,Catheter Associated Urinary Tract Infections in Pregnant Women

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Abstract

The urinary tract infection attributed to the use of an indwelling urinary catheter is one of the most common infections acquired by patients in health care facilities. Catheter-acquired urinary infection is the source for about 20% of episodes of health-care acquired bacteremia in acute care facilities, and over 50% in long term care facilities. The most important interventions to prevent bacteriuria and infection are to limit indwelling catheter use and, when catheter use is necessary, to discontinue the catheter as soon as clinically feasible.

Aim of Study: The aim of this research is to study the urinary tract infection after catheterization and to characterize the various types of microorganisms that are associated with this process. Recommendations concerning the type of treatment and the appropriate ways of catheterization, that help in minimizing urinary tract infection and its complications.

Conclusions : about 74% of these 65 patients for whom the urinary catheterization is used developed urinary tract infections from different kinds of bacteria ,the most common types are Klebsiella pneumoniae (49.23%), also Escherichia coli (13.84%) , Proteus spp. (4.61%), Pseudomonas aeruginosa (3..07%), staphylococcus aureus (4.61%), β- hemolytic streptococci (1.53%) and Staphylococcus albus (1.53%).

Keywords: catheter, urinary tract infection, Pregnant Women

1. Introduction

1.1. Catheter-associated urinary tract infection:

Catheter-associated urinary infection is the source for about 20% of episodes of health-care acquired bacteremia in acute care facilities, and over 50% in the long term care facilities .[1]

Proteus spp., Pseudomonas aeruginosa, Klebsiella pneumoniae, in addition to Escherichia coli are usually the causes of these infections. Many infectious strains show a marked antimicrobial resistance compared with organism that cause community-acquired urinary infection. Factors associated with an increased risk of infection include: Female sex, length of the period of catheterization, Sever underlying illness, faulty catheter care, and poorly trained nursing personnel. Infection occurs when bacteria reach the bladder by one of 2 routes:

a) By migrating through the column of urine in the catheter lumen (intra luminal route). b) By moving up the mucous sheath outside the catheter (per urethral route).

Hospital acquired pathogens reach the patient's catheter or urine collecting system on the hands of hospital personnel, in contaminated solution or irrigants, and via contaminated instruments or disinfectants. Entry of bacteria into the catheter system usually occurs at the catheter-collecting tube junction or at the drainage bag portal bacteria then ascent intraluminally into the bladder .More often, the patient's own bowel flora migrate to the perennial skin and periurethral area and reach the bladder via the external surface of the catheter this route is particularly common in women. Most catheter associated infection appears to be benign, they cause minimal symptoms, no fever and often resolve after withdrawal of the catheter[1].

Gram negative G^- bacteria which causes 1-2% of cases of catheter—associated bacteriuria, are the most significantly recognized complications of catheter induced urinary infection.

1.2. Common hospital-acquired urinary tract infection:

Catheter acquired urinary tract infection is one of the most common health care acquired infections [1,2] .About 70–80% of these infections are attributable to the use of an indwelling urethral catheter. Recent prevalence surveys report that urinary catheter is the most common indwelling device, with 17.5% of patients in 66 European hospitals having a catheter [1], and 23.6% in 183 US hospitals [2] . In the National Healthcare Safety Network (NHSN) 2011 surveillance report, 45–79% of patients in adult critical care units had an indwelling catheter, 17% of those on the medical wards, 23% on surgical wards, and 9% on rehabilitation units [3] .

Thus, indwelling urethral catheter use is exceedingly common in health care facilities. Prevention of infections attributable to these devices is an important goal of health-care infection prevention programs. Indwelling urinary catheters are generally considered to be short term if they are *in situ* for less than 30 days and chronic or long term when *in situ* for 30 days or more [4] .

As a usual consequence of instrumentation of the urethra the most common predisposing factor is the insertion of an indwelling urethral catheter which bypasses the normal anatomic barriers to ascend infection.

1.3. Risk and Contributing Factors for Developing Catheter Associated Urinary Tract Infections these can be divided into two factors including : Catheter Factors& Individual Factors.

The catheter factors are:

 Left in place for more than 6 days.
 Used to measure urinary output
 The catheter is not positioned correctly , and the level of the drainage bag is above the bladder .

The personal factors:

 Is malnourished, frail, or has chronic illness .
 Has diabetes mellitus
 Has azotemia (creatinine > 2.0 mg/dL)

 Not maintained as a closed system (e.g., switching between gravity and leg bag drainage systems) [6,7].

1.4. Clinical manifestations of urinary tract infection

Symptoms of cystitis and urethritis include frequency of urination, burning feeling during urination, and passage of cloudy, occasionally blood-tinged urine. The patient may complain of a foul odor of the urine ,lassitude and suprapublic discomfort. There is sudden rise of body tempreture to 38.9° - 40.6° C, shaking ,chills, aching pain in one or both costovertebral areas or flanks and symptoms of bladder inflammation, acute urinary tract infection complicated by pyelonephritis, frequently arised in patients subjected to urethral instrumentation, especially the indwelling catheter. About 60–80% of hospitalized patients with an indwelling catheter receive antimicrobials, usually for indications other than urinary tract infection [5] .

2. Materials and methods

2.1.l.Patients :

Sixty five pregnant ladies were included in this study out a total of 320. They were females who used urethral catheter during cesarean section. The study was carried in the Maternity and Children Hospital in Hilla, Iraq, full clinical history and examination had been taken from each patient.

2.1.2. Urine specimens into a sterile glass urine tube of mid-stream urine , in sterile tubes after cleaning the area with antiseptic using sterile gloves were collected from each patient before the cesarean section, and on the 2nd and 3rd day post-operatively.

2.1.3. Reagents and chemicals and instruments:

- Balloon catheter, silicone treated..
- Disposable plates.
- Urine sample tube.
- Media used for urine culture are:
    - Mannitol salt agar for growth of staph.
    - Nutrient agar for all microorganism.
    - MacConkey agar for G- bacteria.
    - Kliglar iron agar indicating media.
    - Blood agar base for all micro organisms.

- Urea agar base it is indicating media.
- Susceptibility test Discs: for invitro Diagnostic use.
- Oven,. - Incubator. -, Otoclave., - Olympus microscope.

2.2. Methods:

Our study was carried out in the Maternity and Children Hospital in Hilla , Iraq, It included sixty five female patients who used a catheter during the cesarean section out of 320 patients. Urine samples were collected form each woman before catheterization and subjected to culture and sensitivity test to be sure whether the area was clean or infected before catheterization. Every test was run twice to assure the result. A swab was taken from the same area , and no bacterial growth was found there . Antibiotic cover (Cefixim and /or garamycine) were used for specific patients after cesarean section not all the patients as we will mention latter .

A urine sample was collected from each woman on the first day after the operation and were sent for culture and sensitivity test, when no growth was observed the process was continued for five days to notice the growth when it occurs. The history of the patient was taken daily to notice the symptoms of urinary tract infection when they occurs and to follow up the treatment for each patient which includes drugs used, dosage, route of administration, and the temperature of each patient to see if any change occur.

Results:

This study was done for (65) in- patients for them urinary catheters were used, out of 320, and their data were collected using a questionnaire.

-Types of infected Bacteria: The types of bacteria according to culture and sensitivity were as follow :

- Escherichia coli, 9 patient, (13.84 %).
- Klebsiella pneumoniae 32 patient (49.23 %).
- Proteus spp., 3 patient (4.61 %).
- Pseudomonas, 2 patient (3.07 %).
- Staphylococcus aureus, 3 patient(4.61 %).
- β- hemolytic streptococcus, 1 patient (1.53%)
- Staphylococcus albus, 1 patient (1.53 %). as shown in table (1) and figure (1).
- Catheterization with and without antibiotic in relation to infection
    1- Catheterization with antibiotic cover (Cefixime and/or garamycine) with no infection 8 patients: (12.32 %).
    2- Catheterization without antibiotic cover with no infection : 9 patients (13.84 %).
    3- Infected region after catheterization with antibiotic(Cefixime and /or garamycine) : 48 patients (73.84 %).as illustrated in table (2) and figure (2).
- Age of the patients: patients are classified according to age as follow:
    (A) Patients age from 20-30 years old were: 42 patients (64.62%):-
    (l) 1 patient (1.53%) catheterized with antibiotic with no infection
    (2) 8 patients (12.3%) were catheterized without antibiotic with no infection.
    (3) 33 patients (50. 76%) are infected after catheterization with antibiotic.
    (B) Patients age from 31-40 years old were: 23 patients (35. 38%) as follow:.
    (1) 7 patients (10.76%) catheterized with antibiotic with no infection.
    (2) 1 patient (1.53%) catheterized without antibiotic with no infection.

(3) 15 patients (23.07%) were infected after catheterization with antibiotic as shown in table (3) and figure (3).

And according to chi-square results we found that the catheter causes urinary tract infection regardless the use of antibiotics or the age group of the patients (Table 4 –chi –square) .

Discussion

This study included sixty five healthy female at the age of 20-40 years out of a total of about 320 patients who had no other complaints. They used a urethral catheter during the cesarean section. Before the catheterization, their urine culture showed no growth except for some organisms which are present in distal urethra normally, namely the staphylococci and diphteroides. Catheter associated urinary tract infection is an important device-associated health care acquired infection. In contrast to a study was done for Pakistani women by Sheikh, M.A.at 2000 where during pregnancy among Pakistani women was examined. A midstream urine was collected from 250 pregnant and 100 control women where they found 28.5% had UTI; 30.0% of controls had UTI. Among the pregnant and control women, 24.4% and 20.0% respectively had symptoms, such as incontinence, nocturia and urgency. Symptoms did not correlate with incidence. Socioeconomic status, personal hygiene, education level, pregnancy duration, postcoital washing, contraceptive use and use of underclothing had no significant association with UTI occurrence. A history of past urological problems was associated with an increased incidence of UTI in pregnancy [14], and if we compare this to our study we found that the result of the urine culture after catheterization showed that 12.30% of our patients have no infection with the use of antibiotic and 13.84% have no infection without using antibiotic.[1]. The use of an indwelling urethral catheter is associated with an increased frequency of symptomatic urinary tract infection and bacteremia, and additional morbidity from non-infectious complications.

Most catheter-associated lower urinary tract infections appeared to be benign, they cause minimal symptoms, no fever and often resolve after withdrawal of the catheter . Growth of different types of G^- microorganisms in the urine culture of (73.84%) of our patient after catheterization with the use of antibiotics was observed, this bacteriuria occured in at least 25% of hospitalized patients with indwelling catheter .This means that the presence of antibiotics could not prevent the growth of microorganism as prophylaxis antibiotics are ineffective in patients with indwelling urinary catheter and will only lead to the emergence of bacterial resistance. The presence of G^- organism in the urine culture of many patients in the hospital is an indication that catheterization of the bladder is liable to introduce organisms into the urinary tract and this procedure may be responsible for the later development of acute or chronic pyelonephritis in some patients .Entry of bacteria into the catheter system usually occurs at the catheter-collecting tube junction or the drainage bag portal; bacteria then ascend intraluminaly into the bladder.

Bacteriuria in catheterized patient is very dangerous. It may increase the risk of death of approximately three fold compared with similar patients without bacteriuria,[1]. From the results, it can be noticed that the infection occurs at the age of 20-30 years more frequently than the age of 31-40 years, because the caesarsean sections at 20-30 years are more used than at 31-40 years.

Types of infectious bacteria are:

Escherichia coli 9(13.84%). Klebsiella pneumoniae 32(49.23%). Proteus spp. 3(4.61%). Pseudomonas aeruginosa 2(3.07%). Staphylococcus aureus 3(4.61%). β-hemolytic streptococcus, (1.53%).G$^-$bacteria of the interstitial flora is one of the causative agent. More often the patient's own bowel flora migrates to the perineal skin and periurethral area and reaches the bladder via the external surface of the catheter this route is very common in women.

Factors associated with an increased risk of infection include:

Female sex, length of the period of catheterization, sever underlying illness, so in these cases the female are subjected to an increased risk of incidence of urinary tract infection during catheterization as the urethra is shorter in female than that of the male[5]. Other factors that may increase the risk of infection were faulty catheter care and poorly trained nursing personnel because they do not use the appropriate way for catheterization, which should include: anesthesia of the urethra with 1% xylocaine combined with 0.5% chlorhexidine and allowing three minutes for anesthetic and antiseptic effect to take place and with a septic precaution, and all catheter should be connected by a straight connections to sterile tubes and drainage bottles, which should contain 120 ml of 40% formalin solution .

The hospital-acquired pathogens reach the patient's catheter or urine-collecting system on the hands of hospital personnel, uncontaminated solution and via contaminated instruments or disinfectants. Catheter-associate urinary tract infection can be partially prevented in patient catheterized less than 2 weeks by use of a sterile closed collecting system. Bacteria colonizing the drainage bags of catheterized patients have been reported to be a source for outbreaks of resistant organisms in acute care facilities [4,11]. In the nursing home setting, the urine of residents with chronic indwelling catheters is the most common site of isolation of resistant gram negative organisms[12,13].

Removal of the catheter and a short course of antibiotics to which the organism is susceptible is probably the best course of action and nearly always eradicates the bacteria. If the catheter cannot be removed, antibiotic therapy usually proves to be unsuccessful and may result in infection with a more resistant strain. In this situation the bacteriuria should be ignored unless the patient develops symptoms or is at high risk of developing bacteriuria. In these cases, systemic antibiotics may reduce the degree of bacteriuria and the like hood of bacteriuria. The incidence of ascending infection is nearly halved by connecting the catheter to a sterile collecting bottle which contains a suitable disinfectant e.g. formaldehyde to keep the contents sterile. From the result of sensitivity test, it has been found that the wide differences between the result of the sensitivity test and recommended therapy that is high resistant by the microorganism. This means that it is very important to select the drug on the basis of the antimicrobial susceptibility.

Identification of causative organism and its sensitivity to drugs are very important because of the large range of organisms that may be responsible and prevalence of resistant strain.. Initial treatment may be empirical, but the choice of therapy with oral or parenteral antimicrobial drugs should be based on the results of culture and sensitivity testing. [7].

Generally, short courses treatments from 10-14 days are quite adequate short term high does therapy sometimes with parental agents. Recurrence within few weeks after

treatment is usually due to persistence of the same focus, whereas later recurrence particularly in female is more often the result of reinfection . So it is very important to take care from this point and managed by either very close follow-up and treatment of each episode or by prophylaxis. Antimicrobial agents have not been proven to be effective against urinary tract infection prevention. [8-10] .

Recommendations

A)Using the scientific sterile way of catheterization using combination of 1% lidocain gelly with 0.5% chlorhexidine .

B)Steps to prevent catheter related infection:

1) Restrict the use of indwelling catheter except when required for management of bladder out let obstruction or for close monitoring of fluid and electrolyte balance in severely ill patient.
2) Maintain a system of closed drainage, a good technique can usually keep the urine sterile for 5-7 days after that the risk of infection increase with time 5-10% for each day of catheter .
3) Keep the collecting tube and bag unobstructed and an independent position.
4) When urine specimens are required, aspirate the specimen from the sampling part in the collecting tubing by the use of a sterile needle and syringe rather than be breaking the closed drainage system.

Conflict of Interests.
There are non-conflicts of interest

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الخلاصة

الغرض من البحث: الغرض من هذا البحث هو دراسة حالات التهاب المجاري البولية نتيجة استعمال صوندة الادرار اثناء اجراء العمليات القيصرية وكذلك تشخيص مختلف انواع الجراثيم التي تسبب هذا الالتهاب ووضع توصيات حول نوع العلاج والطريقة الصحيحة لوضع صوندة الادرار لغرض تقليل حالات الالتهابات ومضاعفاتها .

العينة وطريقة البحث: دراسة مقطعية أجريت لمرضى تم اختيارهن عشوائيا واللواتي يرتادون مستشفى النسائية والاطفال في مدينة الحلة . 2015البيانات تم الحصول عليها عن طريق الاستبيانات البسيطة وهي تحليل الادرار العام مع فحص الزرع والتحسس لا يجاد المضاد الحيوي الملائم .

النتائج: ان نتائج البحث كشفت الانواع التالية من البكتريا المسببة للالتهابات وهي اشريشيا كولاي حوالي 9 مريضة أي بنسبة ..(13.84%))والكليبسيللا حوالي 32 مريضة بنسبة (49.23%) ونوع البروتيوس عدد المصابات بها هو3مريضات وبنسبة .(4.61%) وكذلك نوع السيودوموناص حوالي 2 مريضات ونسبتهن حوالي.(3.07%) ونوع ستافيللوكوكس اوريوس عدد المصابات 3 مريضات وبنسبة .(4.61%) ونوع البيتاهيموليتك بكتريا مريضة واحدة وبنسبة (1.53%)ومثلها بكتريا الستاف البس. كذلك ووجدنا ان8 مريضات استعملن المضاد الحيوي من مجموع النساء ووضعت لهن صوندة الادرار لم يصبن باي التهابات بينما 9 مريضات مع صوندة الادرار بدون مضاد حيوي لم يصبن باي التهابات في المجاري البولية اما بالنسبة للعمر فمن العمر 20–30 سنة بلغ عددهن 42 مريضة (64.62%) والبقية من عمر 31–40 سنة كان عددهن 23 مريضة (38% .35)

الاستنتاجات : لقد وجدنا ان هناك تأثير كبير لصوندة الادرار في أحداث ألتهاب ألمجاري البولية لدى النساء وهذا يستدعي اتباع طرق علمية ومعقمة في أدخال صوندة الادرار ويجب ان يقوم بالعملية كادر متدرب وذو خبرة في هذا المجال.

Table (1)
Type of infected bacteria in examined patients

Microorganisms	No. of patients	Frequency
Escherichia coli	9	13.84%
Klebsiella pneumonia	32	49.23%
Proteus spp.	3	4.61%
Pseudomonas aeruginosa	2	3.07%
Staphylococcus	3	4.61%
β Hemolytic streptococcus	1	1.53%
Staphylococcus albus	1	1.53%

Table (2)
Catheterization with and without antibiotic in relation to infection

	No. of Patients	Frequency
Catheterization with antibiotics (Cefixime and /or Garamycine) with no infection	8	12.32%
Catheterization without antibiotics with no infection	9	13.85%
Infected region after catheterization with antibiotics (Cefixime and /or Garamycine)	48	73.84%

Table (3)
Age, Antibiotics and infection relation ship

Group	Age (years)	Patient no. and percentages	No. of patient and percentages		
			Catheterization with antibiotics with no infection	Catheterization without antibiotics with no infection	Infected region after catheterization with antibiotics
A	20-30	42(64.62%)	1(1.53%)	8(12.3%)	33(50.76%)
B	31-40	23(35.38%)	7(10.76%)	1(1.53%)	15(23.07%)

Table -4- Chi-square

Age group	Catheterization with infection	Catheterization with no infection	Total	X^2	P-value
A (20-30 years)	33(68.8%)	9(52.9%)	42(64.6%)	1.372	0.241
B (31-40 years)	15(31.2%)	8(47.1%)	23(35.4%)		
Total	48(100%)	17(100%)	65(100%)		

According to this result it seems that catheter cause urinary tract infection regardless of age of the patient .

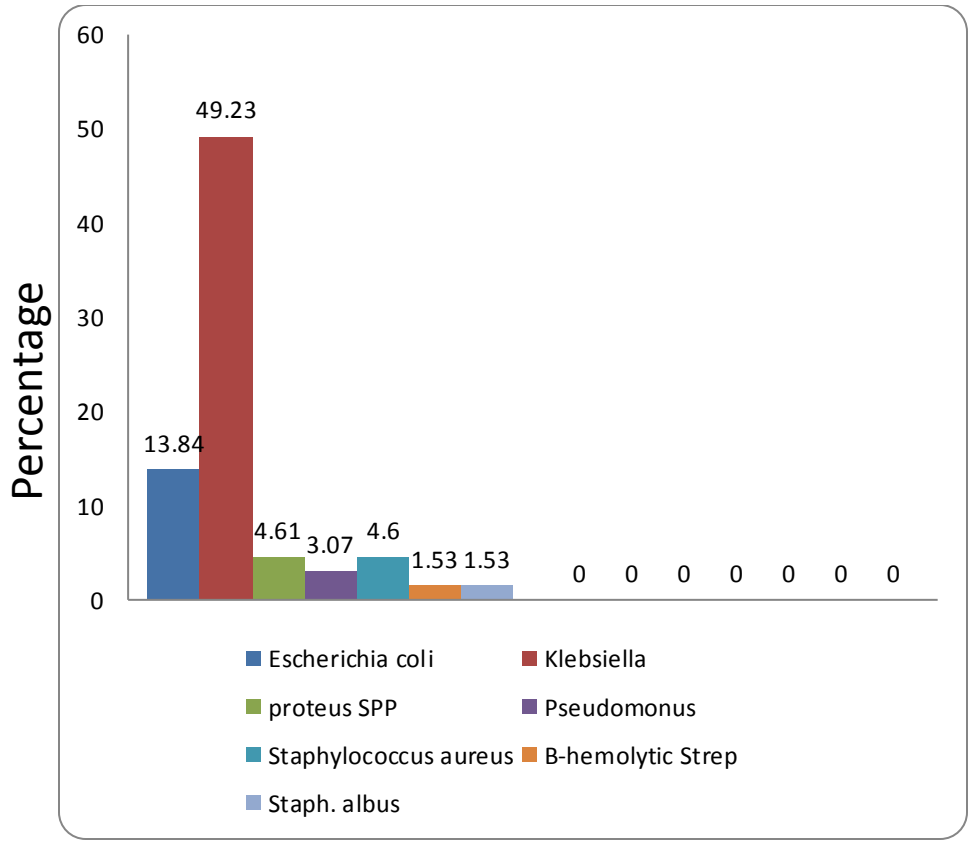

Figure (1) Types of infected bacteria in examined patients

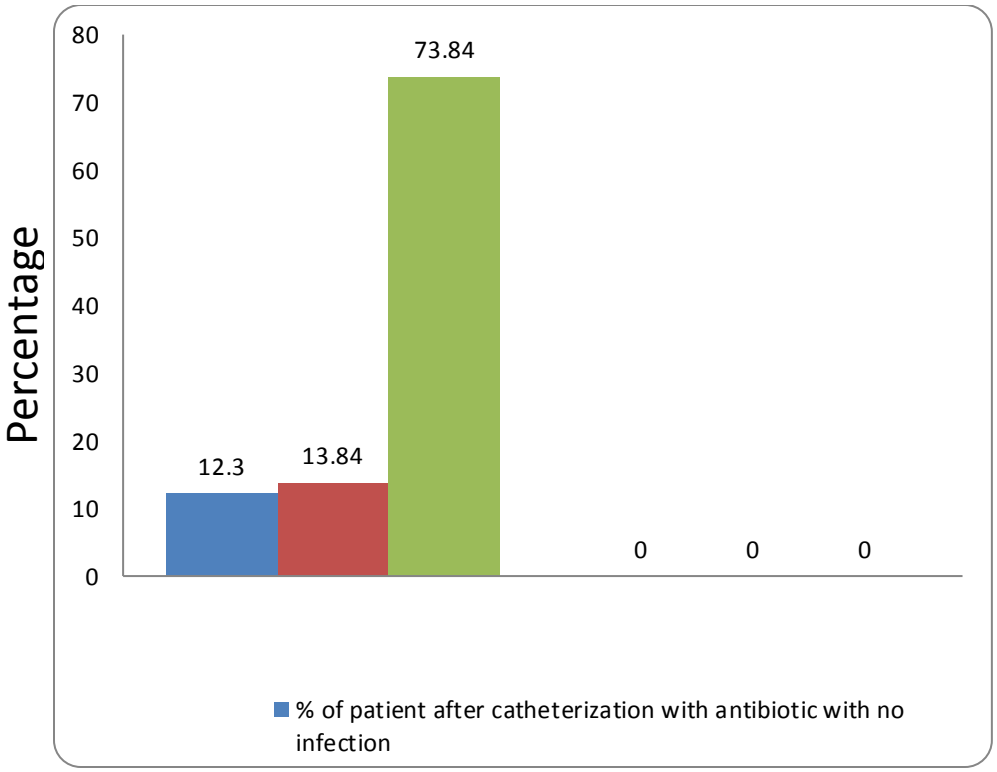

Figure (2) Catheterization with and without antibiotics in relation to infection

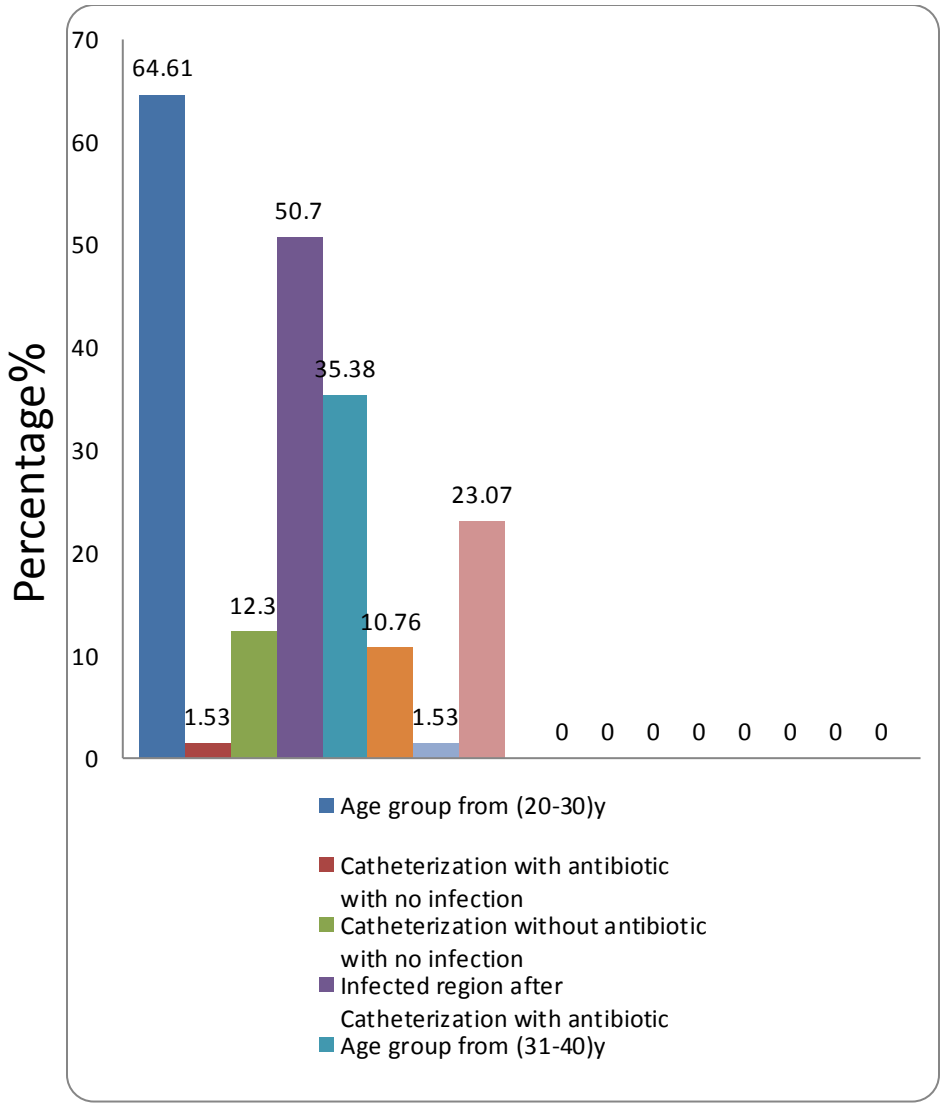

Figure (3) Age group of patients in relation to infection and antibiotics