



Studying the relationship of Nosocomial infection to the age, gender and educational level of the patient

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ABSTRACT

A total of 140 samples were collected from patients staying at Tikrit Teaching Hospital for three days or more in order to identify the most common bacterial isolates within the infections acquired from Tikrit Teaching Hospital and its relation to the age, gender and educational level of the patient. The samples included 75 urine samples, 28 stool samples, 28 wound swabs, and 9 sputum samples. The percentage of nosocomial infections was (45.7%), where the highest percentage were among UTIs (50.7%) from the total of (75) samples, followed by wound infections (42.9%) from the total of (28) samples, gastrointestinal infections (39.3%) from the total of (28) samples, and pneumonic infections (33.3%) from the total of (9) samples. It was noticed that hospital infections were more common in females, age group (51-89) years followed by the age group (5 years and less), and the uneducated (illiterate) where the number of hospital infected patients was 47 uneducated (illiterate) patients with 71.2%, while the number of educated patients was 19 patients with 28.8%. Various bacterial species were isolated in this study, including *Citrobacter.koseri*, *E.coli*, *Staphylococcus schleiferi*, *Staphylococcus epidermidis*, *Proteus vulgaris*, *Staphylococcus saprophyticus*, *Klebsiella ozaenae*, *Klebsiella ornithindytica*, *Enterobacter aerogenes*, *Providencia stuartii*, *Staphylococcus warneri*, *Staphylococcus aureus*, *Proteus mirabilis*, *Prov. rettgeri*, *Staph. flexneri*, *Prov.alcalifaciens* and *K.pneumoniae*.

Introduction

The term [Nosocomial or Hospital Acquired Infection (HAI)] refers to infections acquired by the patient during his or her period in the hospital, in which s/he was not infected before entering the hospital, and whose symptoms appear only 48 hours or more after entering the hospital. These are exogenous infections which are represented by the air, hospital floor and working staff of the hospital or endogenous infections in which the patient carries various types of microorganisms on his skin [1, 2].

Hospital acquired infections has been a major concern in recent years due to its rapid spread in hospitals and the difficulty of controlling it [3]. They are widespread because hospitals are depositories contain many microorganisms such as microbes, some of which may be pathogenic and others opportunistic. These depositories consist of the

patients themselves, airborne particles, non-sterile solutions, etc. From these depositories, pathogens are transmitted through air, contact and food to patients and hospital personnel [4]. The hospital environment plays an important role in hospital acquired infections, as it is an important source of conservation and transmission of germs that cause infections [5]. Surgical operations rooms are also considered the most important component of clean wounds infections [6], therefore, any infringement or deficiency in following the instructions or health directions and the steps of disinfection and sterilization inside the operating room may lead to the spread of pathogens, which is difficult to control later [7]. The risk of infection and severity increase in some special units in hospitals such as the intensive care units, child care units, burns units and units for

patients with weak immune, in which there is a high risk of infections [8].

The problem of hospital acquired infections is considered as one of the most important and serious health problems in the whole world. This is due to the fact that it increases the mortality rate and complications of the disease, increases the length of patient stay in the hospital, affects significantly the quality of medical work in which the patient needs more effort to be under supervision as well as the increase of cost [9].

The most common diseases that can be acquired in hospitals are urinary tract infection, wounds infection, respiratory tract infection, gastrointestinal infection and Septicemia [10]. The most important species and bacterial types that can cause hospital infections are *Staphylococcus spp.*, *Streptococcus spp.*, *Enterobacter spp.*, *Citrobacter spp.*, *Klebsiella spp.*, *Proteus spp.*, *Escherichia coli* and *Pseudomonas aeruginosa* [11].

In a study by the researchers Jean-Louis Vincent *et al.* [12] on acquired diseases within the intensive care unit, 2064 from a total of 4501 patients were found to have hospital acquired infections. The study also showed that the most common infection was Pneumonia with 46.9% then 17.8% for lower respiratory tract infections, followed by urinary tract infections 17.6% and to a lesser extent for septicemia with 12%.

Whereas Richards *et al.* [13] noted in a study of intensive care units in the United States, that the primary acquired infection was urinary tract infection 31% followed by pneumonia 27% and Septicemia 19%.

The medical studies on the subject of hospital acquired infections are still few, despite the importance and seriousness of this issue in Iraq due to the poor environmental and health conditions of hospitals and the high pollution of the environment in general and hospitals in particular; for this we decided to conduct this study.

Materials and methods

1- Samples Collection:

The current study included collection of 140 clinical samples of patients who had been staying for three days or more at Tikrit Teaching Hospital in Tikrit. These samples include 75 urine samples from patients with (renal failure, diabetes, hypertension, fractures, burns, chest inflammation) and 28 stool samples from patients with (high fever, cough, chest inflammation, fractures) and 9 sputum specimens from patients with (renal failure, fractures, heart failure), collected in sterile clean vessels, and 28 wound swabs from patients admitted for surgical operations collected using a sterile cotton swab. The samples were transferred to the laboratory and cultured within 10 minutes. The information was recorded in a questionnaire form for each patient which included (sex, age, educational level, address, date of admission to the hospital and reason for admission to hospital).

2- Samples Culture:

The collected samples were cultured on the blood agar and Macconkey agar and incubated at 37 ° C for 24 hours.

3- Identification of Bacterial Isolates:

3.1- Morphological Characteristics:

The characteristics of the developing colonies were observed on the blood agar and Macconkey agar in terms of shape, size, edge, color, type of hemolysis, fermenting lactose sugar or non- fermenting lactose sugar and the phenomenon of swarming.

3.2 Microscopic examination:

A swab was taken from the colonies of each isolates and stained with gram stain to observe cell response to the dye with its shape and arrangement.

3.3 Biochemical tests:

This consists of Oxidase test, Catalase test, Indol test, Methyl red test, Vogas prouskauer test, Citrate utilization test, Motility test, Carboxylic group clearance of lysine test [14], Coagulase test [15], Sugar fermentation test [16].

Results and Discussion

Isolation:

Table (1) shows the numbers and percentages of bacterial growth taken from different clinical samples. The results showed that bacterial growth was found in 64 samples with 45.7%, while there was no bacterial growth in 76 samples with 54.3%. This result was similar to that found by Jean-Louis [12] who studied 4501 samples collected from patients staying in the hospitals in the United States for 72 hours and above. He found that 2064 samples with 45.8% gave a positive result, while 2437 samples with 54.1% showed no growth.

The high bacterial growth percentage shown in this study maybe due to the continuous use of protective antibiotics in the hospital, which has led to the spread of bacteria resistant to these antibiotics, as well as leaving the doors and windows open and sometimes cooling devices being out of order allowing the passage of air from the outside into the inside carrying germs and other pathogens [17]. In addition, the failure to follow the correct methods of cleaning and disregarding the rules of sterilization by hospital staff as well as other factors related to the hygiene of the patient himself and the medical staff [18].

As shown in the same table, the highest percentage of infection was recorded in UTIs 50.7% while pneumonia infections were less frequent. This result was similar to that of Weinstein [19] in the United States, where the highest rate was recorded in UTIs followed by wound infections and Septicemia, while the lowest percentage was pneumonia infections.

The high percentage obtained for UTIs may be the result of frequent use of urinary catheterization as this is considered one of the most important means to transfer infections to patients as well as lack of following the healthy practices of hygiene and the fact that hospitals are very crowded. Studies have

indicated that the large educational hospitals feature increasing numbers of those who enter it daily [20]. As for the wound infections, it was with a percentage of 42.9%. The bacterial growth appeared in 12 samples from a total of 28 samples and this was similar to that of Zeamanuel Tesfahunegn [21], which showed that the percentage of wound infections was 44.1%. On the other hand, Taye [22] showed that the percentage of wound infections was 14.8%.

The high percentage that was found in this study may be attributed to the lack of efficiency of sterilization, not using the concentrations recommended for sterilization, reducing concentrations of sterilizers according to the wishes of workers and leaving windows open in the corridors of surgical rooms, which leads to the entry of dust loaded with bacteria and this is considered an alarming situation, especially that the first immune barrier (skin) in these patients is ruined. This provides the best conditions for the invasion and settlement of germs in patients not only on the ruined layer, but having access to the internal organs causing serious complications such as cases of Septicemia that may lead to death [18].

As for gastrointestinal infections, it was with a percentage of 39.3%. The bacterial growth appeared

in 11 samples from a total of 28 samples and these results agreed with AL-Rifai [23] in Iraq at Tikrit Teaching Hospital with 32.4%.

The high percentage of gastrointestinal infections that have emerged in this study may be due to the congestion of these lounges with patients, leaving the windows and doors open, frequent entry of visitors and escorts to the lounges without following any means to avoid the transfer of germs to these lounges, not taking care of the food provided to patients and the patient's own personal hygiene [18].

Concerning pneumonia infections, it was with a percentage of 33.3%. The bacterial growth appeared in 3 samples from a total of 9 samples and these results were similar to that of Eriksen *et al.* [24] who indicated that the percentage of pneumonia infections was 29%, while this result was higher than that of Osman *et al.* [25] who found that the infection percentage was 9.9%. The high percentage that emerged in this study is due to the same reasons mentioned in previous cases such as poor ventilation and low health awareness of some patients and hospital staff.

Table (1): Numbers and percentages of bacterial growth from different clinical samples

Source of Sample	Presence of Growth		Non-presence of Growth		Total
	No.	Percentage (%)	No.	Percentage (%)	
Urinary tract infections	38	50,7	37	49,3	75
Wounds infections	12	42,9	16	57,1	28
Gastrointestinal infections	11	39,3	17	60,7	28
Pneumonia infections	3	33,3	6	66,7	9
Total	64	45,7	76	54,3	140

Identification:

Table (2) shows the biochemical tests of the Gram-negative bacteria isolated from different clinical samples, which included (catalase, oxidase, indole, methyl red, vogas prouskauer, citrate utilized,

Motility, H₂S, Carboxylic group clearance of lysine) to identify growing bacterial colonies on the media (blood agar, MacConkey agar and nutrient agar) as well as the use of microscopic examination and observation of culture characteristics.

Table 2: Biochemical tests of Gram-negative bacteria isolated from different clinical specimens

Biochemical Tests											Bacterial Isolates	
Lysine	Urease	Motility	H ₂ S	Gas	Simmons citrate	Vogas prouskauer	Methyl red	Indole	Lactose fermentation	Oxidase		Catalase
	-	+	-	+	-	-	+	+	+	-	+	<i>E. coil</i>
-	+	+	-	+	+	-	+	+	+	-	+	<i>Citro.koseri</i>
+	+	-	-	+	+	-	+	+	+	-	+	<i>K.ornithinolyica</i>
	+	-	-	+	+	-	+	-	+	-	+	<i>K.ozaeliae</i>
	+	-	-	+	+	+	-	-	+	-	+	<i>K.pneumoniae</i>
	+	+	+	+	-	-	+	+	-	-	+	<i>P.vulgaris</i>
	+	+	+	+	+	-	+	-	-	-	+	<i>P.mirabilis</i>
	+	+	-	+	+	+	-	-	+	-	+	<i>E.cloacae</i>
	-	+	-	+	+	+	-	-	+	-	+	<i>E.aerogenes</i>
	+	+	-	-	+	-	+	+	-	-	+	<i>Prov.rettgerii</i>
	+	+	-	-	+	-	+	+	-	-	+	<i>Prov.stuartii</i>
	-	+	-	+	+	-	+	+	-	-	+	<i>Prov.alcalifaciens</i>
	+	+	+	+	-	-	+	+	-	-	+	<i>Morganella morganii</i>
	-	-	-	+	-	-	+	+	-	-	+	<i>Shigella Flexneri</i> (6,variety Manchester)

As for table (3), it shows the tests for Staphylococcus bacteria

Table (3): Biochemical Tests of Staphylococcus aureus

Biochemical Tests										Bacterial Isolates
Novobiocine sensitive	Sugar fermentation					Mannitol salt agar	Coagulase	Catalase	Oxidase	
	Mannitol	Mannose	Trehalase	Sucrose	Motility					
-	+	+	+	+	-	+	+	+	-	<i>Staph.aureus</i>
-	-	+	-	+	-	+	-	+	-	<i>Staph.epidermidis</i>
+	-	-	+	+	-	+	-	+	-	<i>Staph.saprophyticus</i>
-	-	+	+	-	-	+	-	+	-	<i>Staph.schleiferi</i>
-	-	-	+	+	-	+	-	+	-	<i>Staph.warneri</i>

Relationship between Nosocomial infection and Age:

Table (4) shows the relationship between hospital infection and age. The average age of patients in this study ranged from 2 months to 89 years. The ages of patients were divided into five groups. The first group included the ages below 5 years, which comprised 15 patients with a percentage of 23.4%. In the second group, the ages ranged between 6-20 years and

included 6 patients with 9.4%. The third group included ages 21-35 comprising 8 patients with a percentage of 12.5%. The fourth group included ages 36-50 years with 12 patients and a percentage of 18.8%. The fifth group included ages 51-89 years comprising 23 patients with 35.9%.

The results showed that the highest percentage of infections was in the fifth group 51-89 years with a percentage of 35.9% from the total cases, followed by

the first group (under 5 years), then the fourth group 36-50 years, followed by the third group 21- 35 years and finally the second group 6-20 years. These findings were in agreement with the findings of Stephan Francois *et al.* [26], who indicated that the highest percentage of hospital infections was in the age group 60-75. In addition, Nasseab [27] noted that the highest percentage was in the age group of more than 50 years.

Zeamanuel tesfahunegn [21] showed that the highest rate of hospital acquired infection was in the age group of more than 50 years, followed by ages 5 years or less, and this result agreed with the results obtained.

The reason behind the high percentage of infection in the first and fifth groups is due to the fact that children and the elderly are more responsive to and affected by infection than others because of the incomplete maturity of the immune system in children and the elderly have a weakened immune system .

Table (4): Relationship between Hospital and Age Infections

Age (year)	Infected Patients	Percentage (%)
5 years and less	15	23.4%
(6-20)	6	9.4%
(21-35)	8	12.5%
(36-50)	12	18.8%
(51-89)	23	35.9%
Total	64	100%

Table 5: Relationship between hospital and sex infections

Type of Infection	Sex				Total Number	Percentage (%)
	Males		Females			
	No.	(%)	No.	(%)		
Urinary Tract Infection	16	42.1	22	57.9	38	59.4
Wounds Infection	7	58.3	5	41.7	12	18.7
Gastrointestinal Infection	7	63.6	4	36.4	11	17.2
Pneumonia Infection	1	33.3	2	66.7	2	66.7
Total	31	48.4	33	51.6	64	100

Relationship between Nosocomial Infections and Educational Level:

Figure (1) shows the percentage of both educated and uneducated infected patients. It is clear from the results that the number of uneducated patients with hospital acquired infections were 47 with a percentage of 71.2% (Illiterate) while the number of educated patients were 19 with a percentage of 28.8% (Graduates of primary schools, institutes and universities). The appearance of this high percentage for uneducated infected patients in this study may be the main cause of the increase in hospital acquired infections reaching a percentage of 45.7%) because failure to follow health instructions during the period

Relationship between Nosocomial Infection and gender:

During the current study, random samples were collected from both sexes (males and females). The highest percentage of infection was recorded in females who were 33 patients with a percentage of 51.8% compared to males who were 31 patients with a percentage of 31.4% as indicated in Table [5].

In the case of urinary tract infections, the highest percentage of infection in females was 57.9% compared to males with 42.1%. This is in agreement with Stamm [28] who found that the percentage of female infections of the urinary tract is higher than that in males. Buzayan & Taher [29] also obtained the same results as ours, and this may be due to the female physiological condition such as the shortened urethra which facilitates the transmission of pathogens [30]. Similar results were obtained in pneumonia infections where the highest percentage of infection in females was 66.7% compared to males with 33.3%.

As for wound infection, the percentage of infection in males was higher with 58.3% compared to females with 41.7%. This is in line with what was reached by Zeamanule tesfahunegn [18]. This may be due to the nature of men's work and their presence outside the home for long periods, which makes them more likely to be infected with such kinds of infections. In the gastrointestinal tract infection, the highest infection percentage was recorded in males with 63.6% compared to females with 36.4% which was in agreement with AL-Rifai [23] .

of stay in the hospital is more among uneducated patients due to lack of health awareness .

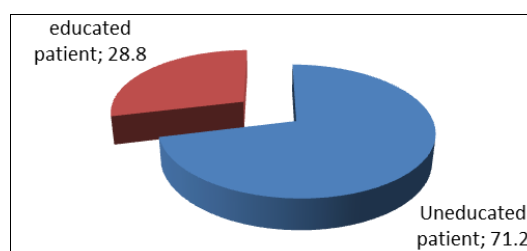


Figure (1): Percentage (%) of both educated and uneducated infected patient

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دراسة علاقة عدوى المستشفيات مع عمر وجنس والمستوى التعليمي للمريض

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الملخص

جمعت (140) عينة من المرضى الراقدين لثلاثة أيام فأكثر في مستشفى تكريت التعليمي بهدف تحديد العزلات الجرثومية الأكثر شيوعاً ضمن أخماج مستشفى تكريت التعليمي وعلاقة ذلك بعمر وجنس والمستوى التعليمي للمريض. تضمنت العينات (75) عينة إدرار Urine و(28) عينة براز Stool و (28) مسحة من الجروح Wound swab و (9) عينات قشع Sputum. كانت نسبة الإصابة بأخماج المستشفيات (45.7%) وقد سجلت أعلى نسبة إصابة في أخماج المسالك البولية (50.7%) من مجموع (75) عينة تلتها أخماج الجروح (42.9%) من مجموع (28) عينة ثم أخماج المعدة والأمعاء (39.3%) من مجموع (28) عينة ثم أخماج ذات الرئة (33.3%) من مجموع (9) عينات وقد لوحظ ان أخماج المستشفيات كانت أكثر شيوعاً لدى الإناث والفئة العمرية (51-89) سنة تلتها الفئة العمرية (5 سنوات فما دون) وكذلك لدى المرضى غير المتعلمين (الاميين) اذ كان عدد المرضى غير المتعلمين المصابين بعدوى المستشفيات 47 مريض ونسبة 71.2% بينما كان عدد المرضى المتعلمين 19 مريض ونسبة 28.8%. وقد عزلت أنواع جرثومية مختلفة في هذه الدراسة ومنها *E.coli* ، *Citrobacter.koseri* ، *Staphylococcus saprophyticus* ، *Proteus vulgaris* ، *Staphylococcus epidermidis* ، *Staphylococcus schleiferi* ، *Staphylococcus aureus* ، *warneri* ، *Prov. alcalifaciens* ، *Staph. flexneri* ، *Prov.rettgeri* ، *Proteus mirabilis* و *Klebsiella ornithindytica* ، *Klebsiella ozaenae* ، *Enterobacter aerogenes* ، *Providencia stuartii* ، *Staphylococcus pneumoniae*.