Incidence, Risk Factors, and Outcomes of Acute Kidney Injury in Hospitalized ELBW and VLBW Preterm Infants at a Tertiary NICU in Thailand

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BACKGROUND

Acute kidney injury (AKI) increasingly contributes to poor outcome in neonatal intensive care unit (NICU), especially in very low birth weight (VLBW) and extremely low birth weight (ELBW) preterm infants. Current studies on incidence and risk factors remain limited and variable.

OBJECTIVES

Primary outcome

Incidence of Neonatal AKI in the ELBW and VLBW neonates admitted in NICU of Chonburi hospital by using Modified Neonatal KDIGO Definition

Secondary Outcomes

- The associated risk factors with neonatal AKI
- The mortality, and Length of hospital stay in survivors of neonatal kidney

METHODS

- Study Design : Single-center, Retrospective cohort study
- Population: Premature neonates weighing less than 1,500 grams admitted NICU between January, 2020 and December, 2023

ELBW and VLBW neonates admitted to the NICU at Chonburi Hospital (N=214)

The exclusion criteria

1. The neonates younger than 2 days old
2. Referred from another hospital at an age greater than 28 days or with no urine output records since birth
3. Admitted to the NICU at an age greater than 28 days
4. The patients with only one serum creatinine measurement
5. The Patients with severe congenital anomaly

(N= 34)

Total neonates includes in the study (N= 180)

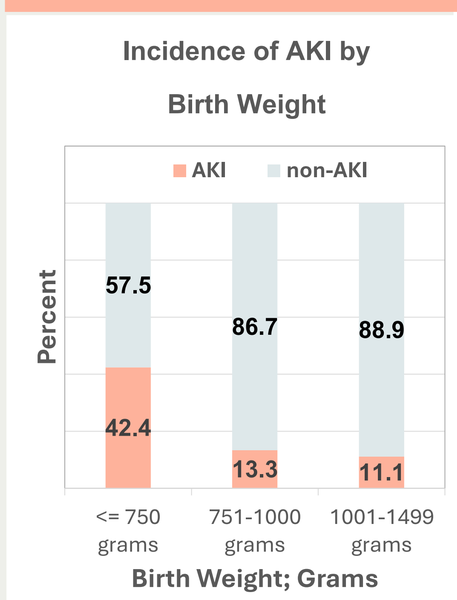
Diagnosis of Neonatal AKI by Modified Neonatal KDIGO

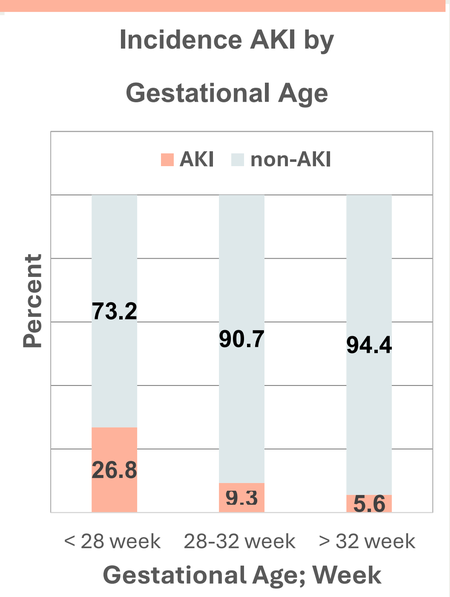
AKI
N= 32 (17.8 %)

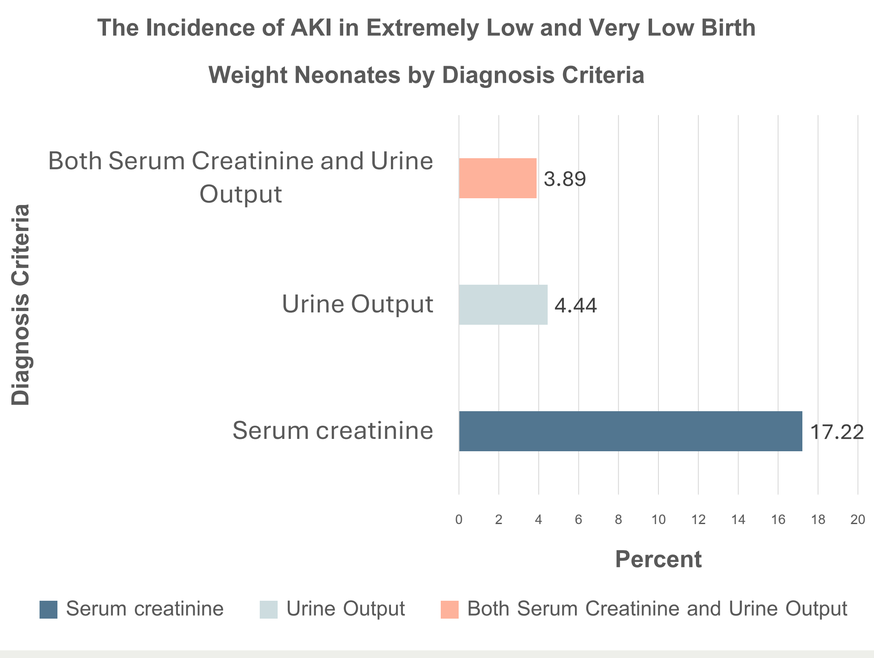
Non-AKI
N= 148 (82.2 %)

Comparison of associated risk factors, mortality rate, and length of hospital stay

RESULTS







Baseline Characteristics

Factors	AKI (n=32,17.8%)	Non-AKI (n= 148, 82.2%)	p-value
Prenatal Factors			
GA (week)	26.8±2.8	28.8±2.5	< 0.001
Maternal age (age)	28.5±7.8	29.5± 6.7	0.452
Maternal hypertension (n, %)	10 (34.5)	45 (30.6)	0.667
Maternal PIH or CHT with severe feature/eclampsia	6 (20.7)	39 (26.5)	0.644
Maternal GDM (n, %)			0.147
Overt DM	4 (13.8)	6 (4.1)	
GDM	2 (6.9)	15 (10.2)	
Maternal infection (n, %)	6 (20.7)	24 (16.3)	0.591
Maternal history of nephrotoxic drug use (n, %) (Aspirin, ACEIs or ARB)	7 (24.1)	20 (13.7)	0.165
Antenatal steroid (n, %)	20 (71.4)	121 (86.4)	0.086
ATB prophylaxis (n, %)	9 (34.6)	45 (32.9)	1.000
Perinatal Factors			
Mode of Delivery (n, %)			
Cesarean section	20 (64.5)	92 (63)	1.000
APGAR score at 5 min (score) [median, IQR]	5 [3, 8]	8 [6, 9]	0.005
Birthweight (gram)	855.8	1016.7	0.001
Postnatal Factors			
Sex			0.169
Female	10 (31.2)	68 (46.0)	
Male	22 (68.8)	80 (54.1)	
Late onset neonatal sepsis (n, %)	24 (75.0)	108 (73.0)	1.000
Surfactant therapy (n, %)	28 (90.3)	119 (81.5)	0.299
Mechanical ventilation (n, %)	31 (96.9)	122 (96.9)	0.051
Inotrope (n, %)	20 (62.5)	44 (29.9)	0.001
PDA with indomethacin treatment only (n, %)	19 (59.4)	49 (33.1)	0.008
Birth asphyxia (n, %)			0.008
Apgar 7-10 (excellent condition)	12 (42.9)	105 (71.4)	
Apgar 4-6 (moderately depression)	8 (28.6)	25 (17)	
Apgar 0-3 (severely depression)	8 (28.6)	17 (11.6)	
NEC any stage (n, %)	4 (12.5)	7 (4.7)	0.109
IVH (n, %)			<0.001
Grade 1-2	10 (31.2)	21 (14.3)	
Grade 3-4	8 (25.0)	7 (4.8)	
Mortality (n, %)	13 (40.6)	12 (8.1)	<0.001
Length of hospital stay in survivors [median, IQR]	97 [69, 119]	57.5 [45.5, 83]	<0.001

The Associated Risk Factors for Neonatal AKI

Factors	Adjusted Odds Ratio (95% CI)	p-value
Birth weight ≤ 750 g	5.36 (1.71-16.81)	0.004
NEC any stage	4.03 (0.81-20.02)	0.088
IVH grade 1-2	1.83 (0.54-6.20)	0.330
IVH grade 3-4	8.83 (1.88-41.41)	0.006
Maternal history of nephrotoxic drug use	3.58 (0.95-13.49)	0.059
PDA with any treatment	5.23 (1.42-19.24)	0.013
Apgar equal to less than 7	5.00 (1.53-16.33)	0.008

The Associated Risk Factors for Neonatal AKI, Focusing on neonates with a birth weight of less than 1000 grams

Variables	Adjusted Odds Ratio (95% CI)	p-value
Birth weight ≤ 750 g	8.27 (2.11-32.44)	0.002
NEC any stage	6.83 (1.13-41.15)	0.036
IVH grade 1-2	2.31 (0.60-8.89)	0.222
IVH grade 3-4	7.68 (1.35-43.64)	0.021
Maternal history of nephrotoxic drug use	5.57 (1.09-28.32)	0.039
Apgar equal to less than 7	6.47 (1.14-29.07)	0.015

Outcomes of Neonatal AKI

Length of Hospital Stay (Survivors)

- The hospital stay was 29.5 days longer for neonates with AKI (95%CI 16.8-42.3; P<0.001)

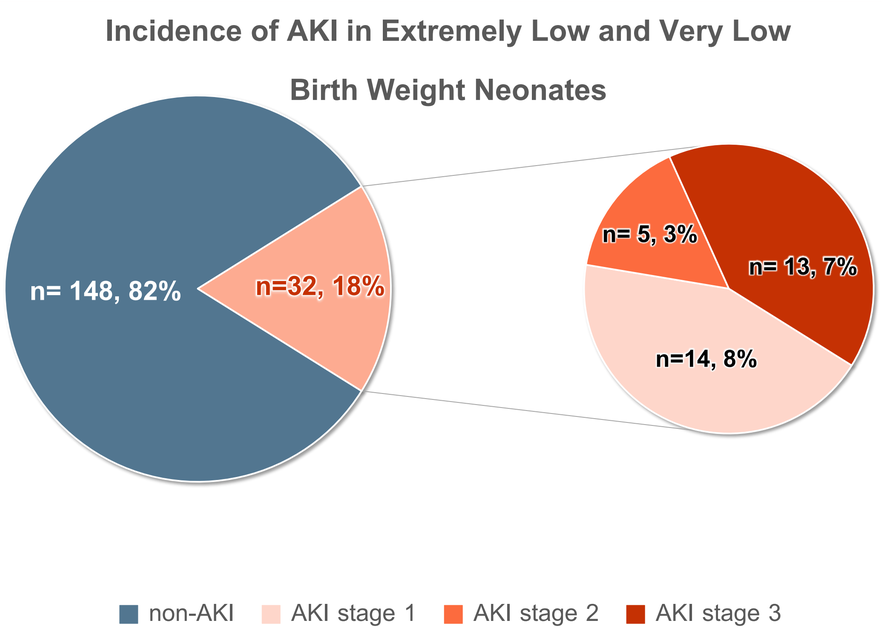
Mortality

- Neonates with AKI had a significantly higher risk of mortality with OR 7.7 (95%CI 3.09-19.45; P-value < 0.001)

CONCLUSION

AKI commonly occurred in ELBW and VLBW preterm infants. Significant risk factors included lower birth weight, low Apgar score, the presence of PDA, and IVH. AKI was also associated with increased mortality and prolonged hospital stay. Early recognition and timely intervention may enhance the survival rate.

RESULTS



Median day of AKI diagnosis [IQR]: 9 [5.5,13]

REFERENCES

1. Nada A, Bonachea EM, Askenazi DJ. Acute kidney injury in the fetus and neonate. Vol. 22, Seminars in Fetal and Neonatal Medicine. W.B. Saunders Ltd; 2017. p. 90–7.
2. Selewski DT, Charlton JR, Jetton JG, Guillet R, Mhanna MJ, Askenazi DJ, et al. Neonatal acute kidney injury. Pediatrics. 2015 Aug 1;136(2):e463–73.
3. Jetton JG, Boohaker LJ, Sethi SK, Wazir S, Rohatgi S, Soranno DE, et al. Incidence and outcomes of neonatal acute kidney injury (AWAKEN): a multicentre, multinational, observational cohort study. Lancet Child Adolesc Health. 2017 Nov 1;1(3):184–94.
4. Vachvanichsanong P, McNeil E, Dissaneevate S, Dissaneewate P, Chanvitan P, Janjindamai W. Neonatal acute kidney injury in a tertiary center in a developing country. Vol. 27, Nephrology Dialysis Transplantation. 2012. p. 973–7.
5. Kellum JA, Lameire N, Aspelin P, Barsoum RS, Burdmann EA, Goldstein SL, et al. Kidney disease: Improving global outcomes (KDIGO) acute kidney injury work group. KDIGO clinical practice guideline for acute kidney injury. Vol. 2, Kidney International Supplements. Nature Publishing Group; 2012. p. 1–138.