

Measurement of Vancomycin Trough level in critically ill children and it's in fluencing factors

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Abstract

Historically, vancomycin has been given to children in intensive care units when a Methicillin-resistant Staphylococcus aureus (MRSA) infection is suspected. Because renal impairment is a potential side effect, it is essential that the dosage be carefully monitored. If you're trying to figure out how much vancomycin to give your dog, you may want to use the dog's trough concentration as a guide. The purpose of the research was to evaluate young patients in the paediatric intensive care unit. Twenty kids in the paediatric intensive care unit at Benha University Hospital were the subjects of this investigation. More instances need to be studied, hence the study has to be expanded.

Keywords: Vancomycin, Severe Illness, Renal Impairment, Critical Care - trough concentration for dosing adjustments.

1. Introduction

Getting paediatric patients in critical care who have a suspected bacterial infection to therapeutic antibiotic levels requires prompt antibiotic delivery and optimum medication dose. However, in critically sick patients, renal excretion of drugs is typically increased [1].

The term "augmented renal clearance" (ARC) describes a condition in which the kidneys filter out a greater amount of waste products than usual, leading to sub-therapeutic blood concentrations of antibiotics and perhaps treatment failure and the development of antibiotic-resistant bacteria [2].

Vancomycin is an antibiotic that has a wide range of action against gram-positive bacteria since it is a tricyclic glycopeptide. To treat gram-positive infections, including those caused by methicillin-resistant Staphylococcus aureus, this medicine is often the first line of defence (MRSA). When used orally, vancomycin is not well absorbed. Since this is the case, it is often given as an IV infusion. Vancomycin has a varied volume of distribution in plasma and is protein bound at about 50%. After an IV dose, the elimination half-life in individuals with normal renal function was found to be between 30 minutes and an hour. This was followed by a mean terminal elimination half-life of 6 hours to 12 hours. Since vancomycin undergoes little metabolism and is predominantly eliminated by glomerular filtration, its clearance is greatly diminished in individuals with severe renal impairment, resulting in a half-life of around 7.5 days compared to 4-6 h in healthy people. Thus, vancomycin dose must be modified for individuals with renal failure [4].

It is recommended that trough vancomycin concentrations be kept between 10 and 20 mg/L, as per current therapy standards (Ye et al., 2014). Based on minimum inhibitory concentrations (MICs) for MRSA (the lowest concentration of the antibiotic that may halt development of visible germs), the advised trough levels are likely to provide optimal bactericidal action of vancomycin [5].

Infections have been shown to deteriorate by a factor of three if the MICs for MRSA are more than 1.5 mg/L, according to studies. A trough concentration of no less than 10 mg/L for vancomycin is recommended, however, per recommendations. However, the risk of nephrotoxicity is increased by two at twice the trough concentrations of vancomycin [3].

2. Aim of Study

To assess children in PICU.

3. Patients and Methods

This study included 20 children admitted in pediatric ICU in Benha University Hospital.

Type of study:

Cross-sectional study

Ethical approval :

The protocol of this thesis was in accordance with the ethical guidelines of the 2004 declaration of Helsinki and was approved by the ethical committee of faculty of medicine, Benha University.

Patients Inclusion and Exclusion criteria:

All children admitted in PICU in our study

Methods

All children were subjected to:

1. History taking from the parents or their caregivers including age, sex, complain and their diagnosis.
2. Clinical examination including body weight, height, head circumference and body mass index (BMI).
3. Sequential organ failure assessment (SOFA) score which is based on six different scores, one each for the respiratory, cardiovascular, hepatic, coagulation, renal and neurological systems.
4. Laboratory tests including:
 - Complete blood picture (CBC)
 - Serum creatinine concentration (at least 2 serum creatinine (S Cr) values)
 - Serum urea & blood urea nitrogen (BUN).
 - Serum electrolytes Na, K, Ca.
 - C- reactive protein (CRP).
 - Arterial blood gases (ABG).

- Blood culture.

4. Results

This table showed demographic characteristics of the included critically ill children; 55% were males, 45% were females, median age 29.0 (8-60 months),

median of their weight was 11.6 (7.4-20.6), median of their height was 89.0 (69-113), and the mean of BMI was 15.9 ± 4 kg/m².

Table (1) Demographic and anthropometric measurements of the studied sample

Variable (n=50)	No.	%	
Sex	Male	11	55.0
	Female	9	45.0
	Median	IQR	
Age (months)	29.0	8-60	
Weight (kg)	11.6	7.4-20.6	
Height (cm)	89.0	69-113	
	Mean \pmSD	Range	
BMI (kg/m²)	15.9 ± 4	7.4-26.5	

IQR= Inter-Quartile Range

This table showed that 76% of the included critically ill children had positive blood culture (52% gram +ve staph and 24% MRSA), pleural fluid aspirate was positive in 5% of the included children, and 6% had positive CSF culture.

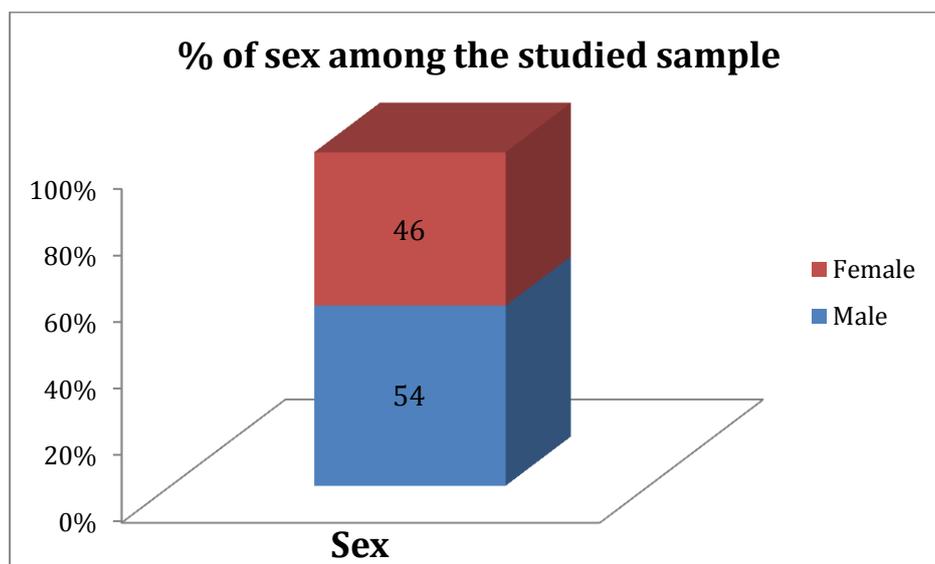


Fig. (1) Component bar chart showing sex distribution among the studied sample.

5. Discussion

Infections caused by methicillin-resistant staphylococcus aureus are often treated with vancomycin, a bactericidal glycopeptide antibiotic [6]. The nephrotoxicity and ototoxicity inherent in the first IV vancomycin formulations severely restricted its use. Current formulations, however, have almost wiped out these contaminants [7]. The exact risk of nephrotoxicity from vancomycin is not well established, which is a cause for worry given the present trend toward higher dose [8].

Because of the 2009 guidelines from the American Society of Health-System Pharmacists, the International Society of Pediatric Pharmacists, and the Society for Infectious Diseases Pharmacists,

vancomycin has being dosed more aggressively in both adults and children [9].

A higher proportion of males than females were found among the seriously sick youngsters in this investigation (54 percent). This is consistent with the findings of a research by dos Santos Feiten et al. on vancomycin-related nephrotoxicity in children in intensive care, which looked at 110 such kids and found that 53.64 percent of them were boys [10].

Only 4% of the seriously sick youngsters in this research who were given vancomycin survived. Comparatively, Sridharan et al. found that mortality among the included children was 61/102 and that the suggested vancomycin dosage was 10-20 mg/L, with lower trough levels being related with an increased risk of death [7].

Of the children who participated in the present research, 51% had at least one additional medical condition, such as cerebral palsy (14%), hydrocephalus with shunt (9%), bipolar disorder (8%), pleural effusion (5%), or intussusception (5 percent). In addition, dos Santos Feiten et al. found that 72.7% of critically sick children had comorbidities, the most common of which were gastrointestinal (15.5%), neurological (14.5%), haematological (14.5%), and respiratory (10%). [4].

6. Conclusion

Clearly, we need to look at more situations.

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