ASSOCIATION BETWEEN POTASSIUM CHLORIDE INTRAVENOUS CONCENTRATION AND SEVERITY OF THE PAIN.

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1- Introduction:

Pain is an unpleasant feeling often caused by intense or damaging stimuli. The International Association for the Study of Pain's widely used definition states: "Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage."

Pain motivates the individual to withdraw from damaging situations, to protect a damaged body part while it heals, and to avoid similar experiences in the future. As result the patient compliance may be effected as well as it can significantly interfere with a patient's quality of life and general functioning. Furthermore, nurses have reported numerous incidents of patients experiencing pain at the infusion site when the contents of these potassium chloride minibags were administered with a peripheral venous cannula. Indeed, in a number of instances patients refused further doses because of the pain experienced during the first infusion.

Local side effects related to potassium chloride intravenous administration have included phlebitis or erythema at the injection site and pain with infusion. Local reactions related to intravenous administration of potassium chloride occur in up to 25% of patients. While the pain at the injection site and phlebitis may occur during IV administration of solutions containing 30 mmoL potassium or more per litre. Therefore, it is strongly recommended dilute 40 mmoL or less of potassium chloride in 1 liter or more of intravenous solution and administering this concentration in no less than 1 hour in order to reduce the likelihood of this problem. If the clinical situation is not critical and the patient's serum potassium is 2.5 mmoL/L or more, an infusion rate not to exceed 10 mmoL/hour is recommended.

Given that hypokalemia is a common occurrence in hospitalized patients and that severe hypokalemia can be life-threatening, it is important that intravenous potassium replacement be carried out with a minimal chance of infusion failure caused by phlebitis, extravasation, or patient refusal because of intolerability. It is also of paramount importance that patients' discomfort be kept to a minimum.

2-Purpose:

To establish the relationship between the intravenous potassium vehicle, concentrations and infusion rate with the severity of the pain.

3-Methodology

3-1 Design

Observational prospective Study

3-2Inclusion Criteria

1- Receive potassium chloride intravenous
2- Able to be interviewed
3- Adult

3-3 Exclusion Criteria

If the patient has pre-existing local pain, tenderness, or phlebitis.

3-4 Method

A sample of 150 prescriptions (patients) selected randomly. Randomization carried out by using a computerized randomization program to select two prescriptions in daily on different hospital areas and times randomly**.**

A consent form was given for each patient before the interview as shown in figure (2). A data collection forms were developed then interview surveys were carried out among the patients who are going to receive intravenous potassium treatment using the developed forms. The first form was used to collect the patient and medication data figure (3) while the second form was used to assess the patient pain figure (4).

An intravenous cannula should be inserted at least 1 hour before the start of the potassium chloride infusion, and all sites were inspected before the first infusion to ensure that there is no obvious pre-existing local pain, tenderness, or phlebitis.

In order to assess the patient pain, a numeric rating scale (NRS) ranging from 1 (no pain) to 10 (worst pain) was used to rate pain at the infusion site. The pharmacist asked patients to rate the severity of pain at the infusion site using the NRS before the start and at 1 hour after the start. The pharmacist also recorded the name and dose of any other drug that was being infused through the same cannula at the same time At the completion of each mini-infusion. The nurse, inspected the infusion site and recorded any signs of redness or heat.

The osmolality and pH of the potassium chloride solutions were determined for 3 samples of each group of solutions. The pH were determined too.

3-1 Statistic test

Linear regression models for comparing unequal means/variances or sample sizes was used to explore the relationship between solution concentrations and infusion rate with the severity of the pain

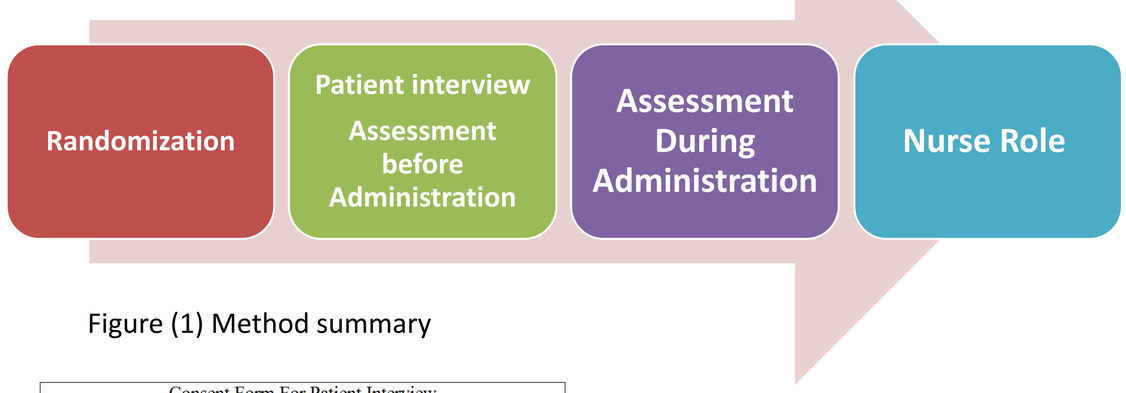
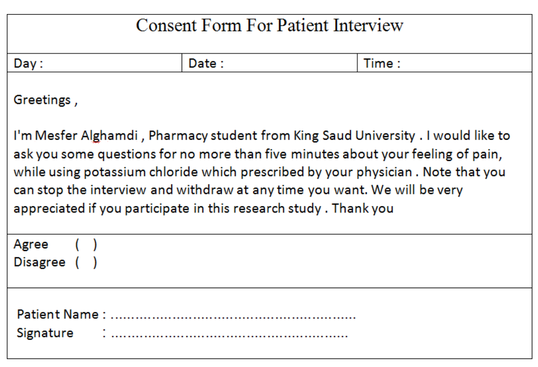


Figure (1) Method summary



Consent Form For Patient Interview

Day : Date : Time :

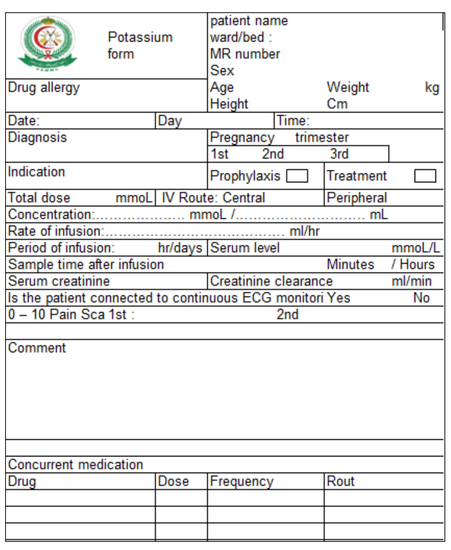
Greetings ,

I'm Mesfer Alghamdi , Pharmacy student from King Saud University . I would like to ask you some questions for no more than five minutes about your feeling of pain, while using potassium chloride which prescribed by your physician . Note that you can stop the interview and withdraw at any time you want. We will be very appreciated if you participate in this research study . Thank you

Agree ( )
Disagree ( )

Patient Name : .....
Signature : .....

Figure (2) Consent form



Potassium form

patient name
ward/bed :
MR number
Sex
Age Weight kg
Height Cm
Drug allergy
Date: Day Time:
Diagnosis Pregnancy trimester 1st 2nd 3rd
Indication Prophylaxis Treatment
Total dose mmoL IV Route: Central Peripheral
Concentration:..... mmoL /..... mL
Rate of infusion:..... ml/hr
Period of infusion: hr/days Serum level mmoL/L
Sample time after infusion Minutes / Hours
Serum creatinine Creatinine clearance ml/min
Is the patient connected to continuous ECG monitori Yes No
0 – 10 Pain Sca 1st : 2nd
Comment
Concurrent medication

Drug	Dose	Frequency	Rout

Figure (3) Data collection form

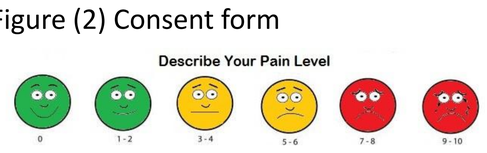


Figure (4) The numeric rating scale (NRS)

4- Results

A sample of 150 prescriptions (patients) selected randomly. Patients ages average is 48.27 years. The average potassium level prior infusion was 3.17 mmol/L. There was no pre-existing local pain, tenderness, or phlebitis at the site of the infusion, and pain scores before the start of the infusions were 0 (no pain) for all selected patients. The study showed that the association between the concentration and pain is statically significant (*p* 0.048). The lowest infusion rate was 20 mL/hour and the highest was 250 mL/hour with an average 105.25 mL/hour. The study showed that the association between the infusion rate and pain is not statically significant (*p* 0.062).

Table (1) Demographic data

Age group	female	Male	Total
15-24	10	9	19
25-34	10	15	25
35-44	14	14	28
45-54	14	3	17
55-64	21	10	31
65-74	8	1	9
75-84	8	9	17
85-94	2	1	3
95-104		1	1
Total	**87**	**63**	**150**
Avrage	**49.80**	**46.14**	**48.27**
Standard deviation	**18.49**	**20.82**	**19.52**

Table (2) Osmolarity according to the infusion site and age group

Osmolarity	Central	Peripheral	Total
175-275	0	2	2
275-375	0	7	7
375-475	2	33	35
475-575	0	33	33
575-675	5	57	62
675-775	0	9	9
775-875	0	1	1
1075-1175	1	0	1
Total	**8**	**142**	**150**
Avrage	**638.00**	**550.44**	**555.11**
Standard deviation	**211.39**	**106.40**	**114.90**

Table (3) Vehicle and IV route

Concentration mmol/L	Central	Total Central	Peripheral						Total Peripheral	Grand Total
	NS		½ NS	D5	D5 +NS	D5+ 1/2NS	D5+ 1/4 NS	NS		
5-15			1		3	5	4	1	14	14
15-25	1	1	1		9	9		4	23	24
25-35					2	10	2		14	14
35-45	1	1	2	1	2	4		19	28	29
55-65			1			2		9	12	12
75-85	5	5	1	1		4		41	47	52
85-95								1	1	1
95-105								2	2	2
115-125								1	1	1
195-205	1	1								1
Total	**8**	8	**6**	**2**	**16**	**34**	**6**	**78**	142	**150**

½ NS= half normal saline D5 +NS= Dextrose 5% and Normal saline D5+1/2NS= Dextrose 5% and half Normal saline NS= Normal saline

Table (4) Potassium level prior infusion

Serum level mmol/L	Central	Peripheral	Total
2.1-2.6	1	9	10
2.6-3.1	3	56	59
3.1-3.6	4	49	53
3.6-4.1		23	23
4.1-4.6		4	4
4.6-5.1		1	1
Grand Total	**8**	**142**	**150**
Avrage	**3.10**	**3.17**	**3.17**
Standard deviation	**0.31**	**0.48**	**0.47**

Table (5) Severity of the pain after administration according to the gender

Severity of the pain	Female	Male	Total
0	39	31	70
1	5	2	7
2	24	13	37
3	13	5	18
4	5	9	14
5	1	1	2
6		2	2
Total	**87**	**63**	**150**

Table (6) Severity of the pain after administration according to infusion site

Severity of the pain	Central	Peripheral	Total
0	7	63	70
1		7	7
2	1	36	37
3		18	18
4		14	14
5		2	2
6		2	2
Grand Total	**8**	**142**	**150**

5- Limitations

Limitations of this study is the other risk factors not taken into account, such as the cannula used, the anatomical location of the cannula, and the duration of cannulation, which also affect pain at the infusion site.

Table (7)Severity of the pain after administration through peripheral line according to Osmolarity

Severity of the pain	175-275	275-375	375-475	475-575	575-675	675-775	775-875	Total
0		2	13	22	23	3		63
1			2		5			7
2	1	3	6	6	17	3		36
3		1	7	1	8	1		18
4	1	1	4	4	3	1		14
5						1	1	2
6			1		1			2
Grand Total	**2**	**7**	**33**	**33**	**57**	**9**	**1**	**142**

Table (8)Severity of the pain after administration according to vehicle

Severity of the pain	½ NS	D5	D5 +NS	D5+1/2NS	D5+1/4 NS	NS	Total
0		1	9	21	2	37	70
1			1			6	7
2	1		1	10	4	21	37
3	2		3	3		10	18
4	3	1				10	14
5			1			1	2
6			1			1	2
Grand Total	**6**	**2**	**16**	**34**	**6**	**86**	**150**

Table (9)Severity of the pain after administration according to Infusion rate

Severity of the pain	20-40	40-60	60-80	80-100	100-120	120-140	140-160	240-260	Total
0		3	3	10	23	23	7	1	70
1		1		1	3	2			7
2			2	6	17	10	2		37
3		1	1	3	4	7	2		18
4			1	1	8	3	1		14
5	1		1						2
6					2				2
Grand Total	**1**	**5**	**8**	**21**	**57**	**45**	**12**	**1**	**150**

6- Discussion:

The exact mechanism of infusion-related pain and phlebitis is not known. Irritation, inflammation, and damage to the venous endothelium can be caused by the inherent chemical property, pH, or osmolality of the infusate.

7- Conclusion:

The association between potassium chloride intravenous concentration with severity of the pain was established. The study showed the importance of initiation of policy for standardization of potassium concentrations as well as, a guideline for treatment of Hypokalemia.