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Serum Electrolyte Changes in Patients with Benign Prostatic Hyperplasia after Transurethral Resection of the Prostate at Muhimbili National Hospital

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BPH; TURP; Transurethral resection; Electrolytes; MNH

1. Abstract

1.1. Background: Transurethral resection of prostate may be accompanied by several complications including dyselectrolytaemia. This study was conducted to determine electrolyte changes after transurethral resection of benign prostate hyperplasia at Muhimbili National hospital.

1.2. Methods: This was across sectional study conducted among elderly men undergoing transurethral resection for benign prostate hyperplasia between August 2019 and April 2020 at Muhimbili National Hospital. A total of 88 patients were recruited consecutively, serum electrolytes including were checked before and immediately after surgery. The mean electrolyte change between before and after surgery was then correlated to irrigation fluid used, amount of tissue resected, resection time, age of the patient, and prostate volume by ultrasound using student t test and regression analysis. The primary outcome was electrolyte change and imbalance.

1.3. Results: Fifty percent of our participant were in the age group 60-70yrs with mean age of 69.1 ±9.1 years with a range of 50-89yrs. Thirty nine participants (44.3%) had electrolyte derangement, hyponatremia was the most encountered electrolyte imbalance (69%) with 6(15%) having severe hyponatremia. We further found there was a statistically significant reduction of mean level of serum sodium post-operatively (p<.000) with mean change of 3.25mmol/l and statistically significant decrease in the mean level of serum potassium post-operatively (p<.01). Electrolyte change was lineally related to amount of fluid used and weight of resected tissue. Our results also demonstrated almost 50% of patients had signs and symptoms of transurethral resection syndrome, six of these developed overt transurethral resection syndrome.

1.4. Conclusions: Hypernatremia is the most encountered electrolyte imbalance post TURP, We suggest that, using large amount of irrigation fluid and resecting large amount of tissue during the procedure is associated with electrolyte change and subsequent imbalance. Warning signs and symptoms of transurethral resection syndrome should alert surgeons to monitor serum electrolytes.

2. Introduction

Electrolyte changes and its associated TUR syndrome have been reported to occur following transurethral resection of prostate [1-3]. Monopolar TURP requires use of non-ionic irrigation flu- id during resection; this has been reported to be associated with increased risk of fluid infusion and subsequent electrolyte changes and its complication TUR syndrome. Approximately 2.5 to 20% of patients undergoing TURP show one or more manifestation of TUR syndrome and approximately 0.5 to 5% of patients with TUR syndrome die perioperatively [4-5].

Various factors have been reported to be associated with an increase incidence of electrolyte changes and subsequently TUR syndrome. The use of electrolyte free fluid for irrigation (as in monopolar resection) has been reported to cause dilutional hyponatremia following its infusion into prostatic venule during resection. The dilutional effect is proportional to amount of fluid used, duration of the procedure, height of irrigation column, weight of resected tissue, and age of the patient and co morbidities [4].

In spite of having many patients with benign prostatic enlargement requiring TURP as mode of treatment, there is existing gap in knowledge on electrolyte changes and its associated complications in sub-Sahara African region. This study was aimed at evaluat-

ing electrolyte changes and its associated complications following transurethral resection of prostate in patients with benign prostate hyperplasia at MNH.

3. Methodology

This was a Hospital based cross sectional study conducted between July 2019 and April 2020 at Muhimbili National Hospital (MNH), Dar es Salaam-Tanzania. MNH is the National Referral Hospital and Teaching Hospital with bed capacity of 1,600 beds, serving an average of 1,000 to 1,200 outpatients' per week. It is organized into two firms with various wads within Kibasila and Sewa Haji block, TURP is among the commonly performed procedure in this department. MNH uses electronic hospital data management system- JEEVA.

The study included all patients who underwent TURP during the study period meeting inclusion criteria. A total of 88 patients were involved in the study, these patients were recruited consecutively as they attend for TURP till sample size reached. Patients who underwent TURP during the study period were included. Patients, who received blood transfusion intra operatively, experienced vomiting and diarrhea prior to TURP and those who had chronic kidney disease were excluded from the study. Sample size was calculated using standard proportion formula (Kirk wood, 2003), a proportion of 8.1% of patient with electrolyte imbalance as for study by Gupta et al were used.

Data were collected using a standardized pre-tested English questionnaire that was filled by research assistant. Data obtained from patient himself, patient's case file, and computer data. The data includes patients Age, co morbidities, prostate volume, amount of resected tissue, volume of irrigant used and time spent for surgery. The outcome variable includes electrolyte change, derangement and warning signs and symptoms of TUR syndrome such as nausea, vomiting, bradycardia, hypotension, chest pain, mental confusion, anxiety, paraesthesia and visual disturbance. Electrolyte derangement was defined as serum sodium less than 135(mild 130-134mEq/l moderate 125-129mEq/l and severe less than125mEq/L) and a rise in serum sodium concentration to a value exceeding 145 mmol/L; Potassium of less than 3.5 or more than 5.5mmol/l and chloride less than 98mmol/l or more than 106mmol/l

3.1. Description of the Procedure

All patients underwent preoperative workup and anesthesia clearance for fitness for surgery as an outpatient. Following admission patients checked electrolytes together with other blood investigations night of surgery while in the ward. In all patients, the TURP operations were done in standard lithotomy position keeping irrigation fluid 60cm above the symphisis pubis. The procedure was performed using monopolar resectoscope for resection and dextrose 5% were used during irrigation. Prostatic chips were evacuated using the evacuator. Patient was then kept on continuous bladder irrigation with normal saline till bleeding stops usually 24 to 72hrs postoperatively. Patients who had long resection time or presented signs and symptoms of TUR syndrome were given loop diuretics (Lasix) 40mg-80mg depending on severity. At the end of the procedure, amount of fluid used, time taken for the procedure, weight of tissue resected recorded. After the procedure a venous blood sample approximately 3mls were collected using sterile disposable syringe by principle investigator or assistant and sent to laboratory for analysis of electrolytes. Post-operative clinical symptoms and signs of TUR were assessed and recorded after collecting second blood sample.

TUR syndrome was considered when symptoms or signs of TUR syndrome including as nausea, vomiting, bradycardia, hypotension, chest pain, mental confusion, anxiety, paresthesia and visual disturbance were present, usually with serum sodium less than 120mmol/l.

3.2. Data Management

Data collection was done using Standard English questionnaire as most of the information obtained from the patient case file. Data was recorded in the data sheet then managed and analyzed by using SPSS program version SPSS V 24. Collected information included age of patient, resection time, volume of irrigant used, prostate tissue resected, mean levels of sodium, potassium and chloride before and after surgery. Correlation between electrolyte change and pre-operative clinical parameters were determined using student t test and linear regression. Linear Regression graphs were used to predict strength of association of electrolyte change with variation in predictor variables such as irrigation fluid, resected tissue of prostate and resection time. The following associations were analyzed, association between outcome such as electrolyte changes and age of patients, volume of resected tissue, Co-morbidities and operative time, and prostate volume. An association with p-value less than 0.05 was considered significant. Data presentation and interpretation was done in form of two ways tables and scatter plot graph.

3.3. Ethical Clearance

Ethical clearance was obtained from MUHAS and Muhimbili National Hospital (MNH) research and ethics committees.Written informed consent from patient via conversation on voluntary basis was taken; data collection started once he signed the consent form. Participation in the study was on voluntarily basis and patient had the right to opt out from the study. The benefits and risk of participating to study were clearly explained to patients. Confidentiality of subjects, information and data obtained as a result of the study was observed.

3.4. Results

A total of 88 participants were enrolled to the study, fifty percent were in the age group 60-70yrs with mean age of 69.1 ±9.1 years. Out of 88 patients majority of patients were having co morbidities

with 48.9 % hypertensive heart disease. All patients underwent TURP using 5% dextrose fluid with mean volume of irrigation of 28.2L ranging 7.5-46L. Patient spent average 59 minutes during resection however with variable range of time 14-107minutes. Patients had prostate size ranging 21-248g, and resected tissue ranged 4-68g (Table 1).

Incidence of electrolyte changes after TURP

Out of 88 patients 39(44.3%) had one or more electrolyte derangement, majority of patients had hyponatremia which accounted for 69% of the patients, hypokalemia was noted in 12(31%) patients and both hyponatremia and hypokalemia were noted among 4 (10%) patients. Out of patients with electrolyte changes 6(15%) had severe hyponatremia. There was a statistical significant reduction of mean level of serum sodium (hyponatremia) post-operatively (p<.000) with mean change of 3.25mmol/l. Similarly, the findings of this study also showed statistically significant decrease in the mean level of serum potassium (hypokalemia) post-operatively(p<.01), However, finding of this study showed that following TURP, there was no significant change in mean levels of serum chloride.ref table 2a and 2b

3.5. Incidence of TUR syndrome

Of 88 patients 42(47.7%) developed one or more clinical signs and symptoms of TURP, nausea were most frequent reported symptom 33(76%) followed by hypotension 22(52%). Among these patients 6 (14%) developed TUR syndrome (Table 3).

3.6. Factors affecting serum electrolytes changes after transurethral resection of prostate for benign prostatic hyperplasia

Regression analysis on factors predicting changes on serum sodium change, both amount of irrigation fluid and amount of resected tissue of prostate were significantly predictors of changes of sodium levels, (p<0.05). The resected tissue of prostate seem to have more predictive power (beta = 0.267), followed by the amount of fluid (5% dextrose) used for irrigation (beta = 0.207) as shown in table below (Table 4).

From the regression line on a scatter plot, the study shows there is a liner relationship between weight of resected prostate, volume of fluid used and the outcome serum sodium change. In figure 1 indicates there were changes of serum sodium levels for an every increase in irrigation fluid. The graph shows that in every one liter increase in irrigation fluid, there is a change of 0.134mmol/L of sodium level. Similar findings on figure 2 in every increase of 1g of resected tissue of prostate during TURP there is a change of sodium level up to 0.115mmol/L mmol/L (Figure 1a and 2a).

Table1: Socio-demographic characteristics of participants (N=88)

Characteristics	Frequency	Percent
Age		
<60	9	10.2
60-70	44	50
>70	35	39.8
Age mean (SD)	69.1 ±9.1 years	
No Co morbidities	39	44.3
Co morbidities	**49**	**55.7**
Hypertension	43	48.9
Stroke	1	1.1
Diabetes	4	4.5
Heart disease	1	1.1

Table 2a: Serum electrolyte changes after transurethral resection of prostate (TURP)

Electrolytes change in mmol/l	Mean level before	Mean level after	Mean change	95% CI		p
				Lower	Upper	
Serum Sodium levels	138.48	134.84	3.25	1.82	4.68	0.000*
Serum Potassium levels	4.09	3.97	0.2	0.05	0.35	0.011*
Serum chloride levels	103.24	102.92	0.78	-0.64	2.2	0.279

** Significant at p<.05, t - student t test*

Table 2b: Incidence of electrolyte derangement

Electrolyte deranged N 39	Frequency	Percentage
Sodium	27	69
Potassium	12	31
Both sodium and potassium	4	10
Severity of hyponatremia n=27		
Mild	14	52
Moderate	7	26
Severe	6	22

Table 3: Warning signs and symptoms of TUR syndrome (N= 42)

	TUR syndrome			
Immediate symptoms and signs of TUR syndrome	**No TUR syndrome (N=36)**	**TUR syndrome (N=6)**	**Frequency**	**Percentage**
Nausea	27	6	33	78.6
Hypotension	17	5	22	52
Bradycardia	15	2	17	40.1
Vomiting	11	2	13	30.1
Chest pain	1	1	2	4.5
Mental confusion	0	2	2	4.5
Anxiety	2	0	2	4.5

Frequencies doesn't tally to 100

Table 4: Regression analysis of factors predicting changes in serum sodium levels

Predictors	***B***	***Beta***	***t-test***	***p***
Fluid (5% dextrose) used for irrigation	0.134	0.207	1.965	0.053*
Resected tissue of prostate	0.115	0.267	2.571	0.012*
Resection time	0.015	0.048	0.445	0.658
Co morbidities				
Hypertension	1.968	0.174	1.565	0.121
Stroke	-3.763	-0.071	-0.651	0.517
Diabetes	-2.43	-0.078	-0.71	0.48
Heart disease	0.237	0.004	0.041	0.967

Note; B= unstandardized linear regression coefficient, Beta= standardized linear regression coefficient

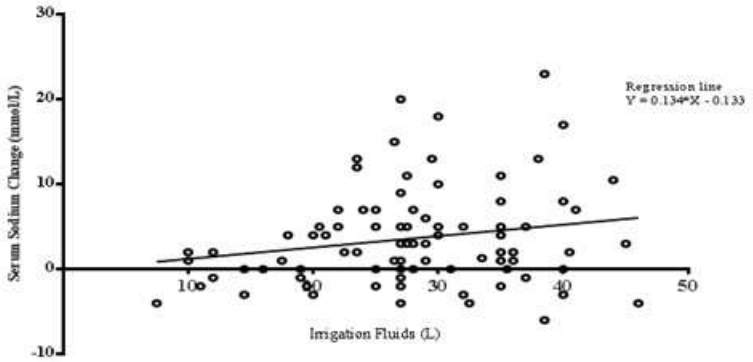

Figure 1a: Regression scatter plot showing relationship between serum sodium change and Irrigation fluid

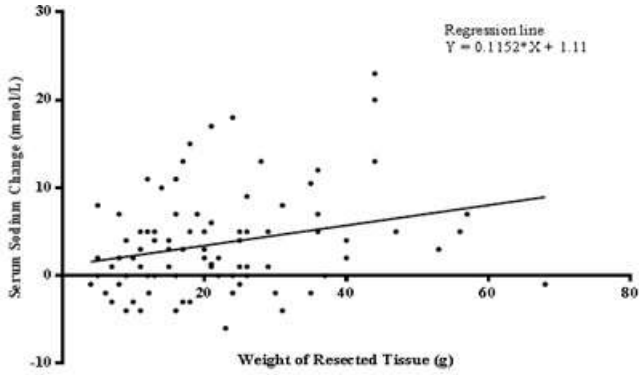

Figure 1b: Regression scatter plot showing relationship between serum sodium change and weight of resected tissue

4. Discussion

Electrolyte imbalance is common complication post TURP at our Hospital. This study describes the changes seen in serum electrolytes (sodium, potassium and chloride) levels following transurethral resection of prostate in patients with benign prostate hyperplasia. We found significant reduction of the mean level of both serum sodium and potassium in majority of patients who underwent TURP. However, the mean levels of serum chloride remained relatively normal after the TURP. Our findings are similar to observations made in similar studies done at similar settings [5, 6].

Similar to other studies our findings showed serum Sodium was the most common affected electrolyte showed a decline by 30% following TURP with six patients having severe hyponatremia [5-7]. However Gupta et al found hyperkalemia contrary to our findings in which hypokalemia was found; this may be attributed to differences in type and volume of fluid used [6].

Our study population comprised mainly of elderly aged males, with age groups consistent with average occurrence of benign prostate hyperplasia in our settings [2, 6]. Most of our patient had underlying co morbidities hypertension being the leading. The size of prostate based on abdominal pelvic ultrasound findings revealed an average of 78g among all patients and in average every patient was resected 22g. In the procedure, all patients underwent TURP using dextrose 5% as irrigation fluid, using average 28L contrary to other studies in which Glycine 1.5 were used for TURP [5]. Our patients spent averaged one hour during resection which is recommended in most studies with regards to TURP [5].

Our study findings tallies with previous studies patients were found to have one or more immediate signs and symptoms of TUR syndrome following TURP [8]. Among patients who presented with signs and symptoms of TUR syndrome six patients (10%) developed overt TUR syndrome similar findings were observed by George et al [1]. All patients who developed TUR syndrome presented with Nausea and where also found to be hyportensive [1]. From this study signs and symptoms of TUR syndrome should worn surgeons the risk of TUR syndrome, hence need for electrolyte monitoring.

Furthermore we found electrolyte change and imbalance was correlated significantly with amount of fluid used and resected tissue of prostate similarly to Gupta el, Petrusheva et l Moothy et al [4, 5]. This suggests an increase in irrigation fluid had a proportionate increase in change (drop) in serum sodium level post operatively. In contrast to other studies our study has shown age of the patient, resection time and co morbidities are to be associated with insignificant change in serum electrolytes [9].

Our study had one major limitation that was a lack of bedside electrolyte check device, blood sample has to be sent to laboratory, and this may contribute to delays in having early results. We mitigated the problem by close follow up of the laboratory results to reduce delays to have timely data. Also our patients used abdominal pelvic ultrasound to estimate prostate size which is subject to user dependent so it's not precise as trans rectal ultrasound.

5. Conclusion

Our study concludes that sodium in reduced in serum post TURP, mostly being influenced by type and amount of irrigation fluids used abut also weight of tissue resected during the procedure. We recommend that urologist should be monitoring the warning signs and symptoms of transurethral resection syndrome and intervene promptly.

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