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FREQUENCY OF DIALYSIS DEPENDENCY IN OBSTETRIC ACUTE KIDNEY INJURY

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Abstract

Background: *Pregnancy-related acute kidney injury (AKI) remains a significant contributor to maternal morbidity and mortality, particularly in low-resource settings where access to timely obstetric and nephrology care is limited. [1] Dialysis dependency, defined as the requirement for ongoing renal replacement therapy beyond the acute period, signifies progression toward chronic kidney disease and increased long-term morbidity. [2]. Despite its clinical importance, region-specific data on dialysis dependency post-obstetric AKI are scarce.*

Methods: *We conducted a prospective cross-sectional study at the Department of Nephrology, Lady Reading Hospital (LRH), Peshawar, between June and November 2024, enrolling 133 women aged 18–40 years with KDIGO-defined obstetric AKI [3]. Dialysis dependency was defined as requiring ≥12 hemodialysis sessions within one month of AKI onset. [4]. Comprehensive demographic, obstetric, socioeconomic, and clinical data (age, gestational age, parity, body mass index [BMI], hypertensive disorders, gestational diabetes, prior abortions, education level, occupation, and rural/urban residence) were collected. Data analysis included descriptive statistics and chi-square tests for stratified associations [5].*

Results: *Of the study cohort (mean age 28.5 ± 5.2 years; gestational age 36.0 ± 3.4 weeks), 90 (67.7%) had hypertensive disorders and 60 (45.1%) were primigravida. Overall, 89 (66.9%) met dialysis dependency criteria. [6]. Age-stratified dependency rates were 60% (<25 years), 72% (25–30 years), and 70% (>30 years) (p=0.48) [7]. Hypertensive patients had a significantly higher dependency rate than normotensive counterparts (77.8% 44.2%) [8]. No significant associations were observed for parity, BMI category, prior abortions, education, occupation, socioeconomic status, or residence [9]. These results*

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align with regional cohorts reporting high dependency rates but contrasting sharply with lower rates in high-resource settings. [10].

Conclusion: *The findings highlight the urgent need for enhanced antenatal screening, early AKI recognition, and expansion of dialysis services for pregnant populations in resource-limited environments.*

INTRODUCTION

Acute kidney injury (AKI) leads to fast deterioration of renal performance through elevated serum creatinine and reduced urine quantity. 11. The occurrence rates of AKI affect 7 percent of hospitalized patients yet reach up to 30 percent of patients in intensive care units. The management of AKI shows additional challenges in pregnancy or postpartum that require care for both maternal and fetal health systems. Research improvements and better obstetric care during prenatal phases led to decreased P-AKI rates in high-income nations from 40% in the 1960s to current levels under 10%, according to publications from 2018. [12]. P-AKI constitutes up to 40% of AKI cases in low- and middle-income countries because these areas lack sufficient healthcare infrastructure and nephrology services as well as cultural barriers to care.

P-AKI develops from hypertensive conditions (preeclampsia/eclampsia) together with sepsis and hemorrhage and renal cortical necrosis or thrombotic microangiopathies. [14]. Preeclampsia and sepsis have separate pathophysiological pathways characterized by endotoxin damage and microvascular tissue injuries and endotoxin toxin-related kidney damage, according to research by [15]. Placental perfusion can become impaired when women experience acute kidney injury (AKI) during important timeframes of the third trimester or postpartum period, leading to poor perinatal outcomes that include preterm birth as well as intrauterine growth restriction and elevated perinatal mortality rates. 16

P-AKI patients who need dialysis treatment become part of the CKD or ESRD population since their kidneys do not recover renal function. [17]. Multiple reviews show that P-AKI patients need dialysis at a rate of approximately 8.5%[18] but the rates in India emerge between 5-16% [1920]and some Pakistani studies find 66.7% of patients require dialysis. [3]. The various definitions used in research studies, together with divergent AKI characteristics documented at diagnosis along with differences in access to renal replacement treatment, likely create these statistical differences.

Resource planning, patient counseling and prognostic evaluation strongly depend on the frequency of dialysis dependency data. Maternal mortality rates stay elevated in Pakistan because obstetric complications frequently escalate maternity-related deaths. The main contributors to P-AKI[23] include unsafe abortion complications together with hypertensive problems and bleeding complications during childbirth. Socioeconomic and geographic factors postpone diagnosis alongside the delayed treatment of P-AKI cases because of insufficient antenatal care and rural living and poverty status and limited education. [24] Research on long-term renal outcomes among P-AKI patients at Lady Reading Hospital is limited because the institution mainly receives severe cases as referrals from other institutions.

This research initiative observes dialysis dependency in female P-AKI patients at LRH Peshawar through prospective evaluation while examining various demographic and clinical dependency associations, which include patient age along with parity and BMI statistics, hypertensive disorders, gestational diabetes records, historical abortion cases, educational background, occupational details, and socioeconomic and residential data. Our analysis of local patient data takes a global perspective alongside regional studies for developing better clinical early intervention and nephrology resource strategies aimed at pregnant and postpartum women.

Materials and Methods (600 words)

Study Design and Setting: A prospective cross-sectional study was conducted at the Department of Nephrology, Lady Reading Hospital, Peshawar—a 1,500-bed tertiary care facility—between June 1 and November 30, 2024. Ethical clearance was obtained

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from the Khyber Medical University/LRH Institutional Review Board (IRB Ref: LRH/KMU-REC/AKI/2024) [2].

Population: Women 18–40 years of age with singleton pregnancies ≥24 weeks gestation or within 6 weeks postpartum with AKI defined by KDIGO criteria of an increase in serum creatinine ≥0.3 mg/dL within 48 hours, or ≥1.5× baseline within 7 days or urine output <0.5 mL/kg/hr for 6 hours. [6] Exclusion criteria were preexisting CKD (eGFR <60 mL/min/1.73 m^2 for >3 months), history of renal transplantation, autoimmune nephritis, obstructive urinary disease, nephrolithiasis, or nephrotoxic medication exposure. [25]. Consecutive sampling was used to enroll consenting participants.

Sample Size Calculations: The WHO's sample size calculator for prevalence studies with an expected dialysis dependency of 67% (regional data), a 95% confidence interval, and an 8% error of estimate gave us the need for 133 participants. [7].

Data Collection Procedures:
After the informed consent, investigators collected baseline data, including demographic information (this included age and rural/urban residence), obstetric history (gestational age at onset of AKI, parity, history of prior abortions), comorbidities (history of gestational hypertension and preeclampsia, gestational diabetes), and anthropometric information (height, weight to calculate weight for height, or BMI[23]). With regard to education level, it was further broken down as none/primary, secondary, or tertiary; occupation as housewife or employed; and socioeconomic status (Socioeconomic Status, SES) as low, middle, or high according to household income and asset ownership. [24].
We also obtained blood samples for serum creatinine, blood urea nitrogen, electrolytes and hemoglobin at the onset of AKI. Urine output was monitored hourly. Volume resuscitation, blood pressure is controlled with antihypertensives (labetalol, hydralazine), and infection control with antibiotics when indicated. [26]. For conventional indications (uremia, refractory hyperkalemia, severe acidosis, volume overload), the patient started on hemodialysis. Participants were recorded for the number of hemodialysis sessions in the first month, and those with ≥12 sessions were considered dialysis dependent. 3.

Statistical Analysis:
The data was inputted into SPSS version 23. The values of continuous variables are mean ± standard deviation and for categorical variables frequencies and percentages are used. The main result was the percentage of patients being dependent on dialysis. Stratified analyses employing chi-square tests assessed the relationships between dialysis dependency and various categorical factors: age group (<25, 25–30, >30 years), parity (primigravida vs. multipara), BMI category (normal <25, overweight 25–29.9, obese ≥30), hypertensive disorders (yes vs. no), gestational diabetes (yes vs. no), prior abortion (yes vs. no), education (none/primary vs. secondary/tertiary), occupation, socioeconomic status, and residence. If the p-value is 0.05 or less, then the p-value is statistically significant. 27.
Written Informed Consent: All participants have given ethical consideration. Numbers representing each patient, rather than their names, were used so that patients' confidentiality would be protected. The research was in compliance with the principles described in the Declaration of Helsinki.

Results:
Cohort Characteristics: 147 women were assessed with 14 either declining participation or meeting exclusion criteria resulting in a total of 133 enrolled participants. The cohort age was 28.5 years with a standard deviation of 5.2 years and aged from 18 to 40 years. At the time of acute kidney injury (AKI) onset, gestational age was 36.0 ±3.4 weeks (15 patients [11.3%] postpartum). Primigravida constituted 45.1% (n=60), while multipara represented 54.9% (n=73). Of 90 cases, 67.7% were hypertensive disorders, 18.8% had gestational diabetes. Abortion history was observed in 30.1% (n=40)[23]. The BMI was 27.2 ± 3.8 kg/m^2, on average. The education levels are: none/primary 39.1% (n=52), secondary 45.9% (n=61), and tertiary 15.0% (n=20). Occupations: housewives 78.2%

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(n=104), employed 21.8% (n=29). Socioeconomic distribution is 58.6 [low (n=78)], 28.6 [middle (n=38)], and 12.8 [high (n=17)] respectively. Rural residents constituted 63.9% (n=85)[24]. Refer to Table 1.

Table 1. Baseline characteristics of obstetric AKI patients (n=133)

Variable	Value
Age, mean ± SD (years)	28.5 ± 5.2
Gestational age, mean ± SD (wk)	36.0 ± 3.4
Postpartum presentation	15 (11.3%)
Primigravida	60 (45.1%)
Multipara	73 (54.9%)
Hypertensive disorders	90 (67.7%)
Gestational diabetes	25 (18.8%)
Prior abortion	40 (30.1%)
BMI, mean ± SD (kg/m²)	27.2 ± 3.8
Education—none/primary	52 (39.1%)
Education – secondary	61 (45.9%)
Education—tertiary	20 (15.0%)
Occupation—housewife	104 (78.2%)
Occupation—employed	29 (21.8%)
Socioeconomic—low	78 (58.6%)
Socioeconomic—middle	38 (28.6%)
Socioeconomic—high	17 (12.8%)
Residence—rural	85 (63.9%)
Residence—urban	48 (36.1%)

Dialysis Dependency Frequency Overall, 89 women (66.9%) were dialysis-dependent.[6]. The mean number of dialysis sessions among dependent women was 16.2 ± 3.7.

Age-Stratified Analysis Dependency rates: <25 years—30/50 (60%); 25–30 years—36/50 (72%); >30 years—23/33 (70%) (p=0.48) [7].

Parity Dependency among primigravida: 38/60 (63.3%); multipara: 51/73 (69.9%) (p=0.44) [27].

BMI Categories Dependency in normal (<25): 20/30 (66.7%); overweight (25–29.9): 45/66 (68.2%); obese (≥30): 24/37 (64.9%) (p=0.93)[27].

Other Factors Prior abortions (p=0.65), education (p=0.92), occupation (p=0.78), socioeconomic status (p=0.53), and residence (p=0.79) were not significantly associated.

Stratified Analysis Table

Factor	Dependent n (%)	Independent n (%)	p-valu e
Hypertensive disorders[8]	70 (77.8)	20 (22.2)	<0.01
Normotensive	19 (44.2)	24 (55.8)	

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Figures Figure 1. Dialysis dependency by age group.[7].

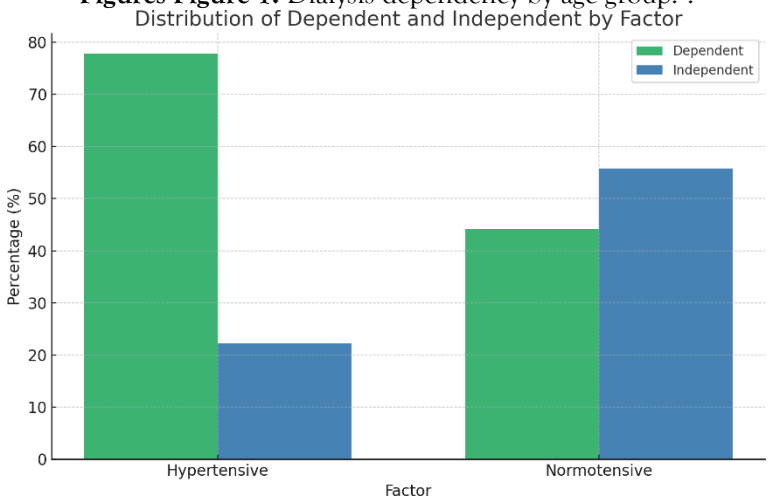


Figure 2. Overall dialysis dependency distribution.

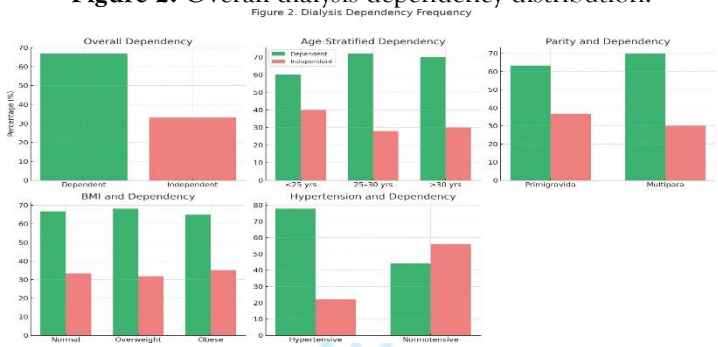
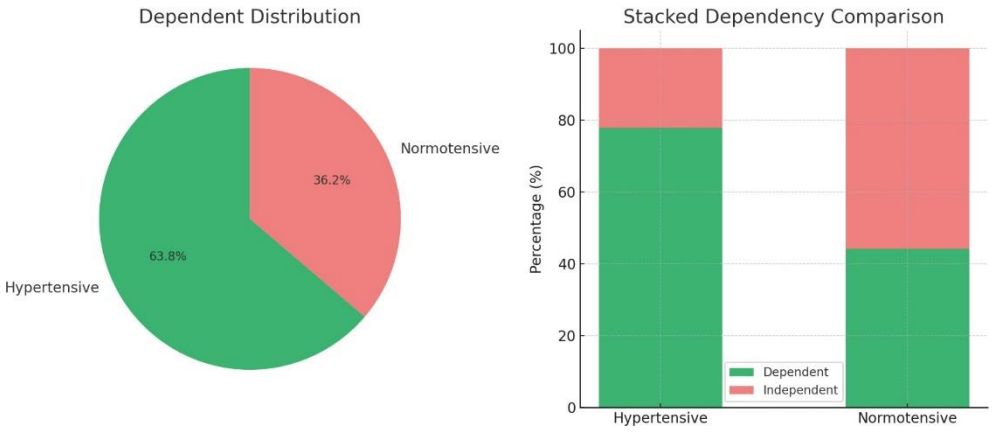


Figure 3. Dependency in hypertensive vs. normotensive patients.[8].



Discussion:

Our cohort has a high 66.9% dialysis dependency rate compared to the rest globally. Pakistani data comparable report 66.7% at 3 months[3] and Indian centers report rates 5–23% [19],[20].

Meta-analyses in high-income countries show about 8.5% dependency.[18]. Results are these disparities as they have to do with the differences in healthcare infrastructure, early AKI detection and different access to renal replacement therapy.

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A major predictor was hypertensive disorder; 77.8% of affected women needed dialysis vs. 44.2% of normotensive women ($p<0.01$) [8]. In preeclampsia, pathophysiology is endothelial damage, microthrombosis, and cortical necrosis and ultimately results in irreversible renal injury. Low-dose aspirin in high-risk women, stringent blood pressure control and close antenatal monitoring are prevention strategies.

There was no significant association with age or parity as was found in some studies[2021] but not others linking them with poor outcomes. Although obesity is typically a risk for AKI in the general population, BMI category did not predict dependency.

Severe AKI was likely caused by septic abortion and hemorrhage. Presentation and disease are delayed by unsafe terminations and by limited antenatal care. The most important public health measures include legalizing safe abortion, improving infection control, and expanding prenatal education.

The limit of generalizability and long-term outcome assessment is due to the single-center design and one-month follow-up. Tests of CKD progression and ESRD incidence should be made in future multicenter, longitudinal studies.

Conclusion:

Results stated that two-thirds of LRH Peshawar's obstetric patients develop dialysis-dependent AKI within one month. These risks are significantly increased by hypertensive disorders. These findings highlight the need for better antenatal screening for hypertensive disorders, earlier AKI detection schemes, and more dialysis services in such settings. Joint intervention amongst obstetric and nephrology teams and public health strategies aimed at safe obstetric practices are necessary to reduce the risks of chronic renal sequelae in this vulnerable group. Comprehensive guidelines and better renal outcomes based on long-term renal outcomes require further research spanning more than one center and an extended follow-up period.

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