

Clinical outcomes in pediatric intensive care unit patients treated with vancomycin



Anutra Khangtragool,¹ Kanokkam Sunkonkit,² Aroonrut Lucksiri,³ Sukanlaya Seetaboot,² ¹ Division of Pharmacy, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand

² Division of Pulmonary and Critical Care, Department of Pediatrics, Chiang Mai University, Chiang Mai, Thailand ³ Department of Pharmaceutical Care, Faculty of Pharmacy, Chiang Mai University, Chiang Mai, Thailand

Correspondence to Dr. Anutra Khangtragool Division of Pharmacy, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand; anutra.k@cmu.ac.th

BACKGROUND

Vancomycin, a glycopeptide antibiotic, is used for the treatment of serious infections by gram-positive microorganisms, especially methicillin-resistant *Staphylococcus aureus* (MRSA). However, the attributable mortality of pediatric patients treated with vancomycin in pediatric intensive care unit (PICU) has been limited.

OBJECTIVE

Our study aimed to determine the factors influencing the mortality of pediatric patients treated with vancomycin in a pediatric intensive care unit (PICU) in a tertiary hospital in Northern Thailand.

METHODS

A retrospective study was conducted in pediatric patients admitted to PICU who received vancomycin from April 2018 to April 2019. We investigated the following variables: age, sex, underlying disease, diagnosis, length of stay (LOS) in PICU, Pediatric Index of Mortality 2 (PIM 2) score, mechanical ventilator use, renal replacement therapy, laboratory data, vancomycin dose, trough serum concentration (C_{trough}) of vancomycin and mortality rate.

RESULTS

One hundred and sixty pediatric patients were enrolled into the study (median age 12 months, range 2-180 months, male 69.4%). Therapeutic trough concentration of vancomycin (10–20 mg/L) were recorded in 32.5% (n=52) of cases. Septic shock was the most common diagnosis (49.3%) and the mortality rate was 39.4%. Our study found that C_{trough} of vancomycin outside the therapeutic range, mechanical ventilation and renal replacement therapy were associated with higher mortality rate in children (OR 3.14, 95% CI, 1.34-7.35; *p*=0.008), (OR 6.1, 95% CI, 1.6-22.7; *p*=0.007) and (OR 10.4, 95% CI, 2.6-41.4; *p*=0.001), respectively.

Chart 1 : Pie graph show underlying disease (A) and diagnosis (B)

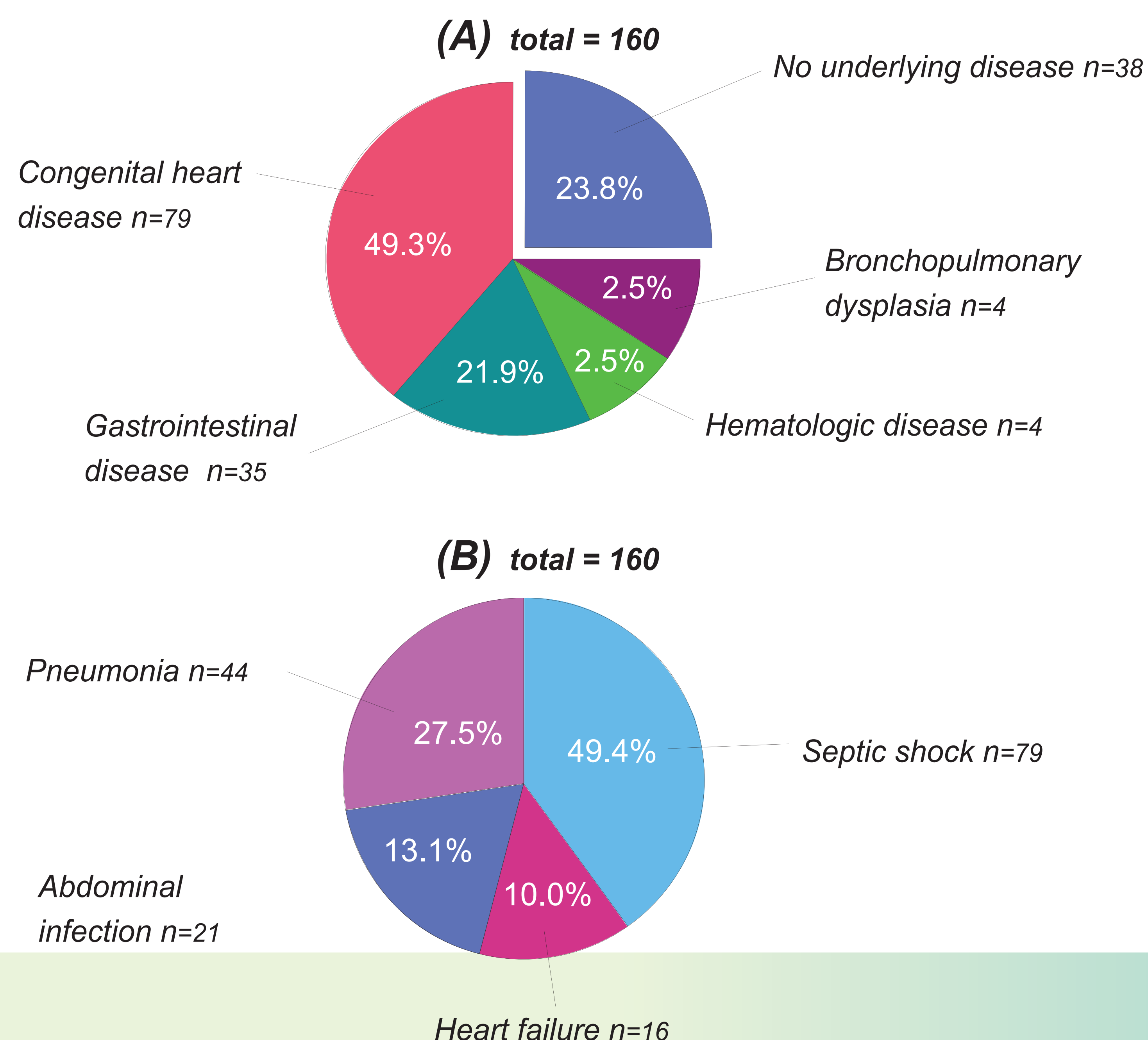


Chart 2 : Demographic and clinical characteristics of patients (n=160)

Parameters	Survived (n=97)	Non-survival (n=63)	p-value
Age >2 years old, n (%)	24 (24.7)	35 (55.6)	<0.001*
Sex, Male, n (%)	69 (71.1)	42 (66.7)	0.549
No underlying disease, n (%)	29 (29.9)	9 (14.3)	
Underlying disease			<0.001*
Congenital heart disease, n (%)	59 (60.8)	20 (31.7)	
Gastrointestinal disease, n (%)	9 (9.3)	26 (41.3)	
Bronchopulmonary dysplasia, n (%)	0 (0)	4 (6.3)	
Hematologic disease, n (%)	0 (0)	4 (6.3)	
Diagnosis			<0.001*
Pneumonia, n (%)	30 (30.9)	14 (22.2)	
Septic shock, n (%)	51 (52.6)	28 (44.4)	
Heart failure, n (%)	16 (16.5)	0 (0)	
Abdominal infection, n (%)	0 (0)	21 (33.3)	
C _{trough} of vancomycin			0.010*
Within 10-20 µg/mL n(%)	39 (40.2)	13 (20.6)	
Outside 10-20 µg/mL n(%)	58 (59.8)	50 (79.4)	
Vancomycin dose (mg/kg/day)	50 (40, 60) ^a	40 (20, 60) ^a	0.005*
BUN (mg/dl)	10 (8, 30) ^a	14 (9, 16) ^a	0.715
Creatinine (mg/dl)	0.3 (0.23, 0.59) ^a	0.23 (0.21, 0.49) ^a	0.109
PIM 2 > 10, n (%)	0 (0)	30 (47.6)	<0.001*
LOS in PICU > 14 days, n (%)	87 (89.7)	57 (90.5)	0.871
Mechanical ventilation, n (%)	74 (76.3)	59 (93.7)	0.004*
Renal replacement therapy, n (%)	4 (4.1)	22 (34.9)	<0.001*

^a median (interquartile range); µg = microgram; mL = milliliter; dL = deciliter; LOS=length of stay; mg = milligram; * = statistically significant *p* < 0.05, C_{trough}=trough concentration

Chart 3 : Factors associated with higher mortality rate (n=160)

Parameters	Survived (n=97)	Non-survival (n=63)	Adjusted Odds Ratio (95% CI)	p-value
Age >2 years old, n (%)	24 (24.7)	35 (55.6)	-	0.103
Underlying disease, n (%)	68 (70.1)	54 (85.7)	-	0.298
Off-target vancomycin C _{trough} , n (%)	58 (59.8)	50 (79.4)	3.14 (1.34-7.35)	0.008*
Mechanical ventilation, n (%)	74 (76.3)	59 (93.7)	6.11 (1.64-22.71)	0.007*
Renal replacement therapy, n (%)	4 (4.1)	22 (34.9)	10.43 (2.63-41.35)	0.001*

* = statistically significant *p* < 0.05, C_{trough} = trough concentration

CONCLUSIONS

Inappropriate therapeutic vancomycin trough concentration, mechanical ventilator use and renal replacement therapy use are factors associated with mortality in PICU.

REFERENCES

1. M iloslavsky M, Galler MF, Moawad I, et al, Cummings BM, El Saleeby CM. The Impact of Pediatric-Specific Vancomycin Dosing Guidelines: A Quality Improvement Initiative. *Pediatrics* 2017;139(6).
2. Maloni TM, Belucci TR, Malagutti SR, Furtado GHC. Describing vancomycin serum levels in pediatric intensive care unit (ICU) patients: are expected goals being met. *BMC Pediatr* 2019;19(1):240.



Hospital Pharmacy 5.0- the future of patient care 25-27 March 2020 Gothenburg, Sweden

