



Study of Changes in the Serum Potassium Concentration after Thiopental in Childrens

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Abstract

Potassium is distributed throughout the body. It is concentrated mainly within the cell as the predominant cation. The kidney plays an important role in regulation of potassium levels. This study was undertaken with the aim of staying the behaviour pattern of serum potassium after thiopental. The clinical manifestations of hypokalaemia do not usually occur until the serum potassium has fallen below 2.5 mEq/L. The predominant sign is muscular weakness resulting into a picture of dyspnea patients exhibiting 'Fish mouth breathing'. All patients were belonging to paediatric children age group ranging from 4 to 17 years. Thiopental produce small, but statistically highly significant decrease in serum potassium in pediatric age group.

Introduction

Potassium plays significant role in the excitability of cardiac, neural and muscle cells. Potassium is distributed throughout the body. It is concentrated mainly within the cell as the predominant cation. The kidney plays an important role in regulation of potassium levels. The mineralo-corticosteroids of the adrenal cortex influence the distribution of potassium within fluid compartment.

The incidence of hypokalemia after thiopental induction ranges between 82% and 89.4%^(1,2,3). A case series reported that 34% of patients had rebound hyperkalemia after stopping thiopental coma therapy⁽²⁾. There have also been several reports of serious adverse events due to hypokalemia and rebound hyperkalemia^(4,5).

This study was undertaken with the aim of staying the behaviour pattern of serum potassium after thiopental the clinical manifestations of

hypokalaemia do not usually occur until the serum potassium has fallen below 2.5 mEq/L. The predominant sign is muscular weakness resulting into a picture of dyspnea patients exhibiting 'Fish mouth breathing' (Weiner, 1970)⁽⁶⁾. Ultimately death can result from respiratory failure, the cardiovascular change includes bradycardia, dysrhythmias and even ventricular fibrillation (wood, 1968), postural hypotension is a common phenomenon. The E.C.G. typically shows prolongation of QT and sagging of the ST segments with an occasional U wave of low amplitude indicating an after potential following action potential.

The hazards of potassium imbalance following administration of muscle relaxant during general anaesthesia make it imparative to find out combination of the relaxant and the anaesthetic agent which would minimize the risk of

hyperkalaemic and hypokalaemic syndrome.

Aim and Objective

The present study is aimed to observe changes in the serum potassium concentration after Thiopental in childrens.

Materials and Method

The present study was carried out upon 90 healthy childrens presenting for various elective surgical procedures with the age ranging from 4 years to 17 years of both sexes.

Selection of patients

All patients were belonging to paediatric children age group ranging from 4 to 17 years.

Criteria for selection of patients

1. All patients included in this study belong to Paedi- atric age group undergoing elective surgery.
2. Patients should not have metabolic disorder.
3. Patients more than 17 years of age were not in-cluded in this study.
4. Special care was taken that patients were not on any drugs therapy or intravenous fluid which will influence potassium levels.

Grouping of the patients

Total 30 patients were studied.

Group includes of 30 patients was further divided by age - 10 patients (1-5 years old), 10 patients (6-10 years old) and 10 patients (11-17 years old).

The 30 patients comprised of control group. The anaesthetic induction in control group consisted of thiopental (6 mg/kg) I/V and N₂O (65%) and halothane by face mask.

For measurement of serum potassium contraction, the blood samples at various stages were collected from peripheral vein in all cases by insertion of intravenous.

catheter at 0 time (pre-anaesthetic) 1 minute, 3 minutes, 5 minutes and 10 minutes of anaesthesia.

Pre-medication:-

In all cases· pre-medication was carried out by injecting atropine 10 µg/kg intramuscular half an hour before anaesthesia.

Anesthetic technique

Patients were induced with thiopental sodium (6 mg/kg) and anaesthesia was maintained by N₂O - 65% and Oxygen 35% with halothane by face mask. The blood sample were taken at a-time, 1 minute, 3 minutes, 5 minutes and 10 minutes of anaesthesia.

Monitoring

A close watch was kept on pulse, blood pressure, respiration and other vital signs. In between collection of blood samples the I.V. catheter was flushed by 'normal saline. The control patients had blood sample drawn at same time comparable to succinylcholine group.

Adequate hydration was maintained and accordingly, intravenous fluid given. Blood loss was estimated clinically and replaced by blood.

The blood samples were collected in plain vial and serum potassium levels were estimated by flame photometry.

Method of Study

(A) Collection of samples

Blood samples from a peripheral vein of children case were collected pre-operatively for 0 time, then 1 minute, 3 minutes, 5 minutes and 10 minutes of anaesthesia in plain vial.

(B) Estimation of Potassium by flame photometry

This method of estimating electrolyte in solution has revolutionized our knowledge of electrolyte disorders by making it poss b Le.to determine sodium and potassium with greatly improved speed and accuracy. The principle is simple. The solution is sprayed as a fine mist of droplets into a non-lumen flame with the help of five automizer, then the flame become coloured by the characteristic emission of the particular ion. the light of wave length corresponding to the eliment is filtered through a filter, blocking there of wave length. This light then falls an photocell (Photosensitive cell) and produce electricity which is measured with very sensitive mirror galvanometer.

Normal value: The normal value in children (Serum potassium)

Method

3.5 to 5.0 mEq/L. The blood sample at various stages were collected from a peripheral vein under aseptic condition in test tubes. These were allowed to stand for clot formation and separation of serum. The supernatant serum was then transferred in a centrifuge tube and centrifuged for 10 minutes at 3000 rounds per minute. The supernatant clear serum was removed by a pipette and put in the serum tube. Dilute the, serum 1/100 with a potassium free distilled water (0.2 ml of serum with 19.8 ml of distilled water), compare the sample by flame photometer with series of standard solution containing both sodium and potassium a n equal concentration.

Procedure

Insert the potassium filter and switch on the motor and wait for 10 minutes. Switch on the galvanometer light turn the gas supply full all, ignite the flame and turn on the air supply. Regulate the air pressure from 10-15 lb/Sq. inch. Then reduce the gas supply until individual blue canes of the flame are found. Then vaporize potassium free bottle and set the gal venometer to zero. Then spray the highest potassium standard solution 1.6)mEq/L and adjust the sensitivity

controlled. So that the galvanometer gives reading 45, then spray one by one all standard solution and note the reading of the galvanometer. After spraying each standard solution spray distilled water to clean the automiser and to bring back the galvanometer to 0 reading, then spray the test solution and take the reading of the galvanometer. Now as the test solution is diluted to 1100 multiply the drived figure with 100.

Solution

(1) Distilled water- It should be free of sodium and potassium. The ordinary distilled water can effectively purified by passing it through a column of suitable ion exchange resine, this water is used for making all solution for rinsing glassware.

(2) Stock potassium standard (10 mEq/L). 746 grams of pure dry potassium chloride per litre in water.

Observations

Observations were carried out In 30 patients of both sexes, age ranging from 4 years to 17 years. The group is again divided into three sub-groups according to the age. Serum potassium levels are estimated in each group as follows:

Table No.1 Showing the distribution of 90 cases in various Groups

S.NO	Anaesthetic technique	Total Cases	Age group (Range in years)		
			1-5	6-10	11-17
1.	Induction by thiopental and maintained on O ₂ +N ₂ O + halothane by face mask.	30	10	10	10

Table No. 2 Showing the operative procedures in STUDY Group

S.No.	Operative Procedures	No. of Cases
1	Reduction of fracture	17
2	Foreign body removal	5
3	Incision and drainage	4
4	Urethral dialatation	3
5	Resuturing	1

Table No. 3: Showing the sex

S.NO	Male	Female	Total
1.	25	5	30

incidence in all groups

Table No. 4: Statistical analysis of serum potassium levels in group (1-5 years)
(n = 10 patients)

Statistical value	0 time pre-anaesthetic	1 min. after Induction	3 min. after Induction	5 min. after Induction	10 min. after Induction
Minimum	4.4	4.5	4.3	4.3	4.3
Maximum	5.3	5.3	5.25	5.25	5.27
Mean	4.9	4.9	4.70	4.88	4.98
S.D. ±	.472	.474	.527	.421	.316
T. Paired	-	2.72	2.52	2.40	2.51
P Value	-	>.01	<.01	<.01	<.01
Significance	-	N.S.	S.	S.	S.

Table No. 5: Statistical analysis of serum potassium levels in group – (6-10)

Statistical value	0 time pre-anaesthetic	1 min. after Induction	3 min. after Induction	5 min. after Induction	10 min. after Induction
Minimum	4.3	4.3	4.1	4.1	4.1
Maximum	5.25	5.24	5.10	5.10	5.24
Mean	4.80	4.80	4.72	4.72	4.78
S.D. ±	.421	.421	.400	.401	.442
T. Paired	-	2.82	2.58	2.54	2.74
P Value	-	>.05	<.05	<.05	>.05
Significance	-	N.S.	S.	S.	N.S.

Table No. 6: Statistical analysis of serum potassium levels in group – (11-17 years)

Statistical value	0 time pre-anaesthetic	1 min. after Induction	3 min. after Induction	5 min. after Induction	10 min. after Induction
Minimum	4.3	4.3	4.1	4.1	4.2
Maximum	4.9	4.87	4.87	4.80	4.84
Mean	4.73	4.71	4.58	4.59	4.65
S.D. ±	.410	.384	.334	.333	.380
T. Paired	-	2.082	2.58	2.43	2.72
P Value	-	>.05	<.05	<.05	<.05
Significance	-	N.S.	S.	S.	S.

(Serum Potassium after Thiopental)

The mean value of serum potassium level at different stages is also shown in comparison to other groups in graphic manner as histogram.

Discussion

(Thiopental with Halothane)

In this group age were ranging from 4 to 17 and weight from 15-40 kg. The duration of anaesthesia ranged 20-30 minutes.

Changes in Serum Potassium Levels

The mean value and the range of serum potassium, at pre-anaesthetic (0 time), 1 min, 3 min, 5min, and 10 min. of anaesthesia along with the statistical analysis with P values are given in Table.

After applying paired 't' test, the serum potassium level are follows:

Thiopental produce small but statistically highly significant decrease in serum potassium at 3, 5, and 10 minutes in 1-5 years age group (p < .01). Significant decrease in potassium occurred at 3 and 5 minutes in 6-10 years old (p < .05). In 11-17 years old there was significant decrease occurred in serum potassium at 3, 5 and 10 minutes (p < .05).

After applying paired 't' test the serum potassium levels are as follows. There were decrease in serum potassium level after the administration of thiopental. This decrease is significant as (p < .01) at 3, 5 and 10 minutes in 1-5 years of age group. Significant decrease in serum potassium occurred

at 3 and 5 minutes in 6 to 10 years of age group as ($p < .05$). In 11-17 years old, there was significant decrease in serum potassium occurred at 3, 5 and 10 minutes of anaesthesia ($p < .05$).

Thiopental has been shown to reduce serum potassium levels in adult. Thiopental reduces potassium permeability of nerve membrane, although the effect of thiopental on potassium permeability of a membrane have not been studied. We used a larger dose of thiopental (6 mg/kg), then Keneally and Bush (4mg/kg). Children require a greater amount of thiopental for induction of anaesthesia in comparison to adult. The high dose of thiopental may explain the difference in finding between our study and that of Keneally and Bush. In our study the serum potassium level decrease after the administration of thiopental. This decrease is significant at 3, 5 and 10 minutes in 1-5 years and 6-10 years of age group. So our study coincide with above study.

Conclusion

Thiopental produce small, but statistically highly significant decrease in serum potassium at 3, 5 and 10 minutes in 1-5 years age group. Significant decrease a n serum potassium occurs at 3 and 5 minutes in 6-10 years old. In 11-17 years, there was also significant decrease in serum potassium at 5 and 10 minutes of anaesthesia.

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