Mortality And Morbidity Influenced By Intensive Care Unit Acquired Infections And Their Management In Different Hospitals In Khartoum State.

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Abstract

Hospital-acquired infection is a serious problem in the ICU. Infection in ICU is associated with increased mortality, morbidity and carries a substantial economic burden. This study was carried out to explore the current situation regarding the mortality, morbidity, as well as length of stay caused by ICU, acquired infections in different governmental hospitals in Khartoum state. This is a prospective observational cross-sectional, case-finding, follow up ICU-based study. The study was conducted in intensive care units of nine governmental hospitals in Khartoum state, during the period from August 2016 to January 2017. 1230 patients were enrolled in the study. Data collected using a predesigned data collection sheet. Then data were analysed using SPSS. The majority (54%) of the patient population fell in age above 46 years; Males outnumbered females. 652 (53%) of patients developed an infection during ICU stay, 504 (41 %) of patients developed complications. 547 (44.5 %)) of patients stay less than six days. 238 patients were died. Significant relationship between: duration of ICU stays and guidelines compliance, outcome and guidelines compliance, ICU infection and complications and number of antibiotics and complications. ICU infections are associated with increased mortality, complications and length of stay. Compliance to international guidelines reduced the length of stay and improved outcomes. Treatment with an antibiotic

combination reduces patients' complications. This fact necessitates early diagnosis, proper management, and prevention of ICU infections.

Keywords: Mortality; Morbidity; Intensive Care Unit; Infections

1. Introduction:

Hospital-acquired infection is a serious problem in the intensive care unit (ICU) and is one of the leading causes of further morbidity and mortality of critically ill patients (1). The susceptibility of patients in the ICU to infection, combined with the risk factors associated with invasive treatments is high. Furthermore, the ICU environment contributes to increased risk of infection in this patient group. This can further be complicated by the fact that clinical signs may be absent or hidden by signs of underlying diseases (1).

It has been estimated that at least fifty percent of patients receive antimicrobials needlessly. Reasons include inappropriate prescribing for antimicrobial prophylaxis, the continuation of empiric therapy despite negative cultures in a stable patient, and a lack of awareness of susceptibility patterns of common pathogens (2). Overprescribing, not only increases the costs of health care, but may also result in superinfection due to antimicrobial-resistant bacteria, as well as opportunistic fungi, and may increase the likelihood of adverse drug reactions (2).

Globally, the intensive care unit-acquired infection rate is 5-10 times higher than hospital-acquired infection rates in general ward patient. It is associated with increased mortality, morbidity, and moreover, carries a substantial economic burden due to high antimicrobial use and increased the length of hospitalization (3). Furthermore, according to the world health organization, 66% of developing countries have no published data on the burden of hospital-acquired infection (3).

This study intended to explore the current situation regarding mortality, morbidity, as well as length of stay caused by ICU, acquired infections in different governmental hospitals in Khartoum state.

2. Methodology

2.1.Study Design:

A prospective observational cross-sectional, case-finding follow up ICU-based study.

2.2.Study Location:

Intensive care units of nine governmental hospitals in Khartoum state (Coded with a capital letter as follow: Alshaab (A), Mohamed Al Ameen (B), Al Naw(C), Ahmed Gasim (D), Bahri (E), Sharg Al Neel (F), Omdurman (G), Military (H) and Police hospital (I)).

Hospitals were selected according to higher coverage of the population.

2.3.Study Population:

Inclusion criteria:

All patients admitted to intensive care units during the study period.

Exclusion criteria:

Post-operative patients admitted for monitoring for 24 hours.

Patients admitted with a feature of brain death; post-cardiac arrest.

2.4.Sample Size:

1230 patients were included in this study; all patients admitted to ICUs of selected hospitals during the study period.

2.5.Data Collection Instrument:

The data were collected by a predesigned pretested data collection forms explicitly prepared to suit this study, filled from patient files and missed information completed from ICU doctors, co-patients and nursing staff. Data collection forms were filled by the researcher, ICU doctors and ICU nursing staff.

2.6.Ethical Consideration:

- Previous permission was taken from the ministry of health and then from the administration of studied hospitals.

- No, harmful interventions were carried out for patients.
- Any information requested from the medical staff were in their free time only.

2.7.Study Period:

This study was carried out during the period of August 2016 to January 2017. According to internal regulations of some hospitals, we were allowed to collect data of our study during the period of time specified by those hospitals (the whole period in hospital A, C, F and G; 6 months in hospital D; 4months in hospital B and E; 2 months in hospital H and I). They were justified by an only specific number of researchers were allowed to perform their study at the same time.

Statistical Analysis:

The data were collected using a predesigned pretested data collection forms. The collected data were organized, tabulated, classified, and analyzed using a statistical software program. Data entry and analyses took place once; each data collection forms were reviewed for clarity and completeness using Statistical Package for Social Science (SPSS) version 21.0 (IBM SPSS INC., Chicago, IL). All data gathered via data collection forms were coded into variables. Both descriptive and inferential statistics, including Chi-square, were performed to present results. The results were further tabulated, interpreted and discussed; figures were plotted using Microsoft Office computer software (2010).

Infections occurred >/= 48 hours after ICU admission were only considered as ICU acquired infections. qSOFA score was used to assess patients risks for poor outcomes. Treatment was evaluated using Infectious Disease Society of America (IDSA).

3. Results:

When patients were classified according to the occurrence of complications, it was found that 504 (41 %) of patients were developed complications during their ICU stay, as presented in Figure ().

When patients were classified in relation to the development of ICU complications, it was noticed that, 13.8 % of patients were developed respiratory failure, 9.3 % of patients were developed acute kidney injury, 0.9% of patients underwent his/her first dialysis session during their ICU stay, 3.8 % of patients developed jaundice, 1.7 % of patients had

disseminated intravascular coagulation, 6.8 % of patients had shock, 4.1 % of patients were developed neurological complications (including coma, cerebrovascular accident and convulsions), 3.8 % of patients had a cardiac arrest, and 7.3 % were developed superinfections (6.7 % fungal and 0.6 % viral), as shown in Figure ().

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When patients were categorized concerning their length of ICU stay, it was observed that about half (547 (44.5 %)) of patients were stayed less than six days, whereas 217 (17.6 %) patients remained between 11 to 15 days and the

Figure () detailed more.

When patients were categorized about their outcomes, it was noticed that 49.4% of patients were discharged from ICU, whereas 238 (19.3%) patients died, while the remaining patients (384 (31.2%)) were referred to other facilities. The referral to other hospitals most probably when the family decided to gain a better quality of service in a private facility (sometimes outside the Country) when the patient was deteriorating or shifted by providers for specialised settings or due to unavailability of service required, as shown in Figure ().

Test of association between ICU infection and SOFA score revealed that there is a significant (0. 00, p>0.05) relationship between qSOFA score and ICU infections. This finding illustrated that ICU infections associated with higher qSOFA score, as presented in Figure ().

Test of association between ICU infections and complications showed that there is a significant (0.00, p>0.05) relationship between ICU infections and complications. This finding demonstrated that ICU infections were found to raises the existence of complications, as displayed in Figure ().

Test of association between ICU infections and length of stay showed that there is a significant (0.00, p>0.05) relationship between ICU infections and duration of stay. This result explained that ICU infections were found to increase patients' length of stay, as shown in Figure ().

Test of association between ICU infection and patients outcome showed that there is a significant (0.00, p>0.05) relationship between ICU infection and patients outcome. This result explained that ICU infections were found to increase mortality, as shown in Figure ().

Test of association between age groups (Years) and complications, showed that there is a significant (0. 00, p>0.05) relationship between age groups (Years) and complications. This finding illustrated that the experience of complications was observed to be increased with advancing age (above 46 years), as presented in Figure ().

Test of association between duration of ICU stay and complications showed that there is a significant (0.00, p>0.05) relationship between the length of ICU stay and complications. This finding revealed that patients who stayed longer in ICU were found to have greater experience of complications, as shown in Figure).

Test of association between age groups (Years) and outcome, showed that there is a significant (0. 00, p>0.05) relationship between age groups (Years) and outcome. This association revealed that advancing age (above 46 years) was associated with higher mortality, as shown in Figure ().

Test of association between guidelines compliance and patients outcome, showed that there is a significant (0.00, p>0.05) relationship between guidelines compliance and patients outcome, most patients who were discharged were treated according to the international guidelines, whereas most of the patients who were died were untreated according to the guidelines, as shown in Figure ().

There is a significant (0.00, p>0.05) association between duration of ICU stay and guidelines compliance, most subjects who were stayed longer than 11 days were untreated according to the guidelines, as presented in Figure ().

Test of association between, showed that there is a significant (0.00, p>0.05) relationship between the number of antibiotics used and complications developed, that as the number of antibiotics used in combination increases, this lower complications that may occur, as presented in Figure ().

4. Discussion:

A recently published meta-analysis showed that combination therapy improved survival in high-risk, life-threatening infections but may be detrimental to low-risk patients [(1)], this study found that higher number of antibiotics used in combination associated lower complications that have occurred, which in turn may be due to multidrug antimicrobial resistance coverage in critically ill patients.

Patients in intensive care units are subject to many complications connected with the advanced therapy required for their serious illnesses [(2)]. Also, complications of care in the ICU are not rare and may independently contribute to in-hospital mortality [(3)]. This study showed that respiratory failure was the most common complications that occurred during ICU stay, followed by acute kidney injury, shock and superinfections (mainly fungal infection).

Considering the clinical and lab markers, this study showed: Higher body temperature was significantly associated with patients developed ICU infections, which can reflect poor infection management.

There is a significant relationship between systolic blood pressure and ICU infection; this finding revealed that lower systolic pressure was associated with ICU. Lower systolic pressures had a worse prognosis and better than the mean pressure in predicting mortality [(4)].

This study revealed that lower mean arterial pressure was associated with ICU infections.

Lower Glasgow coma scale levels were associated with patients had ICU infections. Is the most common scoring system used to describe the level of consciousness, generally, brain injury is classified as Severe: 3-8 moderate: 9-12 mild: 13-15 [(5)])

Test of association between ICU infections and heart rate showed that there is no significant relationship between ICU infections and heart rate, that ICU infection had no considerable influences on heart rate.

There was a positive association between higher respiratory rates as well as average SPO2 level with higher ICU infections among patients.

This study finding illustrated that ICU infections associated with a higher qSOFA score. Sequential [Sepsis-related] Organ Failure Assessment (SOFA) score as a means of identifying sepsis among patients who are critically ill with suspected infection. The qSOFA score (also known as quick SOFA) is a bedside prompt that may identify patients with suspected infection who are at higher risk for a poor outcome. It uses three criteria, assigning one point for low blood pressure (SBP≤100 mmHg), high respiratory rate (≥22 breaths per min), or altered mentation (Glasgow coma scale<15) [(6)].

The findings of this study showed that the use of a mechanical ventilator was associated with higher chances of complications development, which is consistent with different studies, probably due to decreased cardiac output, unintended respiratory alkalosis, increased intracranial pressure, gastric distension, and impairment of hepatic and renal function in addition to infections. [(7, 8)] .

Complications of infections in the ICU were associated with higher morbidity, mortality, and increased health care use [(9)]. Infections were found to increase deteriorations of patients' health inside the ICU departments, as agreed with other investigators [(10, 11)], The physiological deterioration can explain this as a result of infection and the drawbacks of management.

This study resulted in (consistent with another study [(12)]) that the incidence of complications occurred during ICU stay increased with advancing age. With advancing age, the proportion of various preexisting comorbidities, advanced age should be regarded as a significant independent risk factor for mortality [(13)], consistently with what found in this study, that advancing age (above 46 years), associated with higher mortality.

The study findings showed that the development of ICU infections was associated with longer length of ICU stay, consistently with other studies [(14-20)]. This reflects that even after recovering from the initial critical illness, it may be necessary to retain patients in the ICU for a longer time to manage infections and its complications. The pressures associated with a decrease in hospital length of stay do not seem to have influenced the duration of ICU stay [(21)].

This study found that patients' complications were associated with longer length of ICU stay.

Among patients who received antibiotics, this study showed that most of them received one or two antimicrobial agents during their ICU stay. Combination antibiotic regimens may provide a higher overall spectrum of activity but may be associated with increased toxicity, which is acceptable in critically ill patients [(22)]. Meropenem and ceftriaxone were the main antibiotics used for empirical therapy. Meropenem and vancomycin were the main antibiotics used for definitive therapy. Ciprofloxacin was the main antibiotic used for prophylaxis indication. This study found that about two-thirds of patients who received antibiotics were developed ICU-acquired infections, mainly pneumonia, this finding reflects prophylactic antibiotics were given improperly. Considering guidelines (IDSA) compliance, this study showed that, doctors were found to be more compliant to the international guidelines (IDSA) in treatment of particular type of infections than others, such as urinary tract infection and surgical site infection.

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This study found that patients' complications were associated with longer length of ICU stay.

5. Conclusion:

This study concluded that ICU infections were associated with a higher occurrence of complications, more extended ICU stay, and higher mortality. Compliance with international guidelines (IDSA) was associated with a better outcome, the combination of antibiotics was associated with lower complications. This fact necessitates early diagnosis, proper management, and prevention of ICU infections. Suggestions may fulfil the deficiencies are: Multi-disciplinary team involvement in patients' assessment and diagnosis of infections, the microbiological examination should be encouraged, local antibiogram is essential to optimize the empirical therapy, stewardship program is critical to optimize antibiotic use and minimize resistance pattern and all infection control measures must be initiated, including hand hygiene and bundles

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Figures:

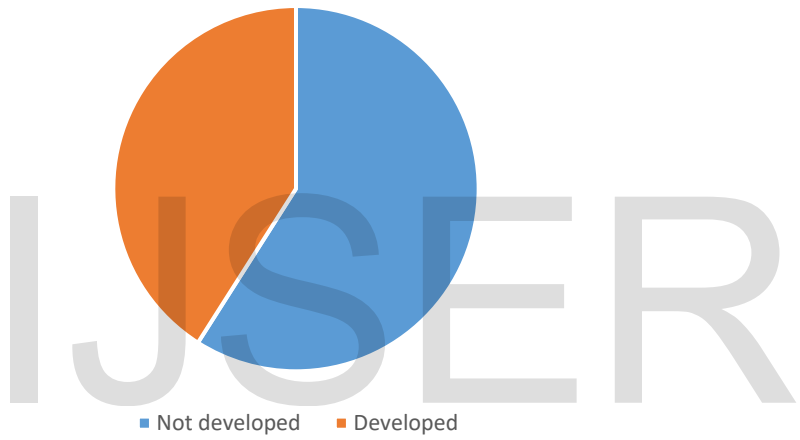

Figure (1): Distribution of complications occurrence.

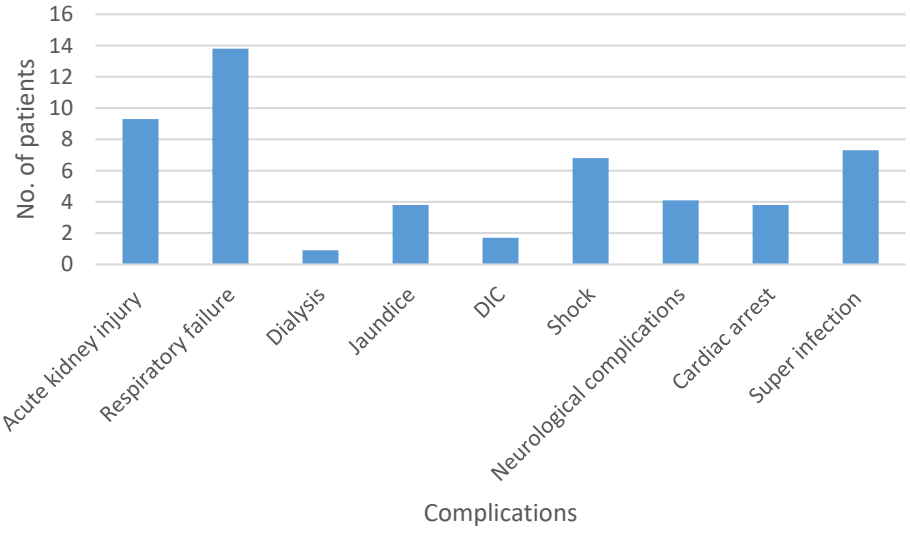

Figure (2): Distribution of ICU complications

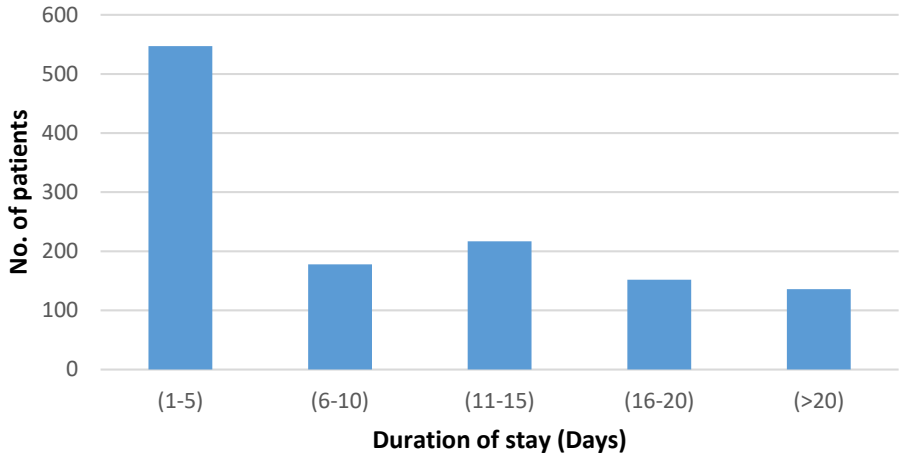

Figure (3): Distribution of duration of ICU stay.

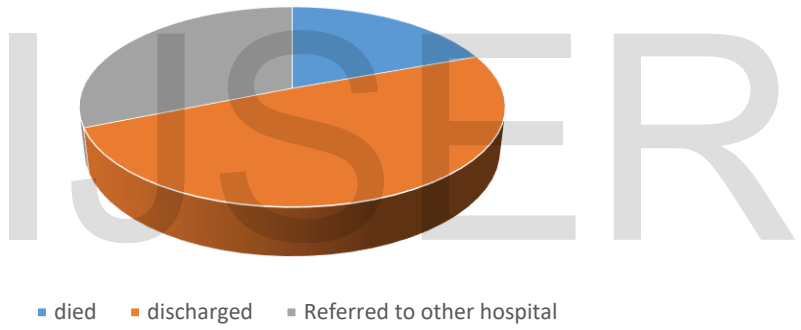

Figure (4): Distribution of patients' outcomes.

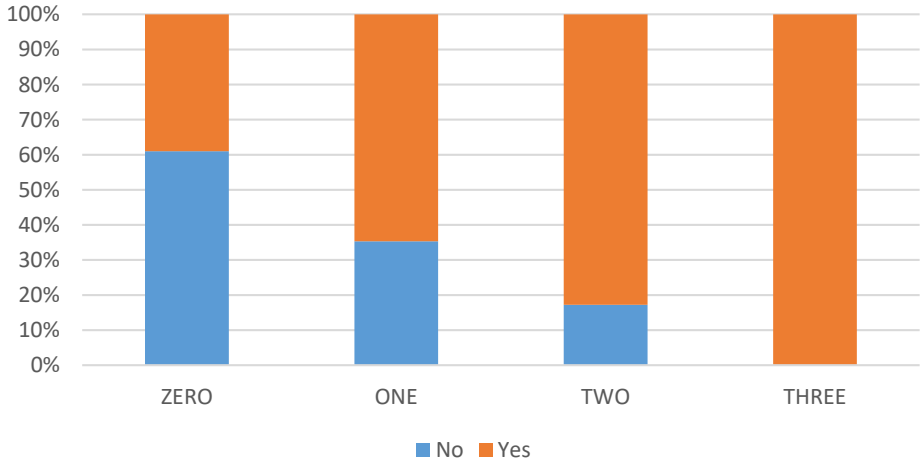

Figure (5): association between qSOFA score and ICU infections.

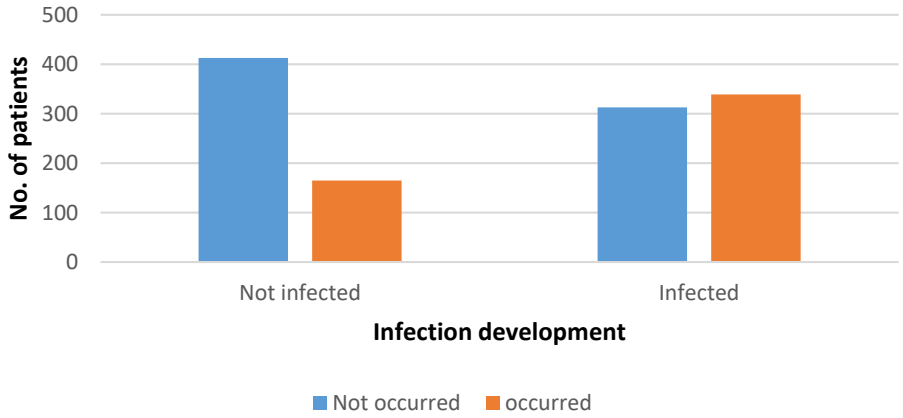

Figure (6): Association between ICU infection and complications.

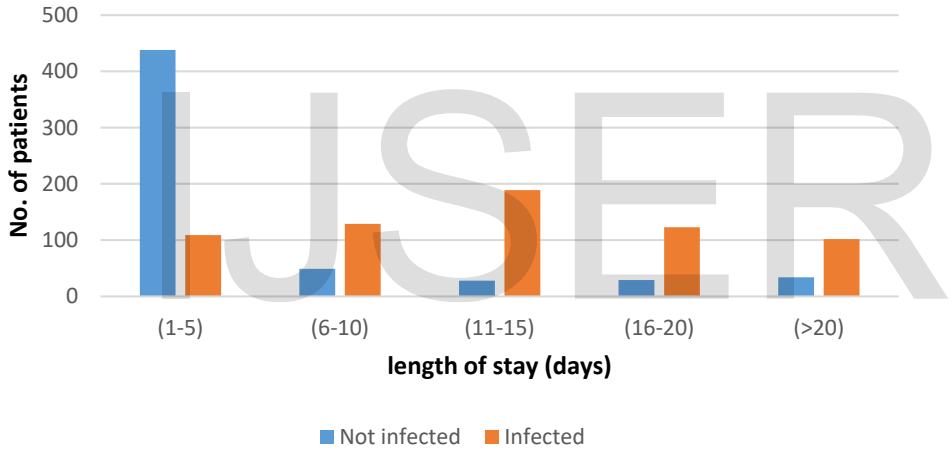

Figure (7): Association between ICU infection and length of stay.

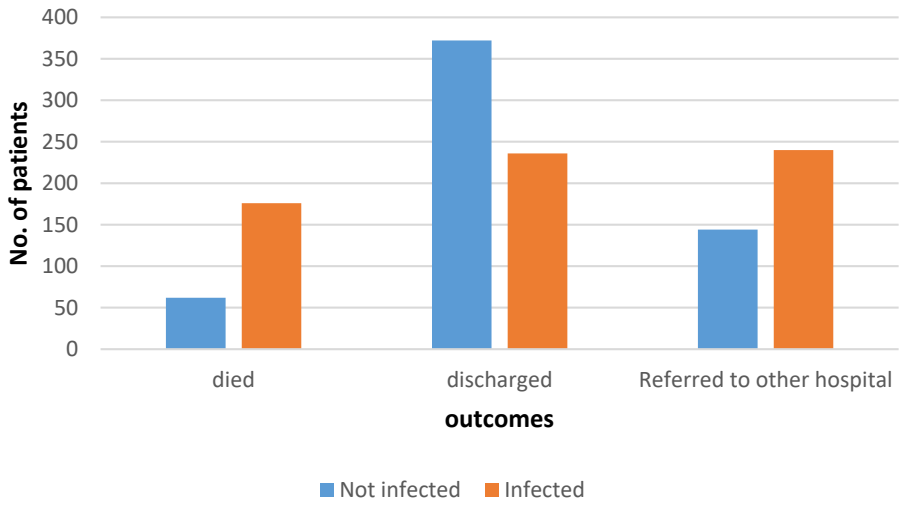

Figure (8): Association between ICU infection and patients' outcome.

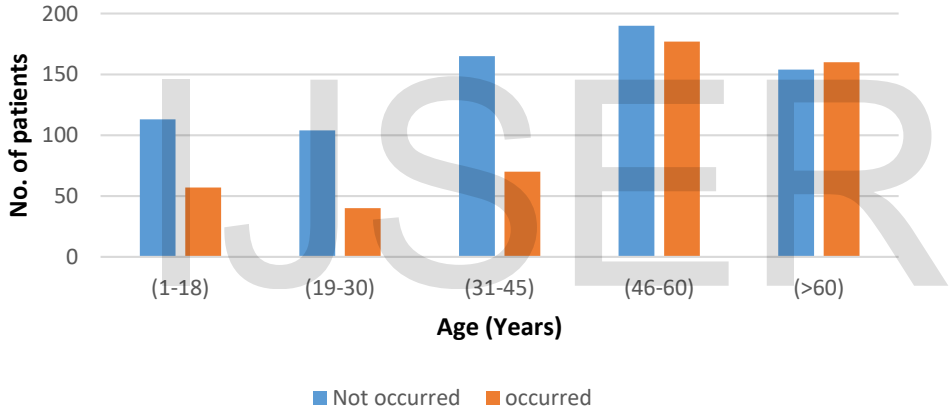

Figure (9): Association between age groups (Years) and complications

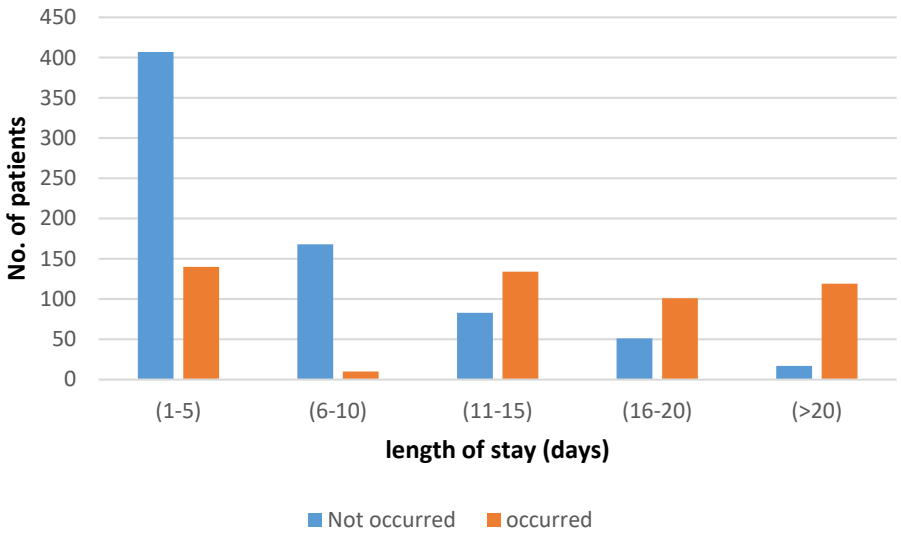

Figure (10): Association between duration of ICU stay and complications

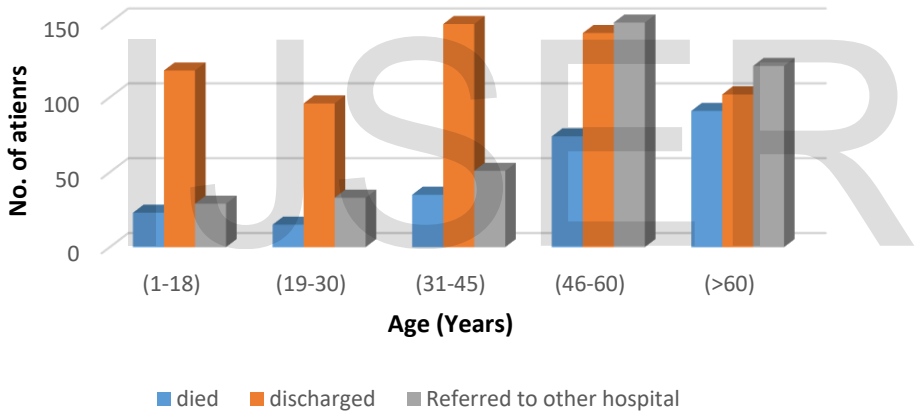

Figure (11): Association between age groups (Years) and outcome

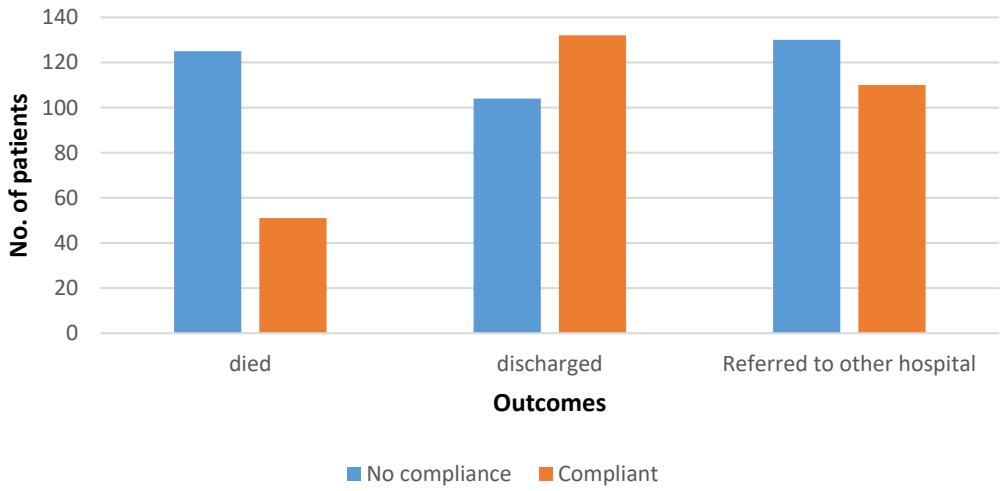

Figure (12): Association between guidelines compliance and patient's outcome.

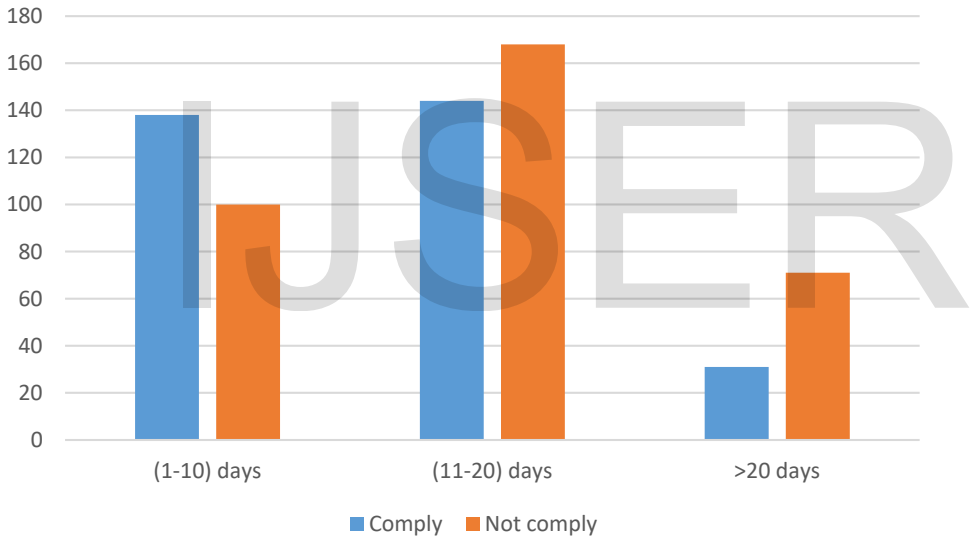

Figure (13): Association between duration of ICU stay and guidelines compliance.

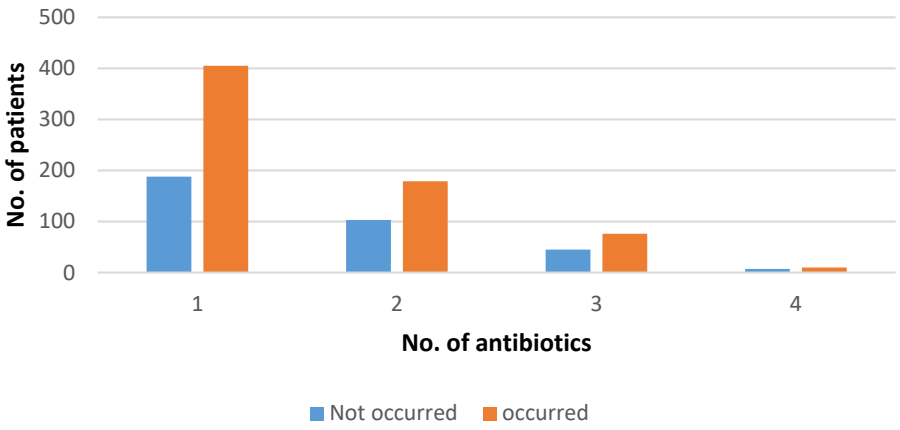

Figure (14): Association between the number of antibiotics and complications.