Prevalence, Risk Factors and Incidence of Acute Renal Failure Disorders in Patients of Quetta (Balochistan)

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Abstract

The study was carried out between March 2023 and January 2024 from four different hospitals from Quetta. The data collected from 1043 patients with acute renal failure disorders were diagnosed for the comprehensive examination of patient's medical records, laboratory test results, and diagnostic reports. Every patient also participates in a research-based questionnaire interview to obtain thorough data on symptoms, medical history, and possible risk factors. Samples from the patients were subjected to various biochemical tests, including complete blood count (CBC), urinalysis, serum urea/creatinine, and electrolyte analysis. The patient counts range from 83 to 380, and the age groups cover 81-100 years to 1-20 years. The cohort from 1 to 20 has the second highest incidence rate (29.72%), with the cohort from 21 to 40 having the highest incidence rate (36.43%). This suggests that there is a notable pattern in the disease's prevalence among different age groups. The majority of the 21–40 year cohort (>60%) is female, which may indicate particular gender-related health issues during this time. Male representation, on the other hand, is consistently higher in different age groups (between 50 and 61%) and may correspond with patterns of age-related male-biased morbidity. As a result, this study clarifies the epidemiological context of acute renal failure disorders in patients, highlighting the growing incidence rates and major healthcare burden associated with these conditions.

Keywords: Prevalence, Risk Factors and Incidence, Acute Renal Failure Disorders.

Introduction

Acute renal failure (ARF) is a major global health concern that causes a considerable amount of morbidity and mortality. Any abrupt decline in kidney function is referred to as acute kidney injury (AKI), which can be reversed if discovered in time (Kellum et al., 2021). AKI is a serious

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issue that hospital patients frequently face, and its prevalence is rising. This is caused by the ageing of the population as well as the increased use of diagnostic and therapeutic procedures that increase the risk of kidney damage (Weis et al., 2019).

The main importance of studying the "Prevalence, Risk Factors and Incidence of Acute Renal Failure Disorders in Patients of Quetta District, Balochistan" lies in its potential to improve public health outcomes in several ways, such as identifying the burden of disease, pinpointing risk factors, early detection and intervention, informing policy decisions and guiding future research.

According to a survey, the death rate from acute renal failure (ARF) increases significantly and ranges from 14% to 41% for patients who start dialysis during their hospital stay (Chan et al., 2020). The collective term for a collection of functional kidney diseases, including AKI, is acute kidney disease and disorders (AKD). The severity of these conditions can range from moderate and self-limiting to severe and long-lasting. For example, AKD may develop without ever meeting the requirement of rapid onset of AKI when kidney dysfunction advances slowly (See et al., 2021). On the other hand, if kidney dysfunction does not improve or if structural damage to the kidneys persists, AKD may persist after an AKI event has ended. If acute kidney disease (AKD) lasts longer than three months, it is considered chronic kidney disease (CKD). Notably, patients with prior CKD often experience AKI and AKD (Lamerie et al., 2021).

According to a 2022 study conducted at JPMC in Karachi, 6.4% to 12.4% of critically ill patients had acute renal failure (Luyckx et al., 2021). ARF incidence has been noticeably high in Pakistan, where it has been linked to various factors, including inadequate access to clean water, poor sanitation, and scarce healthcare resources (James et al., 2020). An international study that was published in The Lancet estimates that there are about 21.6 million cases of AKI annually (Komaru et al., 2020). AKI development is attributed to multiple risk factors. These include advanced age, diabetes, hypertension, heart failure, liver disease, kidney disease that already existed, and certain medications (like some antibiotics and nonsteroidal anti-inflammatory drugs). AKI can also happen as a result of exposure to toxins, major surgeries, or serious infections (Liu et al., 2019).

Despite a wealth of epidemiologic data, it is still unknown how much the development of CKD or AKI itself mediates the negative outcome association between the two conditions (Scholz et al., 2021). It has proven difficult to distinguish between a new episode of AKI and persistent AKI with incomplete recovery. In this issue of AJKD, Liu et al. looked at a cohort of 429,852 eligible adults who were admitted to hospitals between 2006 and 2013 (Liu et al., 2019). Using Scrbased KDIGO (Kidney Disease: Improving Global Outcomes) definitions, they found that 9% of patients experienced AKI during a hospital stay; of these, 28.6% experienced a second episode of AKI. The high rate of recurrent AKI raises concerns because it highlights the need to differentiate AKI recurrence from partial recovery or the advancement of CKD (Macedo & Mehta, 2019).

According to a report (Banda et al., 2020), the prevalence of acute kidney injury (AKI) is estimated to be 20–200 per million in the general population, 7–18% in hospital patients, and approximately 50% in patients admitted to the intensive care unit (ICU). AKI is a major cause of morbidity and mortality; it is estimated that 2 million people worldwide die from AKI each year. Moreover, survivors of AKI are more likely to develop chronic kidney disease (CKD) and end-stage renal disease (ESRD), conditions that have a major detrimental influence on people's lives, the economy, and society (Kellum et al., 2021).

Research Methodology

Research Design

Four different hospitals were used for the study. The Balochistan Institute of Nephrons-Urology Quetta (BINUQ), the Bolan Medical Complex Hospital (BMCH), the Sandeman

Provisional Hospital (SPH), and the Fatima Jinnah General & Chest Hospital Brewery Road (FJICD), all located in the Quetta District. The study was conducted between March 2023 and January 2024. To diagnose acute renal disease, a total of 1043 patients between the ages of 1 year and over 80 were chosen.

Inclusion Criteria

Patients with acute renal failure disorders who reside in Quetta district, Balochistan, between March 2023 and January 2024, ranging in age from 1 year to over 80 years, will be included.

Exclusion Criteria

Patients with chronic kidney disease who reside outside of Quetta district, Balochistan, and who are younger than one year of age will not be accepted.

Data Collections

For the thorough review of patient medical records, laboratory test results, and diagnostic reports, data from 1043 patients with acute renal failure disorders were gathered. Every patient also participates in a research-based questionnaire interview to obtain comprehensive data on symptoms, medical history, and possible risk factors. This all-encompassing strategy guarantees comprehensive data collection and offers insightful information about the incidence, risk factors, and prevalence of acute renal failure disorders within the study population.

Biochemical Tests

Samples from 1043 patients were examined using biochemical tests, including electrolytes, serum urea/creatinine, urinalysis, and complete blood count (CBC).

Statistical Analysis

The statistical Analysis was carried out using SPSS, version 26 statistical software. The mean, median, standard deviation (SD), frequency (%), and mean were the descriptive statistics that were employed. A P-value of less than 0.05 was found to be statistically significant.

Results

A total of 1043 patients were chosen for the study, 506 of whom were male (48.51%) and 537 of whom were female (51.48%). The patients belonged to five different age groups: 1-20 years, 21-40 years, 41-60 years, 61-80 years, and 81-100 years, with a 20-year group difference from different villages in the Quetta district.

Table 1: Incidence of acute renal disorder in different age groups

S.No.	Age Group	No. of Patients	Incidence in Percentage %
1	1-20 years	310	29.72%
2	21-40 years	380	36.43%
3	41-60 years	170	16.29%
4	61-80 years	100	9.61%
5	81-100 years	83	7.95%

Figure 1: Incidence of acute renal disorder in different age groups

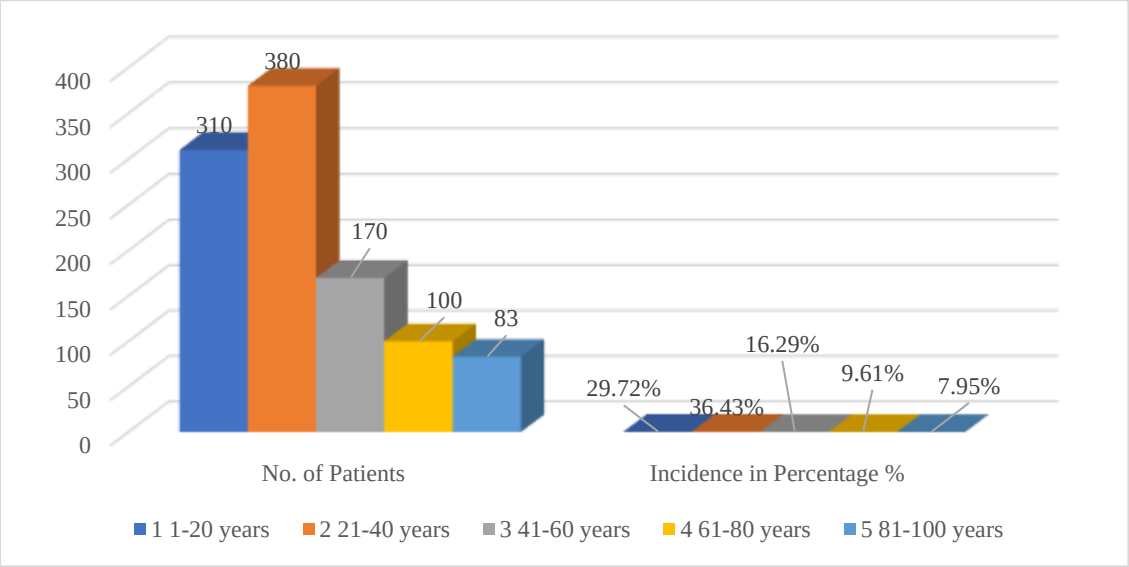


Table 1 and figure 1 provide an essential dataset for epidemiological analysis by showing the age distribution of patients and the associated incidence rates within a given population. The patient counts range from 83 to 380, and the age groups cover 81-100 years to 1-20 years. Notably, the cohort aged 21 to 40 has the highest incidence rate (36.43%), followed by the cohort aged 1 to 20 (29.72%). This indicates a noteworthy pattern in the prevalence of the disease across various age groups.

Table 2: Electrolyte Levels in different age groups

Age Group	Sodium (mEq/L)	Potassium (mEq/L)	Calcium (mg/dL)	Phosphate (mg/dL)	Magnesium (mg/dL)
1-20 years	140	3.8	9.7	4.5	2.2
21-40 years	142	4.0	8.9	4.1	2.0
41-60 years	138	5.2	7.2	4.4	1.8
61-80 years	126	5.8	6.5	5.3	1.4
81-100 years	122	6.0	6.0	5.9	1.1

Figure 2: Electrolyte levels in different age groups

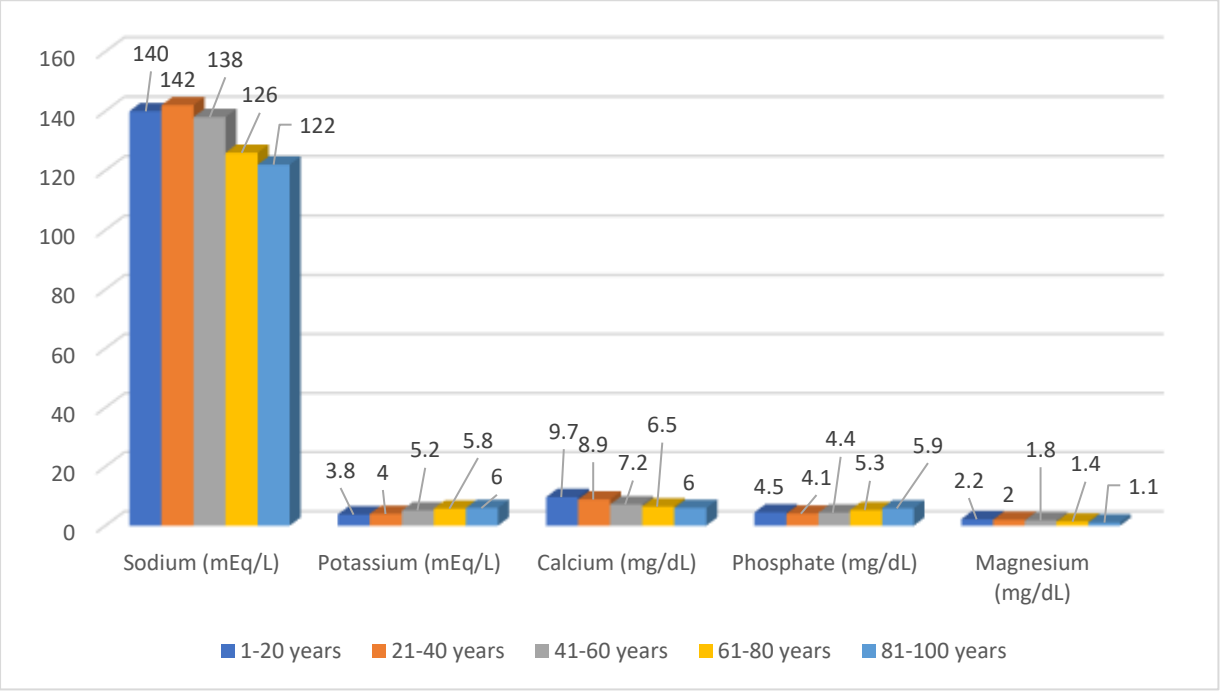
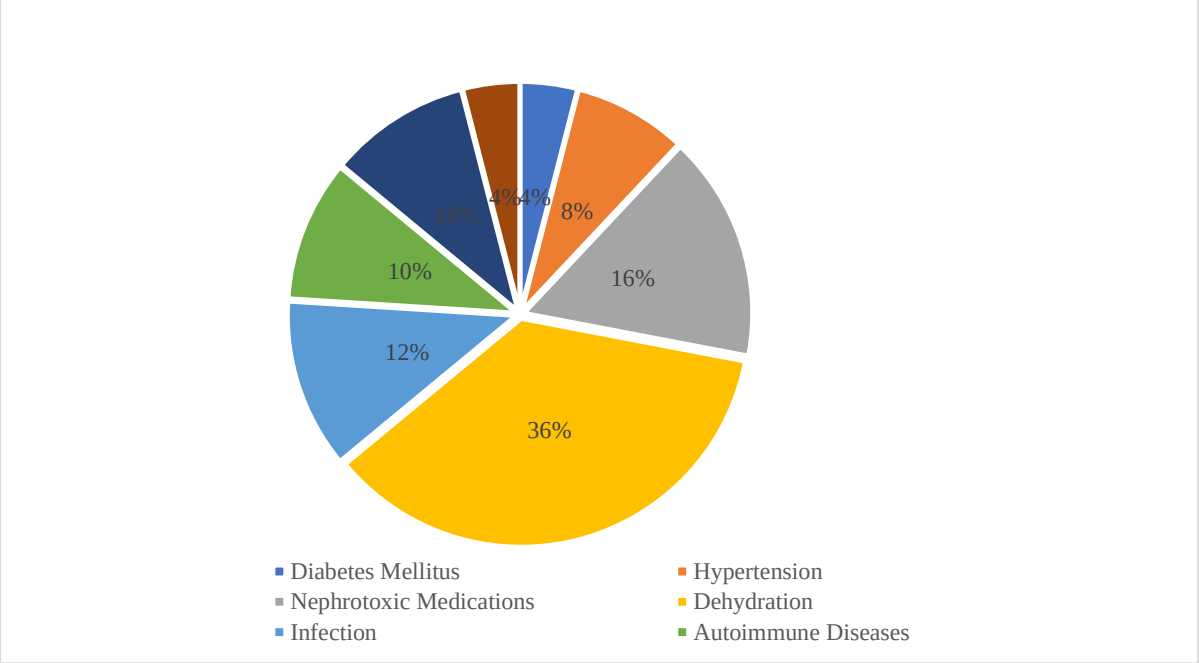


Table 2 and figure 2 provide an overview of the critical electrolyte levels for each age group. Age-related changes in sodium are marginal (mean: 135.6 mEq/L, range: 122-142 mEq/L). Age-related increases in potassium are moderate (mean: 4.76 mEq/L, range: 3.8-6.0 mEq/L). The mean calcium and phosphate levels decrease with age (6.0-9.7 mg/dL and 4.84 mg/dL, respectively; range: 4.1-5.9 mg/dL and 7.88 mg/dL, respectively). The oldest age group has the lowest magnesium levels (mean: 1.18 mg/dL, range: 1.1-2.2 mg/dL). To investigate the possible clinical implications of these observed patterns, more research is required.

Table 3: Risk factors for acute renal failure disorders according to age groups

Factor	1-20 years (%)	21-40 years (%)	41-60 years (%)	61-80 years (%)	81-100 years (%)
Diabetes Mellitus	4	12	21	25	26
Hypertension	8	13	24	28	28
Nephrotoxic Medications	16	25	28	31	34
Dehydration	36	16	14	6	4
Infection	12	26	9	7	4
Autoimmune Diseases	10	2	1	1	1
Glomerular diseases	10	4	1	1	1
Trauma or Surgery	4	2	2	1	2

Figure 3: Risk factors for acute renal failure disorders according to age groups

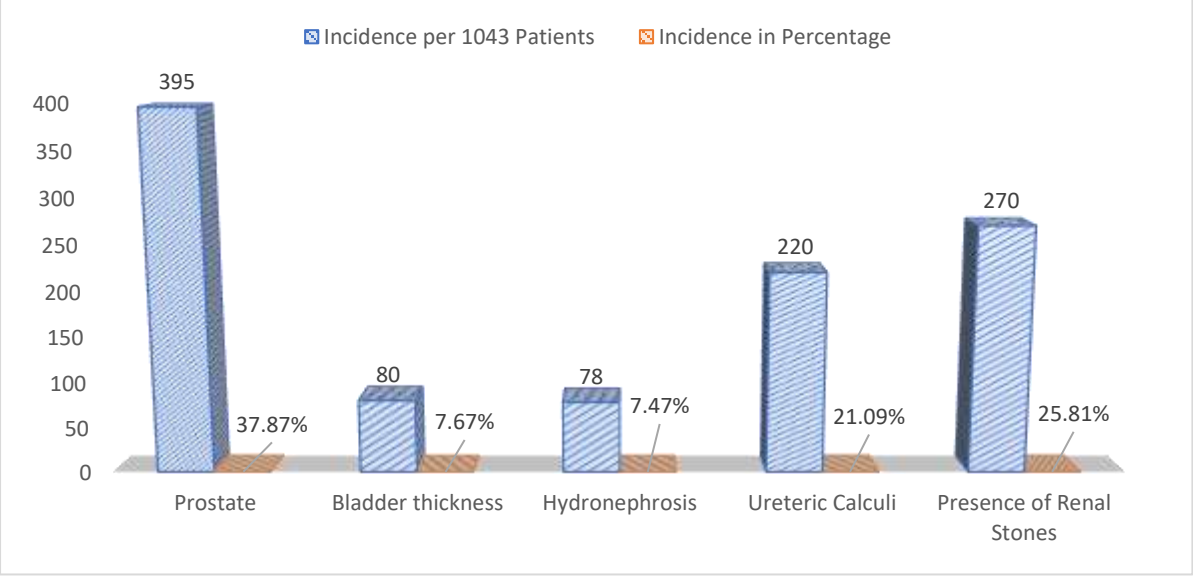


The distribution of contributing factors across various age groups is shown in table 3 and figure 3. Infection and nephrotoxic drugs are the next most common factors in the youngest age group (1–20 years), followed by dehydration. As people age, the prevalence of hypertension and diabetes mellitus rises, ranking first and second in the 61–80 and 81–100 age groups, respectively. Dehydration and nephrotoxic drugs continue to be major factors in all age groups. To investigate the underlying etiological factors and possible interactions between these contributors, more investigation is necessary.

Table 4: Ultrasonography according to genitourinary tract among different patients

S. No.	Ultrasound Finding	Incidence per 1043 Patients	Incidence in Percentage
1	Prostate	395	37.87%
2	Bladder thickness	80	7.67%
3	Hydronephrosis	78	7.47%
4	Ureteric Calculi	220	21.09%
5	Presence of Renal Stones	270	25.81%

Figure 4: Ultrasonography according to genitourinary tract among different patients

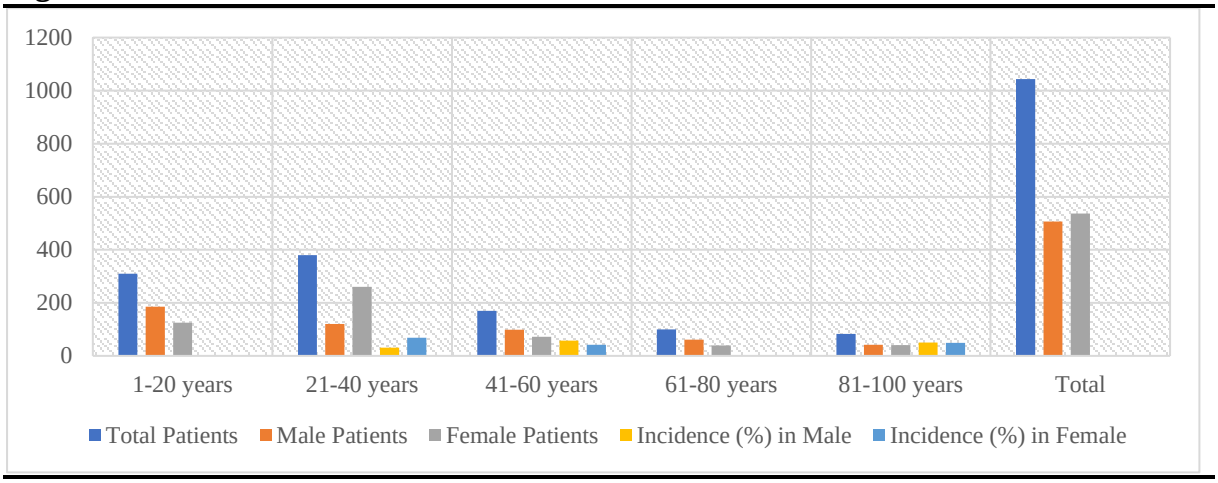


Based on 1043 patients, the data analysis of table 4 and figure 4 shows a high prevalence of renal abnormalities found by ultrasound. Together, renal stones (presence and ureteric calculi) account for almost 47% of cases; renal stones are the most common finding, accounting for 25.81 percent of cases. Another noteworthy finding is the presence of prostate enlargement (37.87%), which may be indicative of underlying genitourinary pathology. Although less common, bladder wall thickening (7.67%) and hydronephrosis (7.47%) merit additional research to rule out possible urological causes. These results point to the importance of using ultrasound screening in this patient population for the early diagnosis and treatment of genitourinary and renal disorders.

Table 5: Ratio of incidence of acute renal disorder in male and female

Age Group	Total Patients	Male Patients	Female Patients	Incidence (%) in Male	Incidence (%) in Female
1-20 years	310	185	125	59.67%	40.32%
21-40 years	380	120	260	31.57	68.42
41-60 years	170	98	72	57.64	42.35
61-80 years	100	61	39	61.0%	39.0%
81-100 years	83	42	41	50.60	49.39
Total	1043	506	537		

Figure 5: Ratio of incidence of acute renal disorder in male and female



There are significant gender differences in the distribution of patients by age group, as shown in table 5 and figure 5. The majority of participants in the 21–40-year age group are female (>60%), which may indicate that there are particular health issues related to gender during this time. In contrast, male representation in other age groups (50–61%) is consistently higher, which may be consistent with age-related male-biased morbidity patterns. The gender distribution in the 81–100 age range is interestingly almost equal, pointing to possible changes in the dynamics of healthcare utilization as people age. In order to fully understand the underlying causes of the disparities that have been observed and how they might affect healthcare strategies designed for particular age and gender groups, more research is necessary.

Discussion

The study's findings about the incidence, risk factors, and prevalence of acute renal failure disorders in the Balochistan district of Quetta are analyzed and interpreted. First, the study discovered that the sampled population's startlingly high prevalence of acute renal failure disorders places a significant burden on the region's healthcare resources. Acute renal failure is highly prevalent, as evidenced by the large number of cases diagnosed during the study period. This underscores the urgent need for better management strategies and efficient preventive measures to mitigate the condition's detrimental effects on public health.

Our analysis shows that there are gender differences in the incidence of ARF in various age groups, with the majority of participants in the 21–40-year age group being female. This result confirms the gender-specific health issues noted in previous research, indicating the necessity of focused interventions to address these discrepancies successfully.

It has been reported that 11.3% of rural Chinese residents have CKD, with 1.6% having a lower eGFR and 10.1% having albuminuria (Duan et al., 2019). Acute kidney injury (AKI), which is characterized by an abrupt loss of kidney function, is indicated by elevated serum creatinine levels. The collective term for a collection of functional kidney diseases, including AKI, is acute kidney disease and disorders (AKD). The severity of these conditions can range from moderate and self-limiting to severe and long-lasting. After an AKI event has concluded, for instance, when renal dysfunction does not improve or when kidney structural damage endures, AKD may arise, or it may never meet the requirements for a rapid onset of AKI (Kellum et al., 2021).

According to Bereda (2022) factors pertaining to the environment, socioeconomic status, and culture, as well as aspects of the healthcare process, acute exposures, and patients themselves, are risk factors for AKI. Inadequate health care systems, inadequate control of infectious

diseases, and inadequate drinking and wastewater systems are examples of environmental factors.

According to Zarkoon et al. (2020) the most common causes of AKI at Multan's medical unit (apart from obstetrics cases) were drug-induced sepsis and sepsis from other causes. It has been reported that 20–50% of patients in ICUs worldwide experience AKI (Santos et al., 2019).

Kulvichit et al. (2022) explored in the report that AKI was reported to be present in nearly half (43%) of the ICU patients at the Central Army Hospital of Gatot Soebroto in Indonesia. With over 30% of cases requiring RRT, the event had a mean incidence of 40.5% and a mean ICU mortality of 23% (Beyene et al., 2021). AKI incidence was almost 6%, the ICU mortality prediction was 45.6%, and more than 70% of critically ill patients required RRT, according to another international study that was published in 2005 (Buttner et al., 2022). As per documented data, the incidence of ARF in patients with critical illnesses ranges from 6.4% to 12.4%. Similarly, an international study that was published in The Lancet calculated that there are about 21.6 million cases of acute kidney injury (AKI) globally each year. These numbers are consistent with our research and show how commonplace ARF and AKI are (Ackan et al., 2007).

The results of the study showed that the Balochistan district of Quetta had a significant burden of acute renal failure disorders, with a high prevalence among the population that was sampled. The incidence rates were different for each age group; the cohort aged 21–40 had the highest rate, followed by the group aged 1–20. There were clear gender differences, especially in the 21–40 age range, where women dominated. The significance of focused interventions in effectively addressing health issues specific to gender is highlighted by these findings. Age-related variations were also underscored by electrolyte level analyses, highlighting the need for additional research to understand the clinical implications fully. An examination of risk factors showed some interesting patterns: the prevalence of diabetes mellitus and hypertension rose with age, while nephrotoxic drugs and dehydration continued to be important risk factors for people of all ages.

Ultrasonography findings highlighted the significance of early detection and treatment of renal and genitourinary disorders. The study's overall findings highlight the intricate interactions that occur between comorbidities, age, gender, and environmental factors when acute renal disorders arise, underscoring the need for all-encompassing strategies to lessen their negative effects on public health.

Conclusion

As a result, this study clarifies the epidemiological context of acute renal failure disorders in patients, highlighting the growing incidence rates and major healthcare burden associated with these conditions. The presence of pre-existing kidney disease and advanced age among the risk factors that have been identified highlights the complex aetiology of acute renal failure. These results support the use of focused preventive approaches and early detection techniques to reduce the morbidity and mortality linked to acute renal failure. To clarify underlying pathophysiological mechanisms and improve clinical management approaches, more research is necessary.

Limitations

The incidence, prevalence, and risk factors of patients in the Quetta district of Balochistan are the only topics covered by this study, which may restrict the applicability of the findings to other areas. Furthermore, biases may be introduced by the retrospective nature of data collection. Moreover, the investigation's emphasis on acute renal failure disorders might neglect additional kidney-related ailments, thereby compromising the findings' comprehensiveness.

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