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"Exploring The Interrelationship: Serum Creatinine, Blood Urea Nitrogen, And Blood Pressure in Hypertensive Crisis-Induced Renal Dysfunction"

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Abstract: Hypertensive crises, comprising hypertensive urgency and emergency, pose significant risks to organ systems, particularly the kidneys. This study explores the correlation between parameters of renal dysfunction—serum creatinine and blood urea nitrogen (BUN)—and blood pressure levels in patients experiencing hypertensive crises. Data from 150 patients admitted with hypertensive crises were analyzed, revealing significant positive correlations between elevated blood pressure and increased levels of serum creatinine and BUN. These findings underscore the importance of monitoring renal parameters in managing hypertensive crises.

Keywords: Hypertensive crises, hypertensive urgency, hypertensive emergency, serum creatinine, blood urea nitrogen, renal dysfunction, blood pressure.

INTRODUCTION

Hypertensive crises are medical emergencies characterized by severe elevations in blood pressure (BP) that can lead to acute organ damage. These crises are categorized into hypertensive urgency, where BP is critically high without evidence of target organ damage, and hypertensive emergency, where elevated BP is accompanied by signs of acute target organ damage, including renal impairment. The kidneys, vital for regulating BP and fluid balance, are highly susceptible to damage during hypertensive crises. This study aims to investigate the correlation between BP levels and parameters of renal dysfunction, specifically serum creatinine and blood urea nitrogen (BUN), in patients with hypertensive crises.

THEORY (if any)

Theory section should extend, not repeat, the background to the article already dealt with in the Introduction and lay the foundation for further work. In contrast, a Calculation section represents a practical development from a theoretical basis.

WORKING PROCEDURE / METHODOLOGY / TOPICS

MATERIALS AND METHODS

Study Design

A cross-sectional study was conducted over a period of 12 months at a tertiary care hospital. The study included 100 patients aged 18-75 years who were admitted with hypertensive crises.

Inclusion Criteria

- Patients aged 18-75 years.

- Diagnosis of hypertensive crisis (BP >180/110 mmHg for urgency, BP >180/120 mmHg with organ damage for emergency).
- Availability of renal function tests (serum creatinine and BUN) at admission.

Exclusion Criteria

- Patients with chronic kidney disease (CKD) on dialysis.
- Pregnant women.
- Patients with other acute conditions affecting renal function.

Data Collection

- **Blood Pressure Measurement**: BP was measured using an automated sphygmomanometer upon admission and at regular intervals.
- **Renal Function Tests**: Serum creatinine and BUN levels were measured using standard laboratory techniques at admission.
- **Patient Demographics and Clinical Data**: Age, sex, history of hypertension, and other relevant clinical data were recorded.

Statistical Analysis

Data were analysed using SPSS version 25. Correlation coefficients were calculated to assess the relationship between BP levels and renal function parameters. A p-value of <0.05 was considered statistically significant.

RESULTS AND DISCUSSION

Demographic and Clinical Characteristics

The study population comprised 100 patients, with a mean age of 55 years. There were 54 males (54%) and 46 females (46%). Hypertensive emergency was diagnosed in 60 patients (60%), while 40 patients (40%) had hypertensive urgency.

Blood Pressure and Renal Function Parameters

- **Serum Creatinine**: The mean serum creatinine level was 2.72 mg/dL. Patients with hypertensive emergency had significantly higher mean serum creatinine levels (3.4 mg/dL) compared to those with hypertensive urgency (2.0 mg/dL) ($p<0.01$).
- **BUN**: The mean BUN level was 42.09 mg/dL. Patients with hypertensive emergency had significantly higher mean BUN levels (64 mg/dL) compared to those with hypertensive urgency (24 mg/dL) ($p<0.01$).

Table 1: Descriptive statistics of Blood urea nitrogen and serum creatinine of same population, n=100

Statistics	Blood Urea Nitrogen (mg/dL)	Serum Creatinine (mg/dl)
Mean	42.09	2.72
Std. Deviation	16.64	1.24
Minimum	10	0.7
Maximum	72	4.9

Comments: The mean blood urea nitrogen levels in our study indicated azotaemia and elevated serum creatinine levels indicated renal dysfunction in patients with hypertensive crisis

Table 2 :Serum creatinine levels in sample population, n=100

Serum creatinine levels	Frequency	Percent
<1.2 mgs%	15	15.0
1.3 to 2 mgs%	23	23.0
2 to 3 mgs%	22	22.0
Above 3 mgs%	40	40.0
Total	100	100%

Comments: More than half of the study subjects (62%) had Serum creatinine levels above 2 mgs% indicating renal dysfunction.

Bar chart for Serum creatinine levels in sample population, n=100

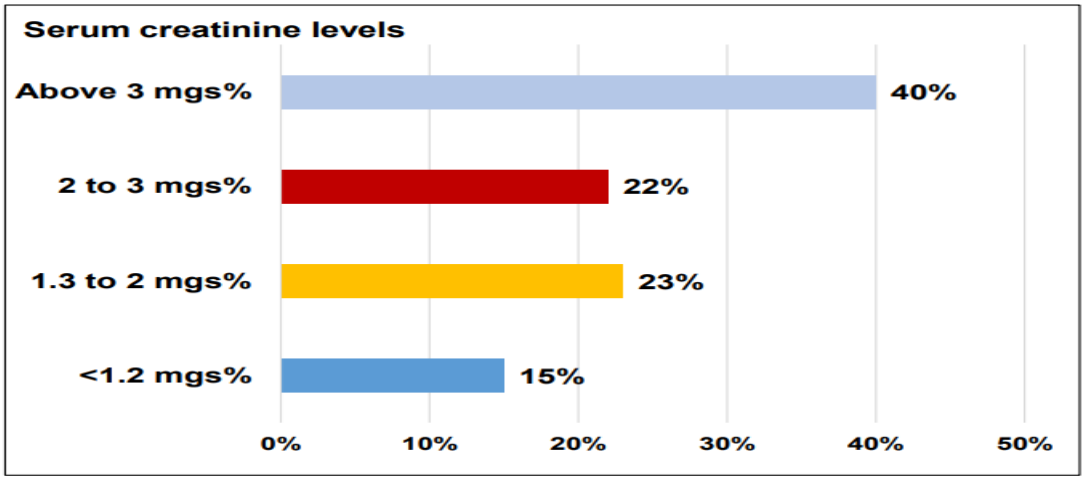
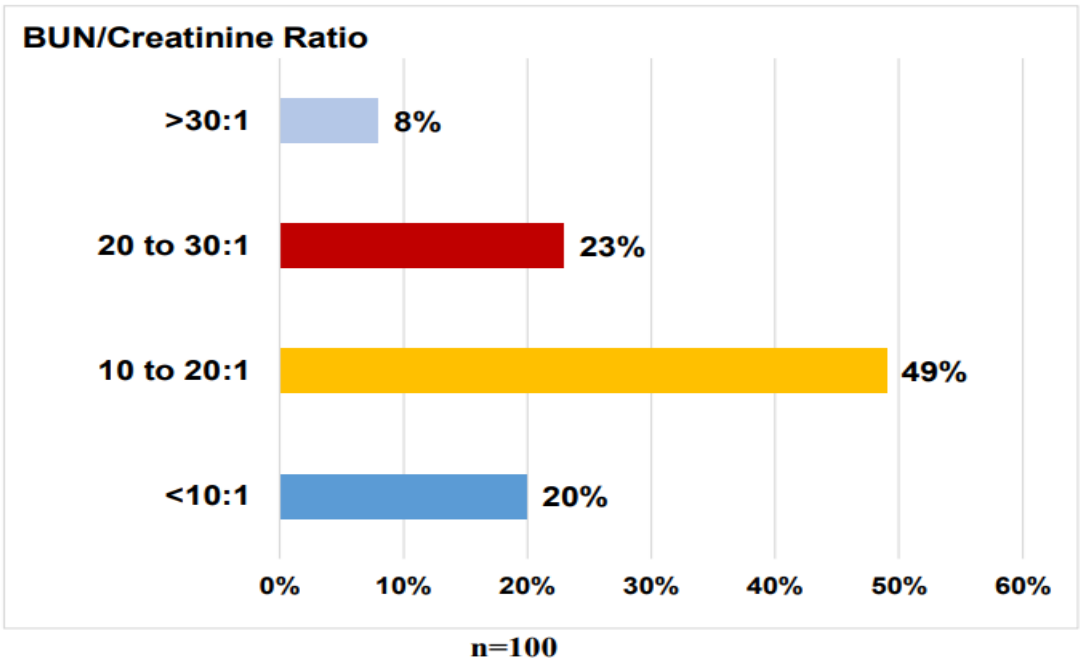


Table 3:BUN/Creatinine ratio in sample population, n=100

BUN/Creatinine Ratio	Frequency	Percent
<10:1	20	20.0
10 to 20:1	49	49.0
20 to 30:1	23	23.0
>30:1	8	8.0
Total	100	100%

Comments: About 20% of the study subjects had BUN/Creatinine Ratio below 10:1 indicating intra-renal pathology possibly due to uncontrolled hypertension.

Figure 1: Bar chart for BUN/Creatinine ratio in sample population



Correlation Analysis

- **Serum Creatinine and BP**: A significant positive correlation was found between systolic BP and serum creatinine levels ($r=0.65$, $p<0.01$) and diastolic BP and serum creatinine levels ($r=0.58$, $p<0.01$).
- **BUN and BP**: A significant positive correlation was observed between systolic BP and BUN levels ($r=0.62$, $p<0.01$) and diastolic BP and BUN levels ($r=0.55$, $p<0.01$).

DISCUSSION

Interpretation of Findings

This study demonstrates a significant positive correlation between elevated BP and increased serum creatinine and BUN levels in patients with hypertensive crises. These findings suggest that as BP rises, there is a concomitant increase in renal dysfunction, evidenced by elevated serum creatinine and BUN.

Pathophysiological Mechanisms

The kidneys play a crucial role in BP regulation through the renin-angiotensin-aldosterone system (RAAS) and the excretion of sodium and water. In hypertensive crises, the excessive pressure can damage renal blood vessels, leading to reduced glomerular filtration rate (GFR) and increased levels of serum creatinine and BUN. The vascular injury and ischemia resulting from high BP can cause acute kidney injury (AKI), further exacerbating renal dysfunction.

Clinical Implications

The findings underscore the importance of early and aggressive management of BP in patients with hypertensive crises to prevent renal damage. Regular monitoring of renal function parameters in these patients is crucial for timely detection and intervention. Healthcare providers should consider the potential for renal dysfunction in the management plans of patients presenting with hypertensive crises.

Comparison with Previous Studies

Previous studies have reported similar findings, indicating a strong correlation between high BP and renal dysfunction in hypertensive crises. This study adds to the existing literature by providing detailed correlation coefficients and emphasizing the need for vigilant renal monitoring in this patient population.

CONCLUSION

Hypertensive crises are associated with significant renal dysfunction, as evidenced by elevated serum creatinine and BUN levels. There is a strong positive correlation between BP and these renal parameters, highlighting the impact of uncontrolled hypertension on kidney health. Early intervention and careful monitoring of renal function are essential in managing hypertensive crises to prevent long-term renal damage and improve patient outcomes.

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