



## PREVALENCE AND MANAGEMENT OF CARDIORENAL SYNDROME IN DIABETIC PATIENTS PRESENTING TO THE NEPHROLOGY DIVISION AT KHYBER TEACHING HOSPITAL, PESHAWAR

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### ABSTRACT

**Background:** Cardiorenal Syndrome (CRS) is a complex condition characterized by the interdependence of cardiac and renal dysfunction. In diabetic patients, this syndrome is prevalent due to the multifaceted impact of diabetes on both organ systems. Effective management of CRS requires a nuanced understanding of its prevalence and the development of targeted treatment strategies.

**Aim:** This study aims to investigate the prevalence of Cardiorenal Syndrome among diabetic patients presenting to the Nephrology Division at Khyber Teaching Hospital, Peshawar, and to evaluate the management approaches employed.

**Methods:** A cross-sectional analysis was conducted involving diabetic patients with documented cardiac and renal conditions. Data was collected from medical records and clinical evaluations conducted between July 2023 to December 2023. Inclusion criteria encompassed diabetic patients with evidence of cardiac and renal dysfunction, while exclusion criteria included patients without complete records or those with non-diabetic etiologies of cardiac or renal disease. Statistical analysis was performed to assess prevalence rates and management practices.

**Results:** Of the 200 diabetic patients with Cardiorenal Syndrome (CRS) at Khyber Teaching Hospital, the most prevalent type was Type 2 (Chronic Cardio-Renal), affecting 60% of patients, with an average age of 68 years. This type was predominantly male (65%) and characterized by high rates of hypertension (95%) and poor glycemic control (85%). Type 4 (Chronic Reno-Cardiac) was observed in 25% of patients, often with advanced CKD stages and significant heart failure

(80% in NYHA Class III/IV). Type 1 (Acute Cardio-Renal) and Type 3 (Acute Reno-Cardiac) were less common, affecting 10% and 5% of patients, respectively. Type 1 was associated with CKD Stage 3 or 4 and a substantial prevalence of low left ventricular ejection fraction (50%), while Type 3 had severe CKD with 70% having LVEF <40%. Type 5 (Secondary CRS) was not present in this cohort. Management strategies revealed that 70% of patients received ACE inhibitors, and 65% adhered to lifestyle modifications including dietary changes and exercise. The majority received coordinated care involving nephrologists and cardiologists (50%) and education on disease management (55%). Follow-up showed that 40% of patients had monthly visits to monitor their condition.

**Conclusion:** The high prevalence of Cardiorenal Syndrome among diabetic patients underscores the need for integrated management approaches. Effective treatment strategies should address both cardiac and renal dysfunctions simultaneously. This study highlights the importance of multidisciplinary care and ongoing research to optimize outcomes for patients with Cardiorenal Syndrome.

**Keywords:** Cardiorenal Syndrome, Diabetes Mellitus, Chronic Kidney Disease, Congestive Heart Failure, Nephrology, Cardiovascular Management.

## INTRODUCTION

Cardiorenal Syndrome (CRS) is a complex and multifaceted condition characterized by the interrelationship between cardiac and renal dysfunction. This syndrome significantly complicates the management of both conditions and is of particular concern in diabetic patients, who are at high risk due to the systemic effects of diabetes on cardiovascular and renal health (1, 2). Diabetes Mellitus (DM) accelerates the progression of both heart and kidney diseases through mechanisms such as hyperglycemia, hypertension, and atherosclerosis, which exacerbate the pathophysiological changes in these organs (3, 4).

The prevalence of CRS among diabetic patients is notably high, with studies indicating that diabetes significantly increases the risk of developing both chronic kidney disease (CKD) and congestive heart failure (CHF) (5, 6). Diabetic patients often present with a combination of these conditions, making CRS a critical concern for effective disease management. The intricate relationship between cardiac and renal dysfunction in CRS requires a comprehensive and integrated approach to treatment, addressing the specific needs of patients with both conditions simultaneously (7, 8).

Effective management of CRS involves not only addressing the symptoms and progression of CKD and CHF but also implementing strategies that target the underlying pathophysiological processes influenced by diabetes (9, 10). Pharmacological treatments, including the use of ACE inhibitors, diuretics, and beta-blockers, play a crucial role in managing the symptoms of CRS, while lifestyle modifications, such as dietary changes and physical activity, are essential for improving overall health and reducing disease burden (11, 12).

Type of Cardiorenal Syndrome	Description	Pathophysiology	Example
Type 1: Acute Cardiorenal Syndrome	Acute heart failure leading to acute kidney injury	Acute reduction in cardiac output causes decreased renal perfusion and elevated systemic venous pressure.	Acute myocardial infarction causing rapid decline in renal function.
Type 2: Chronic Cardiorenal Syndrome	Chronic heart failure leading to progressive chronic kidney disease	Chronic low cardiac output and increased systemic vascular resistance lead to sustained renal hypoperfusion.	Chronic heart failure progressing to chronic kidney disease over several years.
Type 3: Acute Renocardiac Syndrome	Acute kidney injury resulting in acute cardiac	Acute kidney injury leads to fluid overload, electrolyte imbalances, and accumulation of uremic toxins,	Severe dehydration leading to acute kidney injury and subsequent acute heart failure.

	dysfunction	affecting cardiac function.	
Type 4: Chronic Renocardiac Syndrome	Chronic kidney disease leading to chronic heart disease	Chronic kidney disease causes fluid overload, hypertension, and increased systemic vascular resistance, affecting cardiac function.	Chronic kidney disease leading to hypertension and left ventricular hypertrophy, progressing to heart failure.
Type 5: Secondary Cardiorenal Syndrome	Systemic conditions affecting both heart and kidneys	Systemic diseases like diabetes or hypertension cause independent damage to both cardiac and renal systems.	Diabetes mellitus causing both heart failure and chronic kidney disease due to systemic effects.

The current study aims to investigate the prevalence of Cardiorenal Syndrome among diabetic patients presenting to the Nephrology Division at Khyber Teaching Hospital, Peshawar, and to evaluate the management strategies employed for these patients. By examining the prevalence and treatment approaches, this research seeks to provide valuable insights into optimizing care for diabetic patients with CRS and improving their overall outcomes.

## METHODOLOGY

**Study Design:** A cross-sectional study design was utilized to evaluate the prevalence and management of Cardiorenal Syndrome in diabetic patients.

**Sample Size:** The study included 200 diabetic patients who were diagnosed with both cardiac and renal conditions and presented to the Nephrology Division from July 2023 to december 2023.

### Inclusion Criteria:

- Diabetic patients with documented cardiac and renal dysfunction.
- Complete medical records available for review.
- Patients aged 18 years and older.

### Exclusion Criteria:

- Patients with incomplete medical records.
- Patients with non-diabetic causes of cardiac or renal disease.
- Pediatric patients.

**Data Collection:** Data was collected through systematic review of medical records and clinical evaluations. Information on prevalence, types of Cardiorenal Syndrome, and management strategies was documented.

**Statistical Analysis:** Descriptive statistics, including frequencies and percentages, were used to summarize prevalence data. Management approaches were analyzed to assess the common treatment modalities and their effectiveness.

**Ethical Considerations:** The study adhered to ethical guidelines as outlined in the Declaration of Helsinki. Informed consent was obtained from all participants or their legal representatives, and patient confidentiality was maintained

## RESULTS

### Table 1: Demographic and Clinical Characteristics of Diabetic Patients with Cardiorenal Syndrome (CRS)

The table summarizes key demographic and clinical characteristics of diabetic patients with different types of Cardiorenal Syndrome (CRS) at Khyber Teaching Hospital, Peshawar. **Type 2 CRS (Chronic Cardio-Renal)** is the most common, affecting 60% of patients, predominantly

males (65%), with a high prevalence of hypertension (95%) and poor glycemic control (85%). **Type 1 CRS (Acute Cardio-Renal)** affects 10% of patients, mainly in CKD Stage 3 or 4, with 90% having hypertension. **Type 4 CRS (Chronic Reno-Cardiac)** is present in 25% of cases, with advanced CKD stages and significant heart failure (80% in NYHA Class III/IV). **Type 3 CRS (Acute Reno-Cardiac)** is less frequent (5%) but severe, with 70% having a low LVEF (<40%). **Type 5 CRS (Secondary CRS)** was not observed in this study.

CRS Type	Prevalence (%)	Average Age (Year)	Male (%)	Hypertension (%)	Glycemic Control (HbA1c > 7%)	Chronic Kidney Disease (CKD) Stage	Heart Failure (NYHA Class III/IV) (%)	Left Ventricular Ejection Fraction (LVEF < 40%) (%)
<b>Type 1 (Acute Cardio-Renal)</b>	10%	65	70%	90%	80%	CKD Stage 3 (40%), Stage 4 (60%)	70%	50%
<b>Type 2 (Chronic Cardio-Renal)</b>	60%	68	65%	95%	85%	CKD Stage 2 (30%), Stage 3 (50%), Stage 4 (20%)	85%	40%
<b>Type 3 (Acute Reno-Cardiac)</b>	5%	60	60%	85%	70%	CKD Stage 4 (70%), Stage 5 (30%)	65%	70%
<b>Type 4 (Chronic Reno-Cardiac)</b>	25%	70	55%	92%	88%	CKD Stage 3 (20%), Stage 4 (50%), Stage 5 (30%)	80%	50%
<b>Type 5 (Secondary CRS)</b>	0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A

**Table 2: Management Strategies and Utilization Ratios for Cardiorenal Syndrome in Diabetic Patients**

This table presents the management strategies for Cardiorenal Syndrome in diabetic patients at the Nephrology Division of Khyber Teaching Hospital, Peshawar. It includes pharmacological interventions, lifestyle modifications, coordinated care, patient education, and follow-up frequencies. The table highlights the percentage of patients receiving each intervention, emphasizing key ratios such as the 70% usage of ACE inhibitors and the 65% adherence to lifestyle modifications. These ratios reflect the hospital's comprehensive and targeted approach to managing this complex condition effectively.

Management Strategy	Percentage of Patients	Additional Details
<b>Pharmacological Interventions</b>		
ACE Inhibitors	70%	Most commonly prescribed for blood pressure control
Diuretics	60%	Used primarily for fluid management
Beta-Blockers	50%	Prescribed for heart rate and blood pressure control
<b>Lifestyle Modifications</b>		
Dietary Changes	65%	Emphasis on low sodium and balanced diet
Exercise	65%	Includes regular cardiovascular and strength training
<b>Coordinated Care</b>		
Multidisciplinary Care (Nephrologists & Cardiologists)	50%	Involves regular consultations and shared management plans
<b>Patient Education</b>		
Education on Disease Management	55%	Includes understanding of Cardiorenal Syndrome
Self-Monitoring Training	45%	Training on monitoring symptoms and medication

Follow-Up Frequency			
Monthly	40%	Regular check-ups to monitor progress	
Quarterly	35%	Less frequent but still regular follow-ups	
Bi-Annually	25%	Less frequent follow-ups	

## Discussion

The findings of this study underscore the high prevalence of Cardiorenal Syndrome (CRS) among diabetic patients at Khyber Teaching Hospital, Peshawar, revealing a complex interplay between diabetes, cardiac, and renal dysfunction. The predominance of Type 2 CRS (Chronic Cardio-Renal) in 60% of patients aligns with reports from various countries, suggesting a significant burden of chronic conditions in diabetic populations.

In comparison, a study conducted in the United States by Umanath et al. (2021) found that Type 2 CRS accounted for approximately 50% of cases among diabetic patients with CRS [13]. This is somewhat lower than our findings but still reflects a significant prevalence of chronic cardiorenal complications. In the UK, Bhatia et al. (2020) reported a prevalence of 55% for Type 2 CRS, which is similar to our study [14]. This indicates that the prevalence of chronic CRS is consistently high across different regions, highlighting the global impact of chronic cardiorenal dysfunction in diabetes.

In contrast, a study from Brazil by Kalra et al. (2022) observed a lower prevalence of Type 2 CRS at 40% among diabetic patients [15]. This variation might be attributed to differences in healthcare systems, demographic factors, or the severity of diabetes and its complications in different populations. Additionally, in China, Zeng et al. (2021) reported that Type 2 CRS represented 45% of cases [16]. These international comparisons suggest that while the prevalence of Type 2 CRS is high globally, there are regional differences that could be influenced by local health policies, lifestyle factors, and healthcare access.

Regarding Type 1 CRS (Acute Cardio-Renal), which was observed in 10% of our cohort, studies from the United States and Canada indicate a similar prevalence of 8-12% [17, 18]. This consistency suggests that acute forms of CRS are relatively stable across different settings. However, the higher prevalence of Type 1 CRS in our study compared to some international reports may reflect variations in patient population characteristics or differences in diagnostic criteria.

Type 3 (Acute Reno-Cardiac) and Type 4 (Chronic Reno-Cardiac) CRS also showed noteworthy prevalence rates in our study, with Type 3 at 5% and Type 4 at 25%. Comparatively, studies in the UK and Canada have reported Type 3 CRS prevalence ranging from 4-6% [19, 20] and Type 4 CRS at around 20-30% [21, 22]. This alignment suggests that the distribution of acute and chronic cardiorenal dysfunction is comparable across different countries, though specific prevalence rates may vary.

The management strategies employed in our study, including the use of ACE inhibitors (70%) and lifestyle modifications (65%), are consistent with global practices. In the United States, the use of ACE inhibitors is reported at approximately 60-70% [23], while lifestyle modifications such as dietary changes and exercise are also widely recommended [24]. The multidisciplinary approach involving nephrologists and cardiologists, used for 50% of our patients, mirrors practices observed in the UK and Canada, where integrated care is increasingly emphasized [25, 26]. This highlights the importance of coordinated care in managing complex conditions like CRS.

In summary, while the prevalence of different types of CRS among diabetic patients at Khyber Teaching Hospital is generally consistent with international findings, regional variations highlight the need for tailored approaches to management. The high prevalence of chronic cardiorenal complications underscores the importance of integrated care strategies and ongoing research to optimize outcomes for patients with CRS. Future studies should focus on exploring the underlying reasons for these regional differences and refining management protocols to address the specific needs of diverse populations.

## Conclusion

This study provides valuable insights into the prevalence and management of Cardiorenal Syndrome (CRS) among diabetic patients at Khyber Teaching Hospital, Peshawar. Our findings reveal that Type 2 CRS (Chronic Cardio-Renal) is the most prevalent form, affecting 60% of the study population. This highlights the significant burden of chronic cardiorenal complications in diabetic patients, which is consistent with global reports but exhibits some regional variations. The high prevalence of hypertension and poor glycemic control among these patients underscores the need for targeted interventions and integrated care strategies.

The management approaches employed, including the use of ACE inhibitors, lifestyle modifications, and multidisciplinary care, align with established practices and emphasize the importance of a comprehensive approach to managing CRS. Despite the high rates of pharmacological and lifestyle interventions, challenges remain in achieving optimal glycemic and blood pressure control, as evidenced by the persistent prevalence of these issues among patients.

In conclusion, effective management of CRS in diabetic patients requires a multifaceted approach that addresses both cardiac and renal dysfunctions simultaneously. The study highlights the need for ongoing research and tailored treatment strategies to improve patient outcomes. Continued efforts to enhance integrated care and patient education will be crucial in optimizing the management of CRS and mitigating its impact on patients' health.

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