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Electrolyte imbalance monitoring following Transurethral Resection of the Prostate: A Descriptive Case Series Study

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Abstract

Background: Transurethral resection of the prostate (TURP) is a widely performed procedure for managing urinary obstruction caused by benign prostatic hyperplasia. Despite its efficacy, TURP often results in postoperative electrolyte imbalances, which require careful monitoring and management to avoid complications. This study addresses a critical gap in the literature by examining the prevalence and severity of these imbalances within the local population of Karachi, Pakistan.

Methodology: This descriptive case series study was conducted in the Department of Urology at Sindh Institute of Urology and Transplantation (SIUT) from September 12, 2018, to March 11, 2019. It included 200 patients aged 50 to 70 years undergoing TURP. The procedures were performed under spinal anesthesia with patients in the lithotomy position, the alterations in serum electrolyte levels were observed in each patient. Data were analyzed using SPSS 21.0.

Results: This study included 200 patients aged 50-70 years (mean age: 60.32 years) undergoing TURP at SIUT. Preoperative sodium levels averaged 136.52 mEq/L, decreasing to 133.15 mEq/L postoperatively. Preoperative potassium levels averaged 4.46 mEq/L, decreasing to 4.25 mEq/L postoperatively. Electrolyte derangement was observed in 49 patients (24.5%), with a significant mean sodium decrease of -9.75 mEq/L ($p<0.01$) and potassium decrease of -0.48 mEq/L ($p=0.003$) in these patients.

Conclusion: Electrolyte imbalances are common following transurethral resection of the prostate and timely, appropriate correction can prevent significant morbidity and mortality.

Keywords

Benign Prostatic Hyperplasia, Transurethral Resection of the Prostate, Electrolyte Abnormalities.

Introduction

Severe consequences can arise when irrigation fluid enters the intravascular space during surgical procedures, most notably during the transurethral resection of the prostate (TURP). This condition, known as TURP syndrome, has also been reported following other procedures using irrigating fluids, such as ureteroscopic operations and endometrial ablation[1-3]. TURP syndrome can manifest as early as 4 minutes into the resection or up to 24 hours post-surgery[4-6]. It affects 10% to 15% of the more than 400,000 TURP procedures performed annually, with a fatality rate ranging from 0.2% to 0.8%[7].

This syndrome impacts multiple systems, primarily presenting as abrupt changes in intravascular volume and plasma solute concentrations. The diagnosis is challenging due to its lack of a traditional presentation despite a seemingly consistent etiology[8].

Electrolyte derangements are a significant component of TURP syndrome. A previous study showed that, 23.6% of patients experienced electrolyte disturbances, with mean preoperative serum sodium levels of 131.33±2.26 mEq/L in affected patients compared to 141.47±2.70 mEq/L in those without disturbances. Similarly, mean preoperative serum potassium levels were 128.67±5.78 mEq/L in patients with derangements compared to 138.19±2.65 mEq/L in those without. Postoperative serum sodium levels averaged 4.10±0.81 mEq/L in patients with electrolyte issues, while those without had levels of 4.31±0.34 mEq/L[9]. These findings highlight the critical impact of electrolyte management in preventing severe outcomes associated with TURP syndrome.

TURP syndrome is multifactorial, triggered by the absorption of irrigation fluid that leads to cardiovascular, central nervous system (CNS), and metabolic changes. The clinical presentation is often vague, variable, and non-specific, making diagnosis challenging for those unfamiliar with the syndrome. The significant impact on quality of life (QoL) and healthcare costs underscores the need for additional research into therapeutic interventions. This study aims to fill a gap in the literature, particularly for the local population in Karachi, Pakistan, where different body habits, environmental factors, and dietary practices may influence the prevalence and severity of TURP syndrome.

Methodology

Study Design

A descriptive case series study was conducted to assess electrolyte derangements in patients undergoing Transurethral Resection of the Prostate (TURP). The study spanned from September 12, 2018, to March 11, 2019.

Setting

The study was carried out in the Department of Urology at the Sindh Institute of Urology and Transplantation (SIUT).

Participants

Patients aged 50 to 70 years who were scheduled for TURP at SIUT were considered for inclusion. The inclusion criteria mandated that participants had to be within the specified age range and undergoing TURP. Exclusion criteria included patients who received diuretics intraoperatively or in the immediate postoperative period, those with already deranged electrolytes, patients with raised serum creatinine levels (>1.2 mg/dL), those with chronic liver disease, individuals with known bleeding disorders, and those who refused to participate.

Variables

The study focused on both demographic and clinical variables. Demographic variables included age and gender. Clinical variables comprised preoperative and postoperative serum electrolytes (sodium and potassium), serum creatinine levels, bleeding and coagulation profiles, urine culture results, and ultrasound findings of the prostate. Quantitative variables included age, height, weight, BMI, preoperative serum creatinine levels, volume of irrigant used during TURP, and serum sodium and potassium levels both preoperatively and postoperatively, including their changes.

Data Sources/Measurement

Preoperative routine blood tests including complete blood count, serum electrolytes (sodium and potassium), serum creatinine, and urine culture were conducted within one week prior to TURP. Postoperative serum electrolytes were measured within two hours of the procedure. An ultrasound scan of the prostate was performed to assess benign prostatic hyperplasia (BPH). All TURP procedures were conducted under general anesthesia by a surgeon with at least three years of experience.

Bias

To minimize bias, patients were consecutively sampled in a non-probability manner. All patients fulfilling the inclusion criteria were included, ensuring a broad representation of the target population.

Study Size

The sample size was calculated using the OpenEpi calculator based on a prevalence of electrolyte derangement of 23.6%, with a margin of error of 6% and a confidence level of 95%. The calculated sample size was 200 patients.

Statistical Methods

Data entry and analysis were conducted using SPSS version 21. For quantitative variables such as age, height, weight, BMI, serum creatinine level, volume of irrigant used, and serum sodium and potassium levels, the mean and standard deviation were calculated.

Paired sample T-test was employed to compare mean sodium and potassium levels preoperatively and postoperatively. Independent Sample T-Test was used for comparison of mean change in sodium and potassium levels between groups with and without electrolyte derangement. A p-value ≤ 0.05 was considered statistically significant.

Results

Participants

A total of 200 patients were included in this study. The participants were aged between 50 and 70 years, with a mean age of 60.32 ± 6.54 years. The study exclusively considered patients undergoing TURP at the Sindh Institute of Urology and Transplantation (SIUT) within the study period.

Descriptive Data

The mean BMI of the patients was 25.45 ± 0.46 kg/m². The preoperative serum creatinine levels ranged from 0.5 mg/dL to 1.2 mg/dL, with a mean of 0.89 ± 0.22 mg/dL. The volume of irrigant fluid used during the procedures averaged 14.05 ± 2.13 liters.

Outcome Data

Electrolyte derangement was observed in 49 (24.50%) patients, while 151 (75.50%) patients did not exhibit any electrolyte derangement. The mean preoperative sodium levels were 136.52 ± 3.06 mEq/L, which decreased to a mean of 133.15 ± 5.08 mEq/L postoperatively.

This resulted in a mean change in sodium levels of -3.42 ± 4.9 mEq/L. For potassium, the mean preoperative levels were 4.46 ± 0.47 mEq/L, and the postoperative levels averaged 4.25 ± 0.69 mEq/L, indicating a mean change of -0.21 ± 0.73 mEq/L.

Main Results

The mean change in sodium levels was -9.75 ± 5.46 mEq/L in patients with electrolyte derangement versus -1.36 ± 2.25 mEq/L in those without ($p<0.01$). Similarly, the mean change in potassium levels was -0.48 ± 1.30 mEq/L in patients with electrolyte derangement, compared to -0.13 ± 0.36 mEq/L in patients without electrolyte derangement ($p=0.003$).

Table 1: Baseline characteristics.

Variables	Mean±SD
Age (years)	60.32±6.54
Creatinine (mg/dl)	0.89±0.22
Volume of Irrigant fluid (liters)	14.05±2.13
Height	165.6±9.26
Weight	69.9±13.33
BMI	25.45±0.46

Table 2: Preoperative and postoperative changes in serum electrolyte levels.

Variables	Preoperative	Postoperative	Mean Change	p-value
Sodium (mmol/L)	136.52±3.06	133.15±5.08	-3.42±4.9	<0.01*
Potassium (mmol/L)	4.46±0.47	4.25±0.69	-0.21±0.73	<0.01*

Paired Sample T-test is utilized, *p<0.05 is considered statistically significant

Table 3: Comparison of mean change in sodium levels in patients with and without electrolyte derangements.

Variables	No electrolyte derangement	Electrolyte derangement	p value
Serum Sodium	-1.36 ± 2.25	-9.75 ± 5.46	<0.01*
Serum Potassium	4.46 ± 0.47	-0.48 ± 1.30	0.003

Independent sample T-test is utilized, *p<0.05 is considered statistically significant

Discussion

Electrolyte imbalances and fluid overload are frequent complications during TURP, leading to significant morbidity[10,11]. Ignoring these derangements can result in mortality, especially in patients with comorbidities like respiratory and cardiovascular problems, which can quickly decompensate[12]. The main pathophysiological mechanisms for TURP syndrome and electrolyte imbalances include the use of hypotonic irrigation fluids, high irrigation fluid pressures, prolonged procedure durations, glycine toxicity, cell breakdown, bacteremia, and absorption of irrigation fluid through open prostatic venous sinuses[13]. Pre-existing medical conditions, particularly affecting the pulmonary and cardiovascular systems, are recognized risk factors for electrolyte imbalances and TURP syndrome[14].

The occurrence of hyperkalemia or hypokalemia post-TURP can be partly attributed to cell lysis during tissue excision. Additionally, hyperkalemia can arise from fluid uptake into the bloodstream during the procedure, which can lead to heart injury and abnormal electrocardiogram (ECG) readings when serum levels exceed 6 mEq/L[15]. However, our study did not show significant elevations in serum potassium levels postoperatively, which can be partially explained by hemodilution due to fluid absorption counteracting hemolysis. Hemolysis is notably reduced when using 1.5% glycine as an irrigant compared to other hypoosmolar solutions like water.

A study by Singhania et al. on 60 patients compared monopolar versus bipolar saline resection and found minimal alterations in potassium levels in both groups[15]. Our study's demographic characteristics, including age and duration of symptoms, were consistent with those in previous investigations. Pasha et al. reported that the average age of participants was 67.15 ±

7.067 years, and 15.3% experienced electrolyte problems post-TURP[16]. In our study, electrolyte imbalances were observed in 24.5% of patients, with a mean age of 60.32 years.

The prevalence of electrolyte abnormalities post-TURP varies widely, ranging from less than 10% to more than 30%[17]. Most authors recommend using a 1.5% glycine solution for its isotonic properties, low glycine load, and minimal interference with diathermy[18]. However, some studies have also explored sterile distilled water with limited evidence of beneficial effects[19]. Despite guidelines to reduce electrolyte imbalances, their rates remain significant, suggesting that mere adherence to instructions is insufficient.

To mitigate these occurrences, it is crucial to assess preoperative clinical and laboratory indications, as well as intraoperative factors, to identify high-risk individuals. Our analysis found a significant difference in sodium levels pre- and post-surgery, with preoperative levels at 136.52 ± 3.06 mEq/L and postoperative levels at 133.15 ± 5.08 mEq/L. TURP syndrome's primary cause is thought to be a combination of water intoxication and hyponatremia. Suhail et al. found a significant difference in average blood sodium levels pre- and post-operation ($P<0.01$)[19]. Similar findings were documented by Bachmann et al.[20], and Gupta et al.[21] observed significant decreases in serum sodium levels post-surgery, specifically noting hyponatremia.

This study has several limitations. Firstly, it was conducted at a single center, which may limit the generalizability of the findings to other settings. Secondly, the study period was relatively short, which might not capture long-term trends in electrolyte disturbances post-TURP. Additionally, we did not consider other potential confounding factors such as variations in surgical techniques or postoperative care protocols. Lastly, the reliance on retrospective data might introduce bias and affect the accuracy of the reported outcomes.

Based on our findings, we recommend routine preoperative and postoperative monitoring of serum electrolytes in patients undergoing TURP. Special attention should be given to those with pre-existing comorbidities, as they are at higher risk for significant electrolyte disturbances. Strategies to minimize these disturbances should include optimizing the type and volume of irrigation fluids and reducing the duration of the procedure. Furthermore, multicenter studies with larger sample sizes and extended follow-up periods are needed to validate our results and to develop comprehensive guidelines for managing electrolyte imbalances in TURP patients.

Conclusion

Electrolyte abnormalities are a frequent and significant complication following transurethral resection of the prostate (TURP), with our study identifying a prevalence of 24.5%. Postoperative data reveal substantial alterations in sodium and potassium levels, underscoring the importance of vigilant monitoring and prompt intervention. Effective management of these imbalances is essential to prevent severe complications and potential mortality, particularly in patients with pre-existing comorbidities. This study highlights the need for proactive electrolyte management strategies to mitigate risks and enhance patient outcomes following TURP.

Conflicts of Interest

The author(s) declared no conflicts of interest.

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