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Abstract Topic : Acute Kidney Injury

Pregnancy-Related Acute Kidney Injury: Characteristics, Maternal Outcomes and Risk Factors in a Five-Year Retrospective Review at Hasan Sadikin Hospital, Bandung, Indonesia

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Objectives : Pregnancy-related acute kidney injury (PrAKI) is acute kidney injury (AKI) occurring during gestation or within six weeks postpartum. It's contributing to maternal and fetal morbidity. Studies on PrAKI in Indonesia are limited. This study aims to assess clinical profiles and maternal-fetal outcomes of patients with PrAKI admitted to Hasan Sadikin Hospital in Bandung.

Methods : This retrospective cohort study examined medical records of patients hospitalized for pregnancy-related AKI from October 2019 to October 2024. Data included sociodemographic, clinical, and obstetric characteristics, laboratory results, causes, comorbidities, and outcomes. Descriptive analyses evaluated clinical characteristics, while the Kruskal-Wallis test and ANOVA identified differences among variables. Logistic regression calculated odds ratios for dependent variable relationships.

Results : Out of 12,223 patient admissions, 102 cases of PrAKI were identified, yielding an incidence rate of 0.83%. I. Hypertensive disorders in pregnancy, particularly Eclampsia and Preeclampsia, were identified as the most prevalent etiologies, accompanied by chronic hypertension and chronic kidney disease as significant comorbidities. Hemodialysis was necessitated in 22.5% of cases, with 29.5% requiring intensive care unit (ICU) treatment and 24.5% of patients necessitating ventilatory support; moreover, vasoactive agents were administered to 7.8% of the cohort. ($p < 0.001$). Mortality rate of 26.5%, with only 57% of neonates being born alive. Further multivariate analysis revealed that the risk of mortality was significantly heightened in patients classified in AKI stage III, with an odds ratio (OR) of 2.96 (95% [CI] 1.21-7.24). Additionally, the presence of metabolic acidosis (OR 12.00 [CI 2.32-62.17]), loss of consciousness (OR 0.20 [CI 0.13-0.30]), hemorrhagic events (OR 5.15 [CI 1.14-23.21]), and sepsis (OR 13.13 [CI 3.74-46.05]) were identified as significant risk factors associated with increased mortality in this patient population.

Conclusions : This investigation elucidates distinct clinical manifestations compared to other developing nations, specifically regarding Eclampsia and Pre-eclampsia as a primary cause, with a maternal mortality rate quantified at 26.5%.

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Table 1. Demographic and Clinical Characteristics of Study Participants

	Total (n=102)	Outcomes			p
		Complete recovery (n=56)	Partial recovery (n=18)	Death (n=28)	
Demographic Data					
Age					
<20 years	33 (9)	33 (10)	33 (8)	30 (14)	
20-35 years	4 (3.9)	0 (0.0)	1 (5.6)	3 (10.7)	0.333
>35 years	67 (65.7)	37 (66.1)	12 (66.7)	18 (64.3)	
Distance to hospital					
<10 km	31 (30.4)	19 (33.9)	5 (27.8)	7 (25.0)	
10-50 km	50 (49.0)	36 (64.3)	6 (33.3)	8 (28.6)	0.000*
50-100 km	33 (32.4)	17 (30.4)	9 (50.0)	7 (25.0)	
>100 km	11 (10.8)	3 (5.4)	3 (16.7)	5 (17.9)	
Education					
Elementary school	8 (7.8)	0 (0.0)	0 (0.0)	8 (28.6)	
Junior high school	6 (5.9)	4 (7.1)	1 (5.6)	1 (3.6)	0.270
Senior high school	40 (39.2)	20 (35.7)	10 (55.6)	10 (35.7)	
Bachelor's degree	47 (46.1)	25 (44.6)	7 (38.9)	15 (53.6)	
Master's degree	7 (6.9)	5 (8.9)	0 (0.0)	2 (7.1)	
Occupation					
Not working	2 (2.0)	2 (3.6)	0 (0.0)	0 (0.0)	0.378
Working	43 (41.2)	32 (57.1)	10 (55.6)	10 (35.7)	
Characteristics of Pregnancy					
Post Partum	14 (13.7)	4 (7.1)	3 (16.7)	7 (25.0)	0.077
Gravida 1	12 (11.6)	8 (15.4)	1 (6.7)	3 (11.4)	0.615
Gravida 2-4	60 (58.2)	33 (63.5)	11 (73.3)	16 (76.2)	
Gravida >5	16 (16.2)	11 (21.2)	3 (20.0)	2 (9.5)	
Antenatal Care					
Yes	88 (89.8)	48 (92.3)	15 (83.3)	25 (89.3)	0.836
No	14 (13.7)	8 (14.3)	3 (16.7)	3 (10.7)	
Tri-semester					
Tri-semester I	4 (3.9)	1 (1.8)	3 (16.7)	0 (0.0)	0.092
Tri-semester II	18 (17.6)	9 (16.1)	4 (22.2)	5 (17.9)	
Tri-semester III	66 (64.7)	46 (82.1)	11 (61.1)	9 (32.1)	
Clinical Characteristics					
Systolic BP	145.74±34.32	155.63±29.70	142.22±26.36	128.21±40.53	0.002*
Diastolic BP	95.82±27.01	102.59±23.30	93.33±20.23	83.89±33.46	0.009*
Heart Rate	100.95±16.93	97.50±16.63	96.33±14.85	110.82±18.83	0.004*
Temperature	36.56±0.28	36.53±0.24	36.58±0.19	36.60±0.38	0.467
SpO2	95.67±4.77	97.37±3.17	96.28±5.11	91.86±5.19	0.000*
BMI	31.84±6.52	31.73±5.64	31.37±6.71	32.37±6.79	0.867

	Total (n=102)	Outcomes			p
		Complete recovery (n=56)	Partial recovery (n=18)	Death (n=28)	
Stage AKI					
Stage I	37 (36.3)	32 (57.1)	1 (5.6)	4 (14.3)	0.000*
Stage II	26 (25.5)	14 (25.0)	4 (22.2)	8 (28.6)	
Stage III	39 (38.2)	10 (17.9)	13 (72.2)	16 (67.1)	
AKI Complication					
Edema pulmonal	20 (19.6)	8 (14.3)	3 (16.7)	9 (32.1)	0.145
Hyperkalemia	3 (2.9)	1 (1.8)	1 (5.6)	1 (3.6)	0.896
Metabolic Acidosis	9 (8.8)	2 (3.6)	0 (0.0)	7 (25.0)	0.002*
Loss of consciousness	10 (9.8)	0 (0.0)	0 (0.0)	10 (35.7)	0.000*
Haemodialysis	23 (22.5)	2 (3.6)	12 (66.7)	9 (32.1)	0.000*
ICU admission	30 (29.4)	4 (7.1)	6 (33.3)	20 (71.4)	0.000*
Ventilator use	25 (24.5)	3 (5.4)	3 (16.7)	19 (67.9)	0.000*
Vasocative use	8 (7.8)	0 (0.0)	0 (0.0)	8 (28.6)	0.000*
Length of treatment					
1-3 days	8 (7.8)	0 (0.0)	0 (0.0)	8 (28.6)	0.000*
4-7 days	36 (35.3)	26 (46.4)	4 (22.2)	6 (21.4)	
8-10 days	10 (9.8)	5 (8.9)	3 (16.7)	2 (7.1)	
>10 days	20 (19.6)	7 (12.5)	6 (33.3)	7 (25.0)	
Outcome					
Forced return	3 (2.9)	1 (1.8)	2 (11.1)	0 (0.0)	0.000*
Death	27 (26.5)	0 (0.0)	0 (0.0)	27 (96.4)	
Recovered	72 (70.6)	55 (98.2)	16 (88.9)	1 (3.6)	
Outcome of Pregnancy					
Abortus	4 (3.9)	1 (1.8)	3 (16.7)	0 (0.0)	0.009*
Livelihood	58 (56.9)	39 (69.6)	10 (55.6)	9 (32.1)	0.005*
Still birth	4 (3.9)	2 (3.6)	1 (5.6)	1 (3.6)	0.926
IUFD	24 (23.5)	13 (23.2)	3 (16.7)	8 (28.6)	0.650
Causes :					
Hypertensive disorder pregnancy	91 (89.2)	55 (98.2)	17 (94.4)	19 (67.9)	0.000*
Hypertensi kronik	16 (15.7)	12 (21.4)	4 (22.2)	0 (0.0)	0.028*
Gestational Hypertension	19 (18.6)	15 (26.8)	4 (22.2)	0 (0.0)	0.011*
Eclampsia/Preeclampsia superimposed hypertension	26 (25.5)	12 (21.4)	4 (22.2)	10 (35.7)	0.349
HELLP syndrome	30 (29.4)	16 (28.6)	5 (27.8)	9 (32.1)	0.932
Penderitaan	29 (28.4)	14 (25.0)	4 (22.2)	11 (39.3)	0.322
Sepsis	8 (7.8)	2 (3.6)	1 (5.6)	5 (17.9)	0.068
Hyperemesis gravidarum	16 (15.7)	3 (5.4)	1 (5.6)	12 (42.9)	0.000*
Acute Liver Failure of Pregnancy	2 (2.0)	2 (3.6)	0 (0.0)	0 (0.0)	0.436
Acute Liver Failure of Pregnancy	1 (1.0)	0 (0.0)	0 (0.0)	1 (3.6)	0.267

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	Total (n=102)	Outcomes			p
		Complete recovery (n=56)	Partial recovery (n=18)	Death (n=28)	
Comorbidities :					
Heart Disease	6 (5.9)	2 (3.6)	2 (11.1)	2 (7.1)	0.474
Diabetes mellitus	4 (3.9)	2 (3.6)	2 (11.1)	0 (0.0)	0.166
Hipertensi kronik	39 (38.2)	28 (50.0)	8 (44.4)	3 (10.7)	0.002*
CKD	7 (6.9)	1 (1.8)	6 (33.3)	0 (0.0)	0.000*
Chronic Liver Disease	2 (2.0)	0 (0.0)	1 (5.6)	1 (3.6)	0.262
Laboratory Result and Urine output					
Hb	10.41±3.16	11.41±2.76	8.72±3.12	9.49±3.29	0.001*
Leukosit	18.11±8.23	17.28±7.44	17.50±8.97	20.16±9.14	0.301
Trombosit	211.75±136.40	225.18±127.75	247.22±159.40	162.07±128.78	0.063
AST ^a	30.90±19.44	32.23±18.89	20.94±13.36	34.64±22.14	0.654
ALT ^b	22.93±18.51	25.68±20.41	18.97±20.19	19.96±11.88	0.444
Creatinin at diagnosis	3.43±3.22	3.35±1.88	7.68±4.73	2.87±1.84	0.000*
Maximal Creatinine	4.40±3.46	3.08±2.42	8.72±4.46	4.28±2.04	0.000*
baseline Creatinine	0.90±0.45	0.83±0.18	1.17±0.99	0.86±0.16	0.018*
Creatinin at admission	2.39±2.99	0.84±0.39	5.33±4.96	3.60±2.34	0.000*
Urem	77.48±69.46	56.00±51.32	154.48±97.01	69.68±51.38	0.000*
Albumin ^c	2.48±1.23	2.59±0.51	2.25±0.60	2.45±2.20	0.748
Sodium	131.57±14.15	133.18±5.66	133.67±3.40	127.01±25.42	0.133
Kalium	4.28±1.28	4.24±0.98	5.26±1.28	3.71±1.47	0.000*
Urine Output^d					
Anuria	18 (30.5)	3 (7.5)	13 (76.5)	2 (100)	0.000*
Oliguria	10 (16.9)	8 (20.0)	2 (11.8)	0 (0.0)	
Non oliguria	51 (62.5)	29 (72.5)	2 (11.8)	0 (0.0)	
Proteinuria	78 (76.5)	44 (78.6)	14 (77.8)	20 (71.4)	0.765

^a AST and ALT in pts with acute liver failure of pregnancy and extreme data not included in analysis

^b albumin collected in 57 patients

^c urine output data collection available in 74 patients

Table 2. Risk Factors

	OR (95% CI)		
	Complete Recovery	Partial Recovery	Death
Antenatal Care	0.80 (0.29-2.31)	0.75 (0.19-3.03)	1.46 (0.37-5.66)
Tri-semester	1.63 (0.75-3.51)	0.34 (0.14-0.79)	1.55 (0.60-4.03)
Stage AKI			
Stage I AKI	10.93 (3.76-31.83)*	0.08 (0.01-0.62)*	0.21 (0.07-0.66)*
Stage II AKI	0.84 (0.39-2.31)	0.81 (0.24-2.71)	1.24 (0.47-3.31)
Stage III AKI	0.13 (0.05-0.32)*	5.80 (1.87-17.96)*	2.96 (1.21-7.24)*
AKI Complication			
Lung Edema	0.47 (0.17-1.28)	0.79 (0.21-3.04)	2.71 (0.98-7.52)
Hyperkalemia	0.40 (0.04-4.56)	2.41 (0.21-28.13)	1.33 (0.12-15.31)
Metabolic Acidosis	0.21 (0.04-1.05)*	0.81 (0.73-0.89)	12.00 (2.32-62.17)*
Loss of consciousness	0.39 (0.30-0.51)*	0.80 (0.73-0.89)	0.20 (0.13-0.30)*
Causes			
Hypertensive disorder pregnancy	15.28 (1.87-124.53)*	2.30 (0.28-18.18)	0.06 (0.01-0.29)*
Chronic Hypertension	2.86 (0.86-9.58)	1.71 (0.48-6.09)	0.67 (0.58-0.78)*
Gestational Hypertension	3.84 (1.18-12.55)*	1.31 (0.38-4.56)	0.66 (0.57-0.77)*
Preeclampsia	0.62 (0.26-1.53)	0.81 (0.24-2.71)	2.01 (0.78-5.21)
Preeclampsia superimposed hypertension	0.91 (0.39-2.15)	0.91 (0.29-2.82)	1.20 (0.47-3.06)
HELLP syndrome	0.69 (0.29-1.63)	0.67 (0.20-2.25)	2.01 (0.80-5.08)
Hemorrhage	0.25 (0.05-1.29)	0.65 (0.08-5.61)	5.15 (1.74-23.21)*
Sepsis	0.14 (0.04-0.54)*	0.27 (0.03-2.19)	13.13 (3.74-46.05)*
HEG	0.54 (0.45-0.65)	0.82 (0.75-0.90)	0.72 (0.64-0.81)
ALFL	0.45 (0.36-0.55)	0.82 (0.75-0.90)	0.27 (0.19-0.37)
Comorbidities			
Heart disease	0.39 (0.07-2.23)	2.50 (0.42-14.83)	1.35 (0.23-7.79)
Diabetes mellitus	0.82 (0.11-6.02)	5.13 (0.67-39.09)	0.71 (0.63-0.81)
Chronic Hypertension	3.18 (1.35-7.49)*	1.37 (0.49-3.83)	0.13 (0.04-0.46)*
CKD	0.12 (0.01-1.05)*	41.50 (4.59-375.23)*	0.71 (0.62-0.80)
Chronic liver disease	0.44 (0.35-0.55)	4.88 (0.29-81.95)	2.70 (0.16-44.78)