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Empirical antibiotic therapy guidance in surgical ICU in Aljamhori teaching hospital

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Abstract

Background: The choice of empirical antibiotic therapy in surgical ICU should be based on antibiotic guidelines to decrease the possible risk of severe infection which may rise the morbidity among the critical patients in the same ICU.
Objective: The aim of this study is to create guidelines of antibiotic therapy to decrease the risk of complicated infection in patients in surgical ICU in Aljumhori teaching hospital.
Patients and methods: The study was performed between December 2011 and February 2012 in the twelve -beds surgical ICU (SICU) in Al jumhori teaching hospital.
Results: The research was done in the intensive care unit in Aljumhori teaching hospital and we found that the result is can be applicable in future to decrease the morbidity and mortality.
Conclusion: The main drugs which can be used empirically are chloramphenicol, Azteronam , Amikacin, , Norfloxacin, Erythromycin , Rifampicin, Tetracycline and Trimethoprim.

Keywords: antibiotics, culture, ICU, guidelines.

***Abbreviations:** SICU: Surgical intensive care Unit, CRP: C-reactive protein, WBC: white blood cells.

Introduction

The problem of antimicrobial resistance has increased significantly in the past decade and is now a major issue in most hospitals (1). A number of factors magnify this problem in the intensive care unit (ICU). These factors include the multiple invasive devices and procedures predisposing the ICU patient to infection, the widespread use of broad-spectrum antibiotics, and lapse of infection control technique in the care of critically ill patients, and economic pressures that lead to understaffing (1). Bacteria become resistant to antibacterial agents by three main mechanisms: acquisition of complete resistance genes or gene complexes via plasmids and other transposable elements (2), recombination of DNA from other bacteria into the genome by transformation (2), and spontaneous mutational events in the chromosome and accessory DNA.

Nosocomial infections are believed to occur most frequently in intensive care units (ICUs), and they affect the outcome of the patients admitted to the ICU.

The number of infectious complications encountered in the intensive care unit (ICU) continues to increase which may proceed to fatal outcomes. (3)

ICUs have come to represent the most frequently identifiable source of nosocomial infections within the hospital, with infection rates and rates of antimicrobial resistance several fold higher than in the general hospital setting (4).

The prescription of antibiotics in the ICU is usually empiric, given the critical nature of the conditions of patients hospitalized there. Appropriate antibiotic utilization in this setting is crucial not only in ensuring an optimal outcome, but in curtailing the emergence of resistance and containing costs. We propose that research in the ICUs is vitally important in guiding antibiotic prescription practices and, therefore, the achievement of better goals.(4)

Choice of appropriate empirical antibiotic therapy in critical patients is one of the most important factors for the better outcome. (4)

The initial empirical antimicrobial regimen should be broad enough to cover likely pathogens; for mixed (Polymicrobial) or one causative agent infection. (4).
The increase in multi resistant microorganisms, both gram-positive and gram-negative, is an alarming problem worldwide, especially for intensive care unit patients (5).

Any empiric antibiotic regimen should be reassessed and tailored as soon as culture and sensitivity results become available. This practice serves to reduce costs, decrease the incidence of super infection and minimize the development of antimicrobial resistance.
Results of Antibiotic Misuse:

1. Incomplete, delayed, or failed resolution of infection.
2. Prolonged or unnecessary hospitalizations.
3. Increased incidence of antibiotic side effects.
4. Development of multi Drug resistant strains of bacteria.
5. Increased cost of health care.

The aim of this study was to define and recommend the appropriate empirical antibiotic therapy for critical patients in surgical intensive care unit (ICU) in Aljumhori teaching hospital.

Methods

The study was performed between December 2011 and February 2012 in the twelve -beds surgical ICU (SICU) of Al jumhori teaching hospital.

The medical records of patients were retrospectively reviewed. The data collected included: age, gender, type of samples.

Then the statistical analysis done as follow:

1. Samples collected to number of patients, (**Table** -1).
2. Relationship between type of sample and CRP, Total WBC, Neutrophil, (**Table** -1).
3. Relationship between type of bacteria and different sites, (**Table** -2).

Statistical analysis done which done according to culture & sensitivity tests & these reflects the resistance & sensitivity of bacteria & the antibiotics therapy.

(**Table** -1) show the number of patients in comparison with types of samples were isolated & show the real changes of the infection & immune response.

Type of Sample	No. of patients	CRP %		Total W.B.C %		Neutrophil %	
		Normal	abnormal	Normal	Abnormal	Normal	abnormal
Wound	25	9.09	15.91	10.3	14.7	1.47	23.5
Sputum	3	1.5	1.5	2	1	0	3
Foley Catheter	8	5.33	2.66	4	4	0	8
CVL	3	0	3	1	2	1	2
Cannula	5	3.33	1.66	1.25	3.75	0	5
Drain	6	0	6	2.4	3.6	0	6
Total	50	19.25	30.73	20.95	29.05	2.47	47.5

(Table -2) Types of bacteria isolated from different site

Type of Bacteria	Wound	Sputum	Foley Catheter	CVL	Cannula	Drain	Total
Staph. aureus	8(40%)	1(5%)	3(15%)	3(15%)	4(20%)	1(5%)	20(40%)
Coliform	6(66.7%)	2(22.2%)	1(11.1%)	----	----	----	9(18%)
Streptococcus sp	4(57.14%)	1(14.28%)	1(14.28%)	----	1(14.28%)	----	7(14%)
E.coli	1(25%)	----	3(75%)	----	----	----	4(8%)
Klebsiella sp	2(50%)	----	1(25%)	-----	----	1(25%)	4(8%)
Proteus sp	2(66.7%)	----	1(33.3%)	-----	----	----	3(6%)
Diphtheroids	1(50%)	----	1(50%)	----	----	----	2(4%)
Pseudomonas aeruginosa	----	1(100%)	----	----	----	----	1(2%)

Results

In a study 50 patients admitted to SICU in Al Jumhori teaching hospital. The mean age was (range 10 month -85 years),(NO:31; 62% male) & (NO:19;38% female).

Staphylococcus aureus showed a predominant causes of bacterial infection which constitute (20) 40.82% of causative microorganisms followed by *coliforms* which constitutes (9) 18.37% , next to these microorganism are *streptococcus* (6) 12.25% ,*E coli* (4) 8.16%, *Klebsiella* sp (4) 8.16%. , *Proteus* sp (3) 6.12%., *Dipheroids* (2) 4.08% & *Pseudomonas aeruginosa*. (1) 2.04%, **(Table -2).**

Figure (1) types of bacteria isolated.

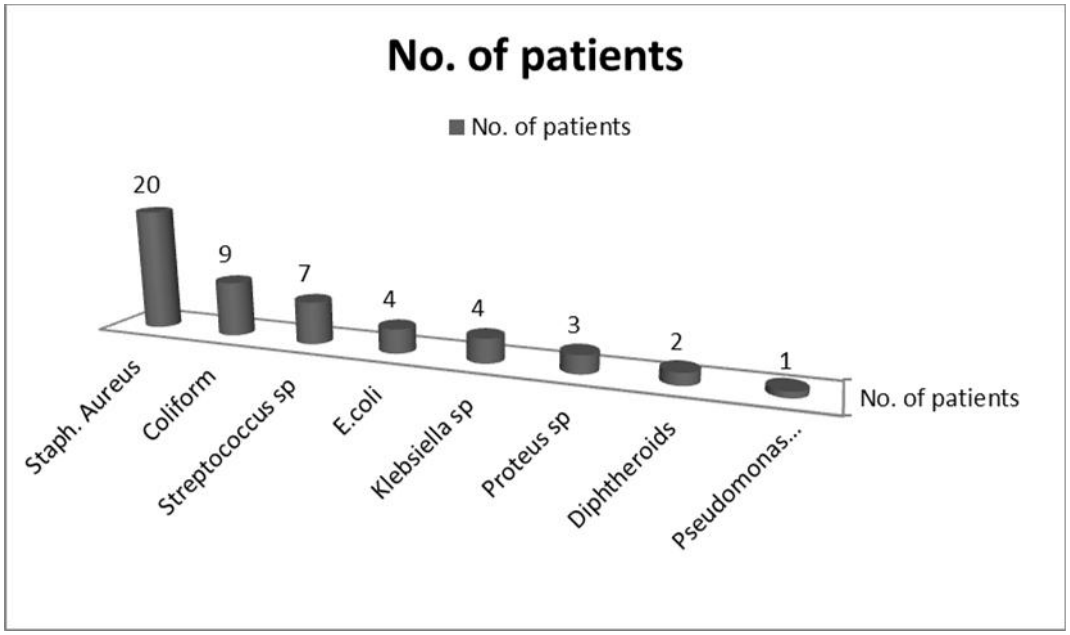

Figure (2): show sensitivity test for *Staphylococcus aureus* which was resistant to all antibiotic discs used.

Figure (3): show sensitivity test for *Coliform* which was resistant to all antibiotic discs used

Figure (4): show sensitivity test for *Streptococcus feacalis* which was resistant to all antibiotic discs used

Figure (5): show sensitivity test for *Klebsiella* which was resistant to all antibiotic discs used.

The results also include the types of most predominant microorganisms which were isolated from SICU & their correspondence antibiotics resistance (Table-3), this study show significant difference of (p-value ≤ 0.05). this mean that it can be applied on daily managing patients in our SICU in order to reduce the possible complication which may happen during residency in SICU. These results should be re-evaluating later in order to detect any changes in antibiotics sensitive or resistance which help to treat any possible way of ICU infections.

Table (3) the relationship between types of bacteria & corresponding resistant antibiotics

Drugs resistant %	*Staphylococcus aureus*	Coli form	P*roteus* sp	*Strep.* sp.	*E.coli*	*Klebsiella* sp	Diphtheroids	*Pseudomonas* sp.
Cefixime	100%	100%	66.67%	100%	100%	100%	100%	100%
Cefotaxime	95%	100%	66.67%	100%	100%	100%	100%	100%
Norfloxacin	50%	88.89%	33.33%	66.6%	100%	100%	50%	50%
Trimethoprim	65%	88.89%	66.67%	83.33	100%	100%	50%	100%
Tetracycline	70%	77.78%	100%	100%	100%	100%	100%	100%
Ceftriaxone	85%	100%	66.67%	100%	100%	100%	100%	100%
Rifampicin	50%	100%	100%	83.33%	100%	100%	50%	100%
Piperaciline	60%	100%	66.67%	83.33%	100%	100%	100%	70%
Erythromycin	70%	66.67%	100%	83.33%	100%	75%	50%	100%
Chloramphenicol	30%	88.89%	66.67%	66.6%	75%	75%	50%	100%
Azteronam	60%	66.67%	66.67%	83.33%	50%	100%	50%	60%
Amikacin	20%	77.78%	33.33%	100%	/	100%	50%	50%
Methicillin	70%	/	/	/	/	/	/	/

The table-3 shows the resistance percent of the most uses antibiotics which help in avoiding these drugs in empiric treatment of ICU patients.

Discussion

Serious infections caused by bacteria that have become resistant to commonly used antibiotics have become a major global healthcare problem in the 21st century (6). It has been estimated that more than 50% of critically ill patients will receive at least one antibiotic during their ICU stay (7).

Empirical therapy is treatment for a possible or likely infection before laboratory results become available, or when they are impossible to obtain.(8).

An infection in SICU is still associated with significant morbidity &mortality and high health-care in spite of the all known guidelines and recommendation for treating.

The most important findings of the our study is the difference of outcome between the fully resistant drugs & very low resistant drugs which help in improving outcome of SICU patients. Our study is one of several to identify an association between empirical guideline antibiotic therapy and patient mortality or length of hospital stay. However, to our knowledge, this is the first study to demonstrate that guideline antibiotic therapy is associated with a reduced patients complication in SICU and time to ICU stay. This association is paramount because it helps identify a clinical intervention (e.g., appropriate empiric antibiotic therapy) that could result in decreased length of hospital stay(9). This study show significant drugs resistant which can be avoided to decrease patients complication & this lead to less ICU stay & better outcome. *Staphylococcus aureus* , show good sensitivity to Amikacin & chloramphenicol & lesser sensitivity to Norfloxacin rifampicin, this is correlates with other study which show Resistance of isolates to Amikacin was least compared to other antibiotics(10,11).

Regarding coliform bacteria show more sensitive to erythromycin & Azteronam & lesser sensitive to Amikacin & tetracycline.

Proteus sp. Show sensitivity toward Amikacin & Norfloxacin & lesser sensitivity to chloramphenicol & Azteronam therapy.

Also *streptococcus sp.* Show sensitive activity with Norfloxacin & chloramphenicol therapy & less sensitivity to Azteronam & erythromycin with same level with trimethoprim, which is correlate to other study(11) which show 26 resistant between 39 cases(11). *E.coli* get high sensitive to Azteronam & less sensitive to chloramphenicol.

Klebsiella sp. Express good response to erythromycin & less activity to chloramphenicol which is similar to same result of (10,11).

Diphtheroids also show some activity to Azteronam & less to Amikacin therapy (Table-4).

Table-4 show the most appropriate useful antibiotic therapy for the different microorganism

Organism	Appropriate antibiotics	Alternative antibiotics
Staphylococcus aureus	Amikacin / Chloramphenicol	Norfloxacin / Rifampicin
Coli form	Erythromycin / Azteronam	Amikacin / Tetracycline
Proteus sp.	Amikacin / Norfloxacin	Chloramphenicol / Azteronam
Streptococcus sp.	Norfloxacin / Chloramphenicol	Azteronam / Erythromycin/ Trimethoprim
E.coli	Azteronam	Chloramphenicol
Klebsiella sp.	Erythromycin	Chloramphenicol
Diphtheroids	Azteronam	Amikacin
Pseudomonas aeruginosa	Azteronam	Amikacin / Norfloxacin

Conclusion

The main points can be obtained from this research are those related to uses of antibiotics therapy for critical patients in intensive care unit of aljumhori teaching hospital which can be summarized by :

1. The antibiotics drugs given to ICU patients should be empirically depend on these guidelines in order to reduce possible factors for morbity & mortality.
2. This way of given these antibiotics should be follow up by swab for culture & sensitivity to establish & confirm the appropriate choice of antibiotics for the same patient.
3. These ways of choosing antibiotics should be updating from time to time to overwhelms the possible mutation states that happen.
4. The main drugs which can be used empirically are chloramphenicol=5, Azteronam = 5, Amikacin =4, , Norfloxacin =3, Erythromycin =3, Rifampicin =1, Tetracycline =1, Trimethoprim=1.

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