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Hyponatremia in Postoperative Patients

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Abstract

Object: This study was done to evaluate the adverse effect of hyponatremia in post-operative patients, the clinical spectrum of complications and comparative study of these complications between the elderly patients (age > 50 years) and relatively young patients (age <50 years).

Methods: The present's study of clinical co-relation of hyponatremia in post-operative patients was carried out in 60 patients. The patients were taken from Department of Surgery. Patients were randomly selected and divided into two groups on the basis of age. Group 1, <50 years of age and group 2, >50 years of age. All selected patients were asked for detailed history of illness and a complete physical and systemic examination was done. All baseline and other relevant investigation were done for confirmation of diagnosis and as pre-operative work up. Serum sodium and potassium was checked in all patients pre-operatively and only serum sodium was checked 24 hours and 48 hours post-operatively.

Results: Significant number of patients post operatively developed hyponatremia (30%) and complications (30%) related to hyponatremia ranging from headache, nausea to altered sensorium. ($p<0.05$, statistically significant). The number of patients who developed post-operative hyponatremia as well as complications of hyponatremia was observed more in the patients who were more than 50 years of age (39.3%). Post-operative hyponatremia and related complications was observed more in patients who were having abdominal pathology like peritonitis and abdominal trauma, (33.3%) which was not statistically significant. Patients who were operated under general anesthesia (72.2%) developed more hyponatremia as compared to patients who were operated under local anesthesia or regional anesthesia (27.8%), which was statistically significant.

Conclusion: We conclude that post- operative hyponatremia is not an uncommon post-operative complication and its progression to severe neurological manifestations like seizures, coma and eventual death can be prevented by anticipating hyponatremia in high risk patients, not confusing early manifestations with normal post-operative sequelae and treating hyponatremia as earlier as its symptoms appear.

Keywords: Hyponatremia; Seizures; Coma; Exploratory laparotomy

Introduction

Sodium as a major extra cellular ion is of primary importance is reflecting changes of water and electrolytes status in the body [1]. Post-operative hyponatremia and its relative complications can occur after any surgical procedure [2], particularly in elderly patients. The early symptoms can be mild which if not recognized on time, can progress to severe neurological manifestations and can even prove fatal to patients. The early warning is most of the time taken as normal post-operative sequelae resulting in increasing morbidity and mortality in patients with hyponatremia. The treatment is simple and in most cases, the early complications can be reversed by infusing sodium containing solutions [3].

Various authors have observed the effect of hyponatremia in post-operative patients involving general surgery [4-6], orthopedics [7-9], neurosurgery [10] or pediatric surgery [11,12].

Materials and Methods

This study was conducted in Shanti Mukand Hospital, Delhi in the Department of General Surgery and included total of 60 patients from both genders.

Exclusion criteria

- Pregnant or breast-feeding women.
- Patients with head trauma.
- Patients on medications which can cause hyponatremia specifically.
- Pateints on radiotherapy or chemotherapy.
- Terminally ill or moribind condition with little chance of short-term survival.
- Receiving vasopressin or its analogs for treatment of any condition.

All selected patients were asked for detailed history of illness including age, chief complaints, personal history, associated disorders (Diabetes, Hypertension, Thyroid dysfunction, past surgery, known allergy). A complete physical and systemic examination was done. All baseline and other relevant investigation were done for confirmation of diagnosis and as pre-operative work up. Serum sodium and potassium was checked in all patients pre-operatively and only serum sodium was checked 24 hours and 48 hours post-operatively. Patients were randomly selected and divided into 2 groups >50 years and <50 years.

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Perioperative fluids

In all elective surgical patients with normal pre-operative serum sodium level, Ringer Lactate was given as intravenous (IV) infusion, intra operatively. Post operatively standard IV fluid regime was given.

Patients with pre-operative hyponatremia were given 0.9% sodium chloride infusion pre operatively and serum sodium level was monitored post operatively. Any know complications of hyponatremia that developed in this period was confirmed with patients serum sodium level so as to ascertain that the complication is directly as an adverse effect of hyponatremia and not as routine post-operative sequelae. Patients who developed hyponatremia and related complications in immediate post-operative period where again 0.9% Normal Saline infusion or other sodium containing solutions till hyponatremia was reversed.

Statistical analysis

Data was systematically analysed using SPSS (statistical package for social sciences) software version 13 and by applying Students 't' test, Chi square test, Levene's test for equality of variances etc.

Observations and Results

The following observations were recorded in 60 patients divided into 2 groups (<50 years of age and >50 years of age) recruited from department of surgery Shanti Mukand Hospital Delhi. Table 1 shows the base line characters of two groups as per age and sex. There was almost equal distribution of male and female patients on the basis of age and gender. There were 32 patients in group with age <50 years and 28 patients with age group >50 years. The mean age was 43.72 years with standard deviation of 20.748 and range of 84 years. The mean age of patients that developed preoperative hyponatremia was 61.08 ± 16.39 years whereas, patients with normal serum sodium level the mean age was 39.38 ± 19.53 years (Table 2). The mean age that developed postoperative hyponatremia was 58.179 ± 16.95 years and thus with normal serum sodium level the mean age was 37.54 ± 19.21 years. The difference between the 2 means statistically significant ($p > 0.05$). Table 3 shows the relation of hyponatremia with clinical diagnosis of the patient. It was observed that the maximum number of patients who developed hyponatremia in post-operative period were those who were having clinical diagnosis of peritonitis or abdominal trauma, 6 patients out of total 18 patients developed post-operative hyponatremia (33.3%), were in this group, though statistically not significant. Table 4 shows the relation of hyponatremia with operative procedure. It was observed that hyponatremia develops maximally in cases who underwent exploratory laparotomy. In this study, out of total 20 laparotomies performed 8 (44.4%) Pateints developed hyponatremia, though statistically not significant. Patients who had less complications procedures as hernia repair, open cholecystectomy and ureterolitholithotomy had no post operative hyponatremia. Table 5 show the relation of post-operative hyponatremia with type anaesthesia under which surgical procedures was done. Majority of patients who were operated under GA (72.2%) developed post-operative hyponatremia as compared to patients who were operated under spinal anaesthesia or regional block (27.8%). Table 6 shows the range of complications which were observed in the study, ranging from mild headache, nausea to altered sensorium. The most frequent complications observed were nausea and vomiting which are the early warnings of hyponatremia. Out of the total 60 cases. 18 patients (30%) developed some complications. 15 patients (83.3%) were observed to have complications related to hyponatremia. Only 3 patients (7.1%) were having complications not due to hyponatremia as confirmed by serum sodium concentration of these patients. A few patients (3 patients) even with hyponatremia did not develop any complications. Table 7 shows correlation of complications with post-operative hyponatremia. Seven patients (21.9%) developed

Gender	Frequency	Percent
Female	34	56.7
Male	26	43.3
<50 yrs	34	53.3 %
>50 yrs	26	46.7%

Table 1: Age and sex distribution of patients (Total 60 pts).

	N	Mean Age in years
Pre-op Hyponatremia (<130)	12	61.08
Pre op Normal sodium (>130)	48	39.38
Post op hyponatremia	18	58.17
Post-op normal sodium	42	37.52

Table 2: Serum sodium levels pre-op and post op.

Operation	Hyponatremia (<130 mEq/L)	Normal (>130 mEq/L	Total
Appendectomy	4	11	15
Exploration Laparotomy	8	12	20
TAH	1	7	8
TURP	2	1	3
I&D/amputation	3	1	4
Ureterolithotomy	0	4	4
Open Cholecystectomy	0	3	3
Hernia Repair	0	3	3
Total	18	42	60

Table 3: Type of surgery and post-operative serum sodium.

	Hyponatremia (<130 mEq/L)	Normal (>130 mEq/L)	Total
Appendicitis	4	11	15
Abscess	3	1	4
Hernia	0	4	4
Fibroid Uterus and Cyst	0	7	7
Peritions and Abdominal	6	10	16
BPH and Uretric Calculus	2	5	7
Cholethiasis with Cholecystitis	0	3	3
Diabetic Foot	3	1	4
TOTAL	18	42	60

Table 4: Diagnosis and hyponatremia in postoperative patients.

	Hyponatremia (<130 mEq/L)	Normal (>130 mEq/L)	Total
General anesthesia	13	39	52
	72.2%	92.9%	86.7%
Spinal anesthesia and regional block	5	3	8
	27.8%	7.1%	13.3%
Total	18	42	60
	100.0%	100.0%	100.0%

Table 5: Anesthesia with hyponatremia and post-operative serum sodium.

	Frequency	Percent	Cumulative Percent
Altered sensorium	1	1.7	1.7
Distension	2	3.3	5.0
Drowsiness	3	5.0	10.0
Headache	1	1.7	11.7
Ileus	1	1.7	13.3
Lethargy	2	3.3	16.7
Nausea	6	10.0	26.7
Vomiting	2	3.3	30.0
Nil	42	70.0	100.0
Total	60	100.0	100.0

Table 6: Complications of post-operative hyponatremia.

		Hyponatremia (<130 mEq/L)	Normal (>130 mEq/L)	total
No complication	Count	3	39	42
	% within hyponatremia post-op sodium	16.7%	92.9%	70.0%
Complication	Count	15	3	18
	% within hyponatremia post-op sodium	83.3%	7.1%	30.0%
Total	Count	18	42	60
	% within hyponatremia post-op sodium	100.0%	100.0%	100.0%

Table 7: Complications and post-operative hyponatremia.

complications and only 5 patients were observed to have post-operative hyponatremia. Out of total 32 patients only 21.9% of patients developed hyponatremia related complications whereas 78.1% of patients had no hyponatremia and related complications. Out of total 28 Patients, 11 (39.3%) patients developed complications. Only 1 patient was observed to have complication with normal serum level whereas 10 patients developed complications with hyponatremia.

Discussion

Hypontremia is defined as serum sodium usually <135 mEq/L. It usually implies a state of hypotonicity with a relative excess of body water compared to sodium. However hyponatremia does not necessarily imply that the total body water is absolutely increased and the patient may be clinically hypovolemic or hypervolomic. The likelihood of symptomatic hyponatremic depends partly on magnitude of the hyponatremia but it is mainly affected by the rapidity of development of the hyponatremia (symptomatic hyponatremia is much more likely if hyponatremia develops acutely in <48 hours) [13]. The brain is the organ most sensitive to hyponatremia and it usually responds to hyponatremia by slowly secreting idiogenicosmoles out of the brain cells in the ECF. It normally takes a few days for the brain cell to accommodate to the hypotonic state by secreting a sufficient amount of idiogenicosmoles to ensure isoosmolality relative to the ECF [14,15].

Central nervous symptoms predominate in acute severe hyponatremia including; lethargy/apathy, headache, nausea, vomiting, disorientation, agitation, seizures, obtundation/coma, cerebral herniation and respiratory arrest. Most patients with chronic hyponatremia are asymptomatic and they are only diagnosed when laboratory testing incidentally detects a low serum sodium concentration [16].

A number of studies are available in literature assessing the risk of post-operative hyponatremia and its adverse effects [9,13,16-19]. It was observed in the present study that post-operative hyponatremia can develop mostly in patients who are admitted in hospital with clinical diagnosis of peritonitis or abdominal trauma. Out of the total 60 patients, 16 patients (16.7%), were having features of peritonitis and among these 6 patients developed hyponatremia, which accounted for 33.3% of the total number of patients out of total number of 18 patients who developed hyponatremia. No hyponatremia was observed in patients with clinical diagnosis of cholelithiasis, hernias and fibroid uterus. Patients with diabetic foot (Table 4 in our study), the greater danger of developing hyponatremia and related complications is due to their high serum osmolarity because of hyperglycemia. They develop hyperosmolar hyponatremia as water shifts from intracellular compartment to extracellular compartment. These patients are prone to get severe hyponatremia post operatively if proper intravenous fluids are not given. On the basis of clinical diagnosis. We can anticipate the risk of developing hyponatremia and related complications in patients with features of peritonitis and those with diabetic foot.

In this study, the type of anaesthesia under which surgical procedure was done was compared with hyponatremia in both the age groups. It was observed that post-operative hyponatremia developed more in patients operated under GA than under LA or regional block. Out of total 18 patients who developed post-operative hyponatremia, 13 patients (72.2%) and 5 patients (27.8%) were operated under GA and LA or regional block, respectively. On analyzing statistically, the p value (<0.05) was found significant.

Fluid and electrolyte management is an important part of PACU nursing care. Any alteration in fluid and electrolytes, especially in the vulnerable elderly population, can be catastrophic [20]. Garcia Segara A [21] studied relation between hospital stay and mortality in patients above 65 years of age. The relationship was studied between serum sodium levels equal to or lower than 130 mEq/l upon admission, and average length of stay and hospital mortality in patients with more than 65 years of age. It was verified that the average length of stay of hyponatremic patients is between 1.44 and 9.2 days longer than in the case of normonatremic patients and the mortality rate is between 2.1 and 28.1% greater. Patients with hyponatremia upon admission have a longer average length of stay and a greater mortality. Plasmatic sodium levels equal to or lower than 130 mEg/l upon admission are associated to a poor prognosis in the latter evolution of the patient. The present study also observed the relation of hyponatremia and its related complications with patients in two age groups, that is in age group <50 years and age group >50 years.

Pre-operative hyponatremia was observed in 12 patients (20%) out of total 60 patients. The mean age of patients with pre-operative hyponatremia was 61.08 + 16.39 years while as in patients with mean age 39.38 + 19.53 years, the serum sodium level was normal, which is statistically significant difference between the two age groups. Hence the patients with age more than 50 years are at higher risk of developing hyponatremia, pre operatively. On monitoring the serum sodium level post operatively, 18 patients (30%) were observed to have hyponatremia out of total 60 patient. The mean age of patients with post operated hyponatremia was 58.17 + 16.95 years whereas the mean age was 37.52=19.22 years in patients with normal serum sodium level. The observation are statistically significant.

In this study, postoperative hyponatremia and related complication were also studied in both the age groups out of total 60 patients, 18 patients (30%) developed hyponatremia related complications which ranged from headache, nausea to altered sensorium. Similar complication were also observed in patients with normal serum sodium level (7.1%) which may be due to some causes other than hyponatremia but majority of patients (92.9%) with normal serum sodium level developed no such complications. Hence, there is correlation(which is statically significant), in developing post operative complication in patient's with post operative hyponatremia and patients with normal serum sodium level.

Even though any surgery procedure [2,17] can predispose to post operative hyponatremia, the patients who underwent exploration laparotomies are more prone to develop hyponatremia and related complication. patients who are operated under GA develop more post-operative hyponatremia and related complications as compared to patients operated under Local ananesthesia or Regional Block. The results suggest the importance of recognizing early warning of hyponatremia in post-operative patients early signs and symptoms of hyponatremia such as lethargy, headache, mausea, vomiting can be distinguished from the post-operative sequelae on the basis of estimation of serum sodium concentration [3]. The treatment is simple. Fluid infusion should be restricted to normal saline (0.9% normal saline) and serum sodium concentration monitored. Hypretonic saline to be used only if neurological symptoms appear. The serum sodium should be raised by 1-2 mmoles per hour (depending on severity of symptoms) untill symptoms resolve. Most of the symptoms are reversible if treated promptly. In our study, hyponatremia was common but severe Neurological Symptoms were not observed. Careful monitoring serum sodium level peri operatively may be responsible for lack of severe complications and mortality due to hyponatremia. The study also emphasized that recognizing the early warnings of hyponatremia can save many patients of its deleterious effects which if untreated can lead to disastrous outcome of an otherwise clean and uncomplication surgical procedure.

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