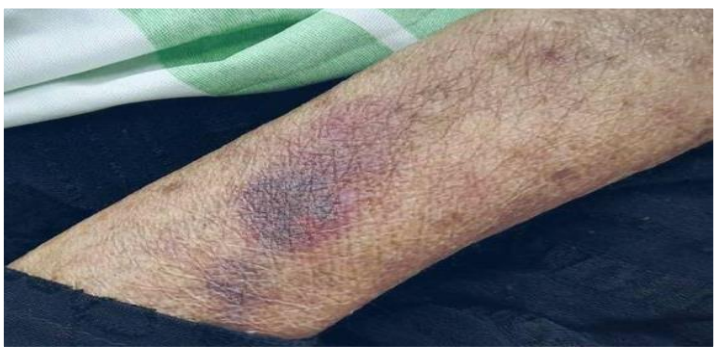

Figure 10. Women 68-year-old who received an intravenous injection in the hand to treat infections with Decadron, which caused the hand to turn blue

Figure 11. The hand of a 22-year-old girl showing the IV injection error of Paracetamol and Decadron, which caused the hand to swell and the injection site to turn blue

Figure 12. A 25-day-old child showing an intravenous injection in the foot. We notice the injection site turning blue

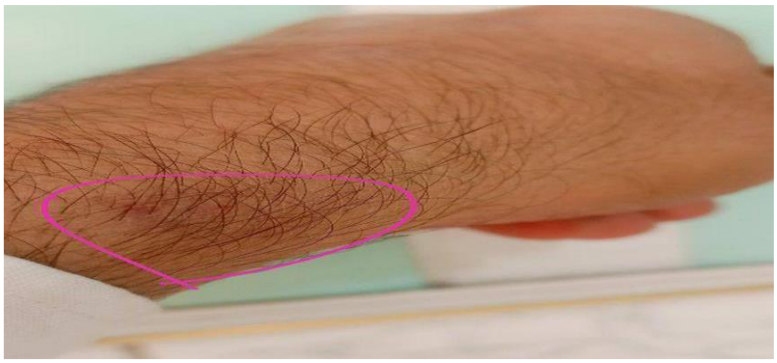

Figure 13. A 20-year-old man showing an IV injection error in the hand showing the blueness and enlargement of the hand

Figure 14. An error in SC injection error of a pregnant woman suffering from blood clotting after being injected with a Heparin syringe

Figure 15. SC injection errors of a person with diabetes after being injected with insulin

Figure 16. The SC injection error for sensitivity test showing redness and swelling of the injected area

Figure 17. The SC injection error for sensitivity test showing the shape of trauma and pigmentation of the injection area

Medication errors are the most common form of medical error, and it is estimated that they have contributed to 12,000 deaths annually, which is why the World Health Organization estimates that harm to patients due to medication errors will increase by 50% by 2022 [9]. Serious patient outcomes significantly accounted for intravenous drug administration errors compared to other adverse events. In the United Kingdom, 62% of voluntarily reported incidents resulting in death or severe harm to a patient involved intravenous administrations [10].

Research in the United States has also shown that intravenous medication errors have a much higher associated mortality rate than other medication errors [11].

The use of injections may be associated with the risk of transmission of infectious diseases. Whereas, intravenous drug errors do not result solely from direct individual action [1]. And unsafe injection practices will logically affect other blood-borne diseases through the reuse of injection equipment, such as hemorrhagic fever and others, as reuse and unsafe practices also lead to an increased risk of bacterial infection [34].

For many years, insulin has been shown to be associated with more medication errors than any other type or class of medication. Insulin was associated with 11% of all AEs in hospitals. Recent studies add evidence of a higher frequency of insulin involvement in AEs [35], [36].

An increasing volume of error reports are associated with selecting a particular vial of medication and the wrong unit of dose measure when drawing it from the vial into the syringe. Many drug errors may be due to similar names, name confusion, or similar dosage and route of administration [37].

A severe allergic reaction when it has occurred previously if the patient is so hypersensitive to certain substances that even the small amounts used in skin tests could result in a life-threatening reaction (anaphylaxis) [38]. Medication error is an important cause of preventable adverse drug reactions and can occur in the form of giving the wrong drug, in the wrong dose, to the wrong patient, in the wrong dosage form, and using the wrong route of administration [39]. All dermal fillers have the potential to cause bruising and are noticed more frequently after direct intradermal injection [16], [29].

It must be mentioned that most of the cases recovered (26%), and only minor signs remained after recovery, the most important of which was redness and mild pain at the injection site.

The study of failures, damaging errors to the area, and the long recovery time of the error must be included, which made it difficult. Therefore, all patients included in the

study made at least one injection with a technical error. Therefore, the need for continued training and education on correct injection technique must be noted [40].

4. Conclusion

Medication error is considered one of the biggest nursing problems because most cases of medication errors are not reported by nurses. The difficulty in obtaining accurate statistics on medication errors is due to previous studies, despite the many benefits of detecting and reporting errors due to nurses' fear of reporting their errors. In order to protect themselves, or they may be subject to administrative penalties as medication error is an important cause of adverse drug reactions that cannot be prevented and can occur in the form of giving the wrong medication, in the wrong dose, to the wrong patient, in the wrong dosage form, and using the wrong method of administration. All dermal fillers have the potential to cause bruising, which is frequently observed after direct intradermal injection. And although a medication error can also be caused by the health care team, injection errors are more common than with other ways of giving medication.

Medication errors are also among the most common health-threatening errors that affect patient care. Such errors are a global problem that increases mortality rates, risks to patients and their families, length of stay in the hospital, and treatment costs. Therefore, medication errors can lead to negative results such as increased treatment time. Hospitalization and medication increase. As it was observed that there are statistically significant relationships between medication errors, the patient's age, and sex, so medication errors can greatly affect patient safety. Reactions at the injection site such as redness and swelling, which may occur particularly for therapeutic substances that have long-term indications for a number of treatments taken will lead to an increased number of adverse events, and that most adverse reactions can cause more serious adverse events, this leaves patients with long-term functional and aesthetic defects.

When feeling one of the signs of a therapeutic allergic reaction immediately after the injection, you should go to the doctor immediately. Also, more research should be done to uncover the causes of injection errors. Health professionals must be monitored and trained and their practical and scientific skills should be developed to avoid the occurrence of errors.

5. Recommendations

One of the most important general precautions and important recommendations that can limit the wrong injection is the necessity of washing hands well before starting to prepare the injection and after completing the injection and cleaning the place to be injected well with alcohol to reduce the chances of germs entering the body and leaving the area for a few seconds to dry, and after completing the injection process. The syringes must be disposed of in a special container in a safe manner. The injection site must also be changed frequently because injection in the same place causes hardening of the fatty area and lipid hypertrophy. To reduce pain and irritation at the injection site and other damages, the doctor, pharmacist, nurse or any medical team must also give the medicine to the patient according to the prescription. Which the doctor puts, and it is in appropriate doses according to the weight and age of the patient, with the necessity of giving the medicine in the correct place and method, because any mistake can lead to irreversible complications.

Ensure that the patient is allergic to a particular drug. Therefore, an allergy test must be taken into account before administering the drug by knowing the patient’s medical and medical history and avoiding blood-thinning drugs that can affect the results of the allergy test, including antihistamines, aspirin and many antidepressants a week before. From a filler injection procedure, as well as when the patient has skin diseases such as eczema in large areas of the skin on the arms and back, which represent usual test sites that may affect the results of allergy test reactions, and in cases that require obtaining medical care, you must go to the doctor or seek care healthy if you feel any of the signs of a rash, itching,

shortness of breath, swelling of the face, mouth, lips, coughing, sneezing, or fever immediately after the injection, or the appearance of bruises or lumps at the injection site. Also, work on more research to reveal the causes of errors in injections, and workers in the health professions must be monitored and trained, and their practical and scientific skills should be developed to avoid the occurrence of errors.

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