

Biochemical Profile of Chronic Kidney Disease (CKD) Patients Across Various Age and Gender Groups Visiting a Tertiary Care Centre: A Retrospective Observational Study

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ABSTRACT

Background: Chronic Kidney Disease (CKD) represents a significant public health concern with distinct biochemical abnormalities that vary across demographic groups. Understanding the biochemical profile of CKD patients stratified by age and gender can offer insights into disease progression and management strategies.

Methods: This retrospective observational study analyzed the biochemical profiles of CKD patients visiting a tertiary care center over two years. The study included patients grouped by age (18–40, 41–60, >60 years) and gender. Parameters such as serum creatinine, urea, potassium, hemoglobin, and calcium levels were evaluated and compared.

Results: A total of 350 CKD patients were included, with males comprising 58% and females 42%. Serum creatinine levels were significantly elevated in males compared to females ($p < 0.05$). Younger patients (18–40 years) exhibited lower hemoglobin levels, while elderly patients (>60 years) showed more pronounced hyperkalemia and hypocalcemia.

Conclusion: Biochemical profiles in CKD patients exhibit significant variations based on age and gender. Tailored management strategies are necessary to address these disparities and improve outcomes.

Keywords: Chronic kidney disease, Biochemical profile, Gender differences, Age stratification, Retrospective study, Tertiary care

INTRODUCTION

Chronic Kidney Disease (CKD) is a progressive condition characterized by impaired renal function and metabolic derangements. Biochemical alterations, such as elevated serum creatinine and urea levels, anemia, and electrolyte imbalances, are hallmarks of CKD. However, these parameters can vary significantly across age and gender groups, impacting clinical management.

This study investigates the biochemical profiles of CKD patients across different age and gender groups to identify trends and differences. Such insights can guide personalized interventions and improve patient care.

Methodology

Study Design and Setting:

This retrospective observational study was conducted at a tertiary care center from January 2021 to December 2022.

Study Population:

The study included 350 CKD patients, categorized into three age groups:

1. Group A: 18–40 years
2. Group B: 41–60 years
3. Group C: >60 years

Gender-based subgroups were also analyzed.

Inclusion Criteria:

- Diagnosed CKD (eGFR <60 mL/min/1.73 m² for >3 months).
- Patients aged ≥18 years.
- Availability of complete biochemical records.

Exclusion Criteria:

- Acute kidney injury (AKI).
- Incomplete medical records.
- Patients with comorbid conditions affecting biochemical markers (e.g., malignancies).

Data

Data were collected from electronic medical records, including:

- Serum creatinine, urea, potassium, sodium, hemoglobin, and calcium levels.
- Demographic information (age, gender).

Collection:

Statistical

Analysis:

Continuous variables were analyzed using ANOVA, while categorical variables were compared using the chi-square test. Statistical significance was set at $p < 0.05$.

Results

Demographics:

Of 350 patients, 203 (58%) were male and 147 (42%) were female. The mean age was 52 ± 15 years, with the majority (45%) in the 41–60 years age group.

Biochemical Profiles:

- **Serum Creatinine:** Elevated levels were observed across all groups, with males showing higher values than females (6.5 ± 1.2 mg/dL vs. 5.8 ± 1.0 mg/dL, $p < 0.05$).
- **Serum Urea:** Urea levels were highest in the >60 years group (82 ± 15 mg/dL).
- **Hemoglobin:** Younger patients had significantly lower levels (9.5 ± 1.3 g/dL in Group A vs. 11.2 ± 1.5 g/dL in Group C, $p < 0.05$).
- **Potassium:** Hyperkalemia ($K^+ > 5.5$ mmol/L) was more prevalent in the elderly (30% in Group C vs. 12% in Group A).
- **Calcium:** Hypocalcemia (< 8.5 mg/dL) was noted in 40% of patients, predominantly in females ($p < 0.05$).

Gender Comparisons:

- Females had higher rates of anemia (72% vs. 58%, $p < 0.05$).
- Males exhibited slightly higher serum creatinine and urea levels.

Discussion

The findings of this study highlight distinct biochemical trends in CKD patients based on age and gender.

Age-Related Variations:

Younger patients (18–40 years) demonstrated more severe anemia, likely due to nutritional deficiencies and delayed diagnosis. In contrast, elderly patients exhibited more pronounced hyperkalemia and hypocalcemia, reflecting advanced renal dysfunction and comorbid conditions.

Gender Differences:

Males presented with higher serum creatinine and urea levels, possibly due to greater muscle mass and dietary protein intake. However, females showed a higher prevalence of anemia, consistent with hormonal and nutritional factors.

Clinical Implications:

- **Younger Patients:** Focus on early diagnosis and anemia correction.
- **Elderly Patients:** Close monitoring of electrolyte imbalances and bone health.
- **Females:** Address gender-specific factors contributing to anemia.

Strengths and Limitations:

This study's strengths include a large sample size and detailed subgroup analysis. Limitations include its retrospective design and potential confounding factors affecting biochemical parameters.

Table 1: Biochemical Profiles by Age Group

Parameter	18–40 Years (n=90)	41–60 Years (n=157)	>60 Years (n=103)	p-Value
Serum Creatinine (mg/dL)	5.8 ± 1.0	6.2 ± 1.1	6.5 ± 1.2	< 0.05
Serum Urea (mg/dL)	72 ± 12	78 ± 13	82 ± 15	< 0.05
Hemoglobin (g/dL)	9.5 ± 1.3	10.3 ± 1.4	11.2 ± 1.5	< 0.05
Potassium (mmol/L)	4.8 ± 0.5	5.1 ± 0.6	5.6 ± 0.7	< 0.05
Calcium (mg/dL)	8.8 ± 0.5	8.5 ± 0.6	8.2 ± 0.7	< 0.05

Table 2: Gender Differences in Biochemical Profiles

Parameter	Male (n=203)	Female (n=147)	p-Value
Serum Creatinine (mg/dL)	6.5 ± 1.2	5.8 ± 1.0	<0.05
Serum Urea (mg/dL)	80 ± 15	75 ± 14	<0.05
Hemoglobin (g/dL)	10.2 ± 1.4	9.5 ± 1.3	<0.05
Potassium (mmol/L)	5.3 ± 0.6	5.0 ± 0.5	<0.05
Calcium (mg/dL)	8.6 ± 0.6	8.4 ± 0.5	<0.05

Conclusion

The biochemical profiles of CKD patients reveal significant differences across age and gender groups. Elderly patients and females require special attention for managing electrolyte imbalances and anemia, respectively. These findings emphasize the need for tailored therapeutic approaches to improve clinical outcomes.

Future research should focus on longitudinal studies to assess the impact of these biochemical variations on CKD progression and treatment efficacy.

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