# Isolation and Identification of Bacterial Pathogens Associated with Indwelling Devices and their Antimicrobial Susceptibility

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**Abstract**

The current research project has been designed to evaluate the bacterial isolates in indwelling devices and their susceptibility pattern at Al-Syed Hospital Rawalpindi, a tertiary health care Hospital. The collection of microbial samples was performed from various indwelling devices at the hospital from indoor patients (hospital admitted). The bacterial samples collected were analyzed at Laboratory of the aforementioned hospital. After processing the samples were inoculated on Blood Agar, and MacConkey agar medium. The bacterial strains were allowed to get cultured for proper identification. Different identification techniques were followed for the cultured bacterial strains. After identifying, the pathogens were assessed for antibiotic sensitivity pattern by modified method of Kirby Bauer Disc diffusion technique. Similarly, suspected cases of hospital acquired infections were studied. The rate of indwelling devices infections were recorded as 23.4 %. The urinary (Foley's Tips), respiratory (ETT Tips), central venous line (CVP Tips), DJ Tips and other (Suction Tube Tip, Drain Tube Tips, Perma Catheter Tip and NG Tube Tips) related infections were 27.4 %, 19.9%, 32.2%, 13.8% and 52.4% respectively. *Escherichia Coli* (16.2 %) and *Enterococcus faecium* 14.1 % were the most common isolate with maximum sensitivity to Colisten and Linezolid respectively. From the current investigational study it may be concluded that risk of hospital acquired infection was directly related to the placement of indwelling catheters and duration of the placement. It may also be inferred that the indwelling devices in the hospitals may be soft corner for gram positive, gram negative, aerobic, inaerobic, facultative aerobic and facultative in-aerobic bacterial strains.

**Key words:** Bacteria, Pathogen, antibiotic, Indwelling Devices

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## Introduction

The indwelling devices have an important role in the recovery of certain patients. One of the most important indwelling devices is the catheter, which provides a pathway for the urine from the urinary bladder [1]. In most of the cases, catheter is applied after the surgery of benign prostatic hyperplasia. The catheter assists the patients in the wound healing after the surgical operations. Sometimes catheter is inserted into the urethral line by non professional personnel, which may lead to critical complications. Patient with chronic illness, long term implanted/intravascular devices give a feasible venous access to drug delivery, laboratory tests, waste disposal and the total parenteral nutrition [2]. Indwelling intravascular and the urinary catheters are the two most common types of medical devices and similarly, the common causes of nosocomial infection [3]. Formation of biofilm on the superficial layer of devices especially the catheters is basically important to cause infectious diseases. Among the most effective precautionary measures against intravascular catheter infections, strict and serious attention to the practice for the infections control is considered to be the milestone [4]. Bacteria which are responsible for the urinary tract infections in the patients having catheters for the short period of time, are the same bacteria, that are found in the patients in hospital without catheters. *E. coli* leads the whole list of pathogens and rest of the bacteria responsible for causing urinary tract infections including *Proteus*, *Klebsiella* species, numerous miscellaneous Gram-negative rods and *Enterococci*. Patients who require a long period catheterization tend to develop bacteriuria, which may be caused by different group of bacteria including multiple antibiotic-resistant bacterial strains of *Enterobacter spp*, *Pseudomonas aeruginosa*, indole-positive *Proteus* spp, and *Acinetobacter* spp. Biofilm is not just a filmy slime and static layer rather it is a living layer of microorganisms which is composed of variety of bacterial species which secrete the matrix of polysaccharide and the deposited body fluid components [5]. Microbes, especially the bacterial strains, primarily exist in the free flowing state. Mostly in the natural environments, the bacterial strains associate and adhere with the surface, so as to avoid sweeping away with the shear forces [6]. The sensitivity and susceptibility of microorganisms especially bacterial strains have been thoroughly investigated by various groups of researchers throughout the world. A specific bacterial strain will show sensitivity to a specific antibiotic and there will be a specific range of the dose of antibiotic which will show the inhibition of a specific strain. Not all the bacteria are susceptible to all types of antibiotics rather a specific antibiotic will kill a specific class of bacteria though there are some antibiotics which can stop the growth of wide range of bacteria which are termed as broad spectrum antibiotics [7]. The current research was designed to study the bacterial pathogens isolated from Urinary Catheter, CVP, Endo-tracheal Tube, DJ Catheter and other life sustaining catheters used in indoor patients and to study their anti-microbial susceptibility patterns.

## Material And Method

### *Collection of samples*

Eight Hundered and twenty (820) samples were collected from indoor patients at Alsyed Hospital Rawalpindi. The samples included indwelling devices such as Endotracheal tubes, Urinary Catheter (foleys tip), Central Venous Pressure (CVP tip) and DJ catheters Line, Nasogastric tube, Suction Tube, Parma Catheter Tube and Drain Tube were analyesd for isolation and identification of bacteria. The indwelling devices were Endotracheal Tube (ETT) (n = 321), Urinary Catheters (n = 296), CVP Line (n = 59), DJ Catheters (n= 123) and others [Nasogastric tube Tip, Suction Tube Tip, Parma Cath Tube Tip, Drain Tube Tip] (n=21).

### *Pure Culture*

After collection of the samples, a small quantity of Brain Heart Infusion (OXOID) broth was added to make the tip wet in sterile condition and an inoculam was made. With a sterile 3cc syringe the inoculam was placed on Blood agar (OXOID) and MacConkey agar (OXOID) plates. Streaking/inoculation was done with sterile wire loop. After inoculation, inoculated plates were incubated at 37°C for 24 hours. Next day after 24 hours of incubaton the culture plates were examined. Positive cultures were further processed for the bacterial identification, and the negative plates were reincubated for next 24 hours at 37°C. After 48 hours of incubation the bacterial culture plates were reexamin, the negative plates were reported as no growth and the positive plates were further processed for the bacterial identification.

### *Morphological and biochemical identification of Bacteria*

The isolated bacteria were examined by gram's staining test to differentiate between gram-positiveand gram-negative bacteria and their morphology. Further identification of bacteria was made by performing a series of biochemical tests using the taxonomic scheme of Bergey's Manual of Determinative Bacteriology such as Coagulase, Catalase, Simmons citrate test, oxidase Triple Sugar Iron and Indole test were performed.

### *Antimicrobial Susceptibility Testing*

The susceptibility testing of bacterial strain against different antibiotics was carried out by Kirby-Bauer disc diffusion method [8]. Bacterial colonies were emulsified in the distal water ampule to make .5% McFarland standard. Then sample was streaked onto Mueller-Hinton agar (Oxiod) plates with the help of sterilized stick swab. The antibiotic discs were dispensed on the surface of the media at the various positions and the petri plates were allowed to incubate aerobically at 37°C for the period of 24 h. Grades of sensitivity was measured and reported as sensitive, intermediate and resistant by comparison of zone of inhibition as indicated.

### *Data analysis*

Data analyzed by statistical tool 'Statistix ver.8.1'.Analysis of variance (ANOVA) at $\alpha = 0.05$ (level of significance),Further more if significant difference noticed among the meansthen least significance difference (L.S.D) performed.

**Results**

***Microbiological growth from samples analyzed from indwelling devices***

A total 820 suspected samples were analysed.Of these 314 samples were collected from males and 506 from female. Microbial growth was shown in 108 samples from males (34.39%) and 84 samples from females (16.6%). Of 820 samples 192 (23.4%) showed microbial growth as shown in table (3.1).

**Table 0.1:** Gender wise samples collected and Microbial growth obtained.

| Gender | Total No of Sample Processed | Growth Obtained | Percentage |
|---|---|---|---|
| Males | 314 | 108 | 34.3 |
| Females | 506 | 84 | 16.6 |
| Total | 820 | 192 | 23.4 |

Among the indwelling devices related infection other tubes total 21 (Drain Tube tip 8, Nasogastric Tube tip 2, Parma catheter tip 6 and suction tube tip 5) infection was the most common (52.4%) followed by CVP catheter (32.2%) and Urinary Catheter (Foley's Catheters) Tip (27.4 %) as shown in Table (3.2).

**Table 0.2:** Microbiological growth obtained from samples analyzed from indwelling devices

| Sample | Total no of samples | Samples showing growth | Percentage |
|---|---|---|---|
| Urinary Catheter/ Folys Catheter | 296 | 81 | 27.4 |
| Endotracheal tube | 321 | 64 | 19.9 |
| CVP line | 59 | 19 | 32.2 |
| DJ Tip | 123 | 123 | 13.8 |
| Other | 21 | 11 | 52.4 |
| Total | 820 | 192 | 23.4 |

***Microorganisms isolated from different indwelling devices***

Microorganisms isolated from Indwelling devices were Gram positive, Gram negative and fungi. *E. coli* was the most common among the Gram negative Bacteria (31/192, 16.14%) of which 28 isolates were ESBL producing. *Pseudomonas aeruginosa* (26/192, 13.54%) was the second most Gram negative bacteria, followed by *Klebsiella pneumoniae* (20/192, 10.4%) of which 15 isolates were ESBL producing. This was followed *Enterobacter Colacae* (7/192, 3.64%) of which 4 isolates were ESBL producing. *Serratia marcesences* stood next (5/192, 2.6%) of which 3 isolates were ESBL producing followed by *Klebsiella oxytoca* (04/192, 2.08%) which is indole positive and differentiated by this characteristic from *Klebsiella pneumoniae* as *Klebsiella pneumonia* is indole negative. These were followed by *Acinetobacter baumanii* and *Stenotroptrophomonas maltopjilia* (3/192, 1.56%) each and *Proteus mirabilis and Burkhulderia cepacia* were same each

(2/192, 1.04%) each. *Acinetobacter jhonsonii*, *Citrobacterfraundii*, *Morganella morganii* and *Enterobacter aerogenes* each were (1/192, 0.52%). Among the Gram positive bacteria, *Enterococcus faecium* (27/192, 14.0%) was the most common microorganism isolated. Of them 8 isolates were VRE (Vancomycin resistant Enterococcus). The second most common microorganism was *Enterococcus faecalis* (13/192, 6.8%) of which 5 isolates were VRE (Vancomycin resistant *Enterococcus*). *Enterococcus faecalis* was differentiated from *Enterococcus faecium* by API 10s Arabinose test as it ferments Arabinose and this changed colour from blue to yellow. *Enterococcus faecium* and *Enterococcus faecalis* can also be differentiated by Quinupristin antibiotic disk as *Enterococcus faecium* was resistant and *Enterococcus faecalis* was sensitive. The third common bacteria among Gram positive was coagulase negative *Staphylococcus* (*Staphylococcus epidermidis*) (11/192, 5.72%). Of these 10 isolates were MRSE (Methacillin resistant *Staphylococcus epidermidis*). It was followed by *Staphylococcus aureus* (07/192, 3.64%) of which 4 isolates were MRSA (Methiciline Resistant *Staphylococcus aureus*). MRSA detection was done by Cefoxitin antibiotic disk. If the growth of Staphylococcus aureus was resistant to Cefoxitin disk, it was consider as MRSA. Coagulase negative *Staphylococcus* ( *Staphylococcus epidermidis*) and *Staphyloccus arues* were differentiated by coagulase test, *Staphylococcus aureus* is coagulase positive and *Staphylococcus epidermidis* is coagulase negative. In fungi, *Candida albicans* was the most common microorganism (21/192, 10.93%). *Aspergillus species* were the second most fungi isolated from indwelling devices (03/192, 1.56%) followed by *Candida glabrata* (02/192, 1.04%) and *Candida tropicalis* (01/1920.52%). *Candida* species were differentiated by Chrom agar media. *Candida albicans* produced green colour pigment when cultured on Chrome agar. *Candida glabrata* produced pink colour pigment and *Candida tropicalis* produced blue colour pigmentation when cultured on Chrom agar (Oxiod) media after 18 to 24 hours of incubation at 37˚C.

***Microorganisims isolated from Urinary Catheter/Foly's Catheter Tips***

The total number of microorganisms isolated from urinary catheter/Foly's catheter tips were 81 from 296 samples tips (27.36%). The most common isolate from these tips was *Enterococcus faecium* (17/81, 20.98%). The second most microorganisim was *E. coli* (15/81, 18.51%). The third most bacteria was *Klebsiella pneumoniae* (11/81, 13.58%) followed by *Enterococcus faecalis* (9/81, 11.11%) *Pseudomonas aeruginosa* were isolated (6/81, 7.4%), *Candida albicans* (6/81, 7.4%), *Enterobacter Cloacae* (4/81, 4.93%), Coagulase negative *Staphylococcus* (*Staphylococcus epidermidis*) (3/81, 3.7%) which were all methicillin resistant *Staphylococcus epidermidis* (MRSE). *Candida glabrata* and *Proteus mirabilis* were two each (2/81, 2.46%). *Seratia marsecences*, *Acinetobacter jhonsonii* , *Acinetobacter baumanii*, *Citrobacter fruindii*, *Morganella morganii* and *Burkholderia cepacia* were one each (1/81,1.23%).

***Microorganisim isolated from Endotracheal Tube (ETT) Tips***

The total number of microorganisms isolated from ETT (Endotracheal tube tips) were 64 out of 321 (19.93%). The most common isolate was *Pseudomonas aeruginosa* (14/64, 21.87%). The second most was *Candida albican* (13/64, 20.31%), *Escherichia coli* was the third most isolated (11/64, 17.18%) microorganism, followed by *Klebsiella pneumonia* (9/64, 14.06%), and then *Staphylococcus aureus* (4/64, 6.25%) all of which were Methicillin resistant *Staphylococcus aureus* (MRSA). *Klebsiella oxytoca* and *Serratia marscecences* each were (3/64, 4.68%). *Stenotrophomonas maltophilia* was (2/64, 3.12%) in number. One each of *Enterobacter aerogenes, Candida Tropicalis, Burkholderia cepacia, Acinetobacter baumanii and Enterobacter cloacae* were isolated (1/64, 1.56%).

***Microorganisim isolated from CVP line***

The total number of microorganisms isolated from CVP line were 19 out of 59 samples (32.2%). The most common isolate was *Staphylococcus epidermidis* (7/19, 36.84%) of which 6 isolates were Methacillin resistant *Staphylococcu epidermidis* (MRSE) followed by *Staphylococcus aureus* (3/19, 15.78%). *Pseudomonas aeruginosa* and *Candida albicans* each were two in number (2/19, 10.52%). One each of *Stenotrophomonas maltophilia*, *Klebsiella oxytoca*, *Acinetobacter baumanii*, *Serratia marsecences* and *Enterobacter cloacae* were also isolated (1/19, 5.26%).

***Microorganism isolated from DJ Catheter Tips***

The total number of microorganisms isolated from DJ catheter tip were 17 out of 123 samples (13.82%). The most common isolate was *Eterococcus faecium* (8/17, 47.05%) of which 3 isolates were vancomycin resistant *Enterococcus* (VRE). The second most was *Escherichia coli* (4/17, 23.52%), followed by *Pseudomonas aeruginosa* (2/17, 11.76%). One each of *Enterococcus faecalis*, Coagulase negative *Staphylococcus epidermidis* and *Enterobacter cloacae* were also isolated (1/17, 5.88%).

**Microorganism isolated from other tube Tips**

Total number of microorganisms isolated from other tubes tips was 11 out of 21 samples (52.38%). The most common isolates were *Enterococcus faecalis* and *Aspergillus* species each (3/11, 27.27%) followed by *Pseudomonas aeruginosa* and *Enterococcus faecium* ( 2/11, 18.18%) each. The *Escherichia coli* was 1/11, (9.09%). The microorganisms isolated from different indwelling devices tips are shown in Table (3.3).

**Table 0.3:** List of Microorganisms isolated from different Indwelling Devices

| Microorganisms | Folys Tip/ Urinary catheter | ETT Tip | CVP Tip | DJ Tip | Other | Total |
|---|---|---|---|---|---|---|
| *E. coli* | 15 | 11 | - | 04 | 01 | 31 |
| *Pseudomonas aeruginosa* | 06 | 14 | 02 | 02 | 02 | 26 |
| *Klebsiella pneumonia* | 11 | 09 | - | - | - | 20 |
| *Enterobacter cloacae* | 04 | 01 | 01 | 01 | - | 07 |
| *Serratia marcesences* | 01 | 03 | 01 | - | - | 05 |
| *Klebsiella oxytoca* | - | 03 | 01 | - | - | 04 |
| *Stenotrphomonas maltopilia* | - | 02 | 01 | - | - | 03 |
| *Acinetobacterbaumanii* | 01 | 01 | 01 | - | - | 03 |
| *Proteus mirabilis* | 02 | - | - | - | - | 02 |
| *Burkholderia cepacia* | 01 | 01 | - | - | - | 02 |
| *Enterobacter aerogenes* | - | 01 | - | - | - | 01 |
| *Acineto jhonsoni* | 01 | - | - | - | - | 01 |
| *Morganella morganii* | 01 | - | - | - | - | 01 |
| *Enterococcus Faecium* | 17 | - | - | 08 | 02 | 27 |
| *Enterococcus Faecali* | 09 | - | - | 01 | 03 | 13 |
| *Staph. Aureus* | - | 04 | 03 | - | - | 07 |
| *Coagulase negative Staph* | 03 | - | 07 | 01 | - | 11 |
| *Candida albican* | 06 | 13 | 02 | - | - | 21 |
| *Aspergillus species* | - | - | - | - | 04 | 04 |
| *Candida glabrata* | 02 | - | - | - | - | 02 |
| *Candida Tropicalis* | 01 | - | - | - | - | 01 |

***Sensitivity pattern of isolated microorganisms against different antibiotics***

The sensitivity of different bacterial strains against the different antibiotics has been summarized in the Tables 3.4 and 3.5. The organism *E. coli* which was the most susceptible to Colistin (100%) followed by Imipenem and Amikacin (77.4%) and Tigyccline (74.1%) as shown in (Table 3.4). *Klebsiella pneumonia* was also (100%) susceptible to Colistin followed by Amikacin (75%), Imipenem (70%). *Serratia marceences* was susceptible (100%) to Amikacin, Imipenem, Sulzone and tazocin and (60 %) to Sulfamethoxazole/Trimethopprim. (Table 3.4). *Proteus mirabilis* was mostly susceptible to all antibiotic except Augmentin and Ampicillin as shown in (Table 3.4). *Enterbacter cloacae* was (100%) sensitive to Colistin followed by Amikacin, Imimpenem each (85.7%) and Fosfomycin (80%) as shown in (Table 3.4). *Pseudomonas aeruginosa* was found (84.6%) susceptible to Colistin, (80%) to Tazocin and followed by Amikacin (73%), Ciprofloxacin, Levofloxacin (69% each) and then Sulzone, Imipenem were (65.3% each) as shown in (Table 3.4) *Staphylococcus aureus* was (100%) susceptible to Tigicycline, Chlorampenicol, Fusidic acid, Vancomycin and Linezolid each followed by

Clindamycin (71%) and Amikacin, Doxycycline (57.14% each) as shown in (Table 3.5). *Staphylococcus epidermidis* was found (100%) susceptible to Tigycycline, Chloramphinical,Vancomycin and Lanzolid each followed by Clindamycin (57%) and Amikacin (54%). *Enterococcus faecium* and *Enterococcus faecalis* were found (100%) susceptible to Tigicycline and Linezolid. *Enterococcus faecium* was 70 % and *Enterococcus faecalis* was 61.5 % sensitive to Vancomycin. *Acinetobacter jhonsonii* was resistant to Ampicillin, Augmentin, Ceftriaxone, Nitrofeurantine, Fosfomycin, and sensitive to Tigycycline, Amikacin, Ciprofloxacin, Levofloxacin, Cefepime, Merophenem, Imephenem, Sulzone, Tazocin, Sulfamethoxazole/trimethoprim and Colistin antibiotics. *Citrobacter feurandii* was found sensitive only to Tigycycline and Colistin while *Morganella morganii* was found sensitive to Amikacin, Fosfomycin and Colistin antibiotics. *Enterobacter aerogenes* was found sensitive to all antibiotics used except Ampicillin, Augmentin and Doxycycline.

**Table 0.4:** Sensitivity pattern of isolated Gram negative bacteria against various antibiotics

| Microorganisms | I-N | Different Antibiotics | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | AMP | AMC | D | TGC | AK | CIP | LEV | CRO | FEP | MEM | IPM | SCF | TZP | SXT | CT | F | FOSF |
| *Esherichia coli* | 31 | 0% | 3.2% | 25 % | 74.1 % | 77. 4% | 9.6 % | 9.6 % | 9.6% | 9.6 % | 77.4 % | 77.4 % | 41.9 % | 45.1 % | 6.4 % | 100 % | 47. 3% | 68.4 % |
| *Klebsiella Pneumoniae* | 20 | 0% | 0% | 0% | 30% | 75 % | 35 % | 35% | 25% | 25% | 70% | 70% | 60% | 55% | 5.2 % | 100 % | 9.1 % | 18.1 % |
| *Klebsiella Oxytoca* | 4 | 0% | 0% | 50 % | 50% | 100 % | 75 % | 75% | 75% | 75% | 100% | 100 % | 100 % | 100 % | 75% | 100 % | Nd | Nd |
| *Serratia marcescencs* | 5 | 0% | 0% | 25 % | 60% | 100 % | 60 % | 60% | 40% | 40% | 100% | 100 % | 100 % | 100 % | 60% | 20 % | Nd | Nd |
| *Proteus mirabilis* | 2 | 0% | 50% | Nd | 0% | 50 % | 50 % | 100 % | 100 % | 50% | 50% | 100 % | 100 % | 100 % | 100 % | 0% | 0% | 100% |
| *Enterobacter cloacae* | 7 | 0% | 0% | 50 % | 0% | 85. 7% | 42. 8% | 42.8 % | 57.1 % | 57.1 % | 85.7 % | 85.7 % | 71.4 % | 71.4 % | 28.5 % | 100 % | 40 % | 80% |
| *Stenotrophomonas maltophilia* | 3 | 0% | 0% | 66. 6% | 66.6 % | 0% | 100 % | 100 % | 0% | 0% | 0% | 0% | 100 % | 100 % | 100 % | 33. 3% | Nd | Nd |
| *Burkholderia cepacia* | 2 | Nd | Nd | Nd | 100 | 0% | 50 % | 50% | 0% | 0% | 0% | 0% | 100 % | 100 % | 50% | 0% | Nd | Nd |
| *Acinetobacter baumanii* | 3 | 0% | 0% | 50 % | 0% | 100 % | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 100 % | 0% | 0% |
| *Pse``domonas aeruginosa* | 26 | Nd | Nd | Nd | Nd | 73. 0% | 69. 2% | 69.2 % | Nd | 57.6 % | 53.8 % | 65.3 % | 65.3 % | 80.7 % | Nd | 84. 6% | Nd | Nd |

**Discussions**

Hospital acquired infections are becoming an increasing problem for hospitalized patients. Hospital acquired infections mainly affect the respiratory tract, surgical wound, skin and blood. The common interventions done in different wards in hospital are endotracheal intubation, urinary catheterization and insertion of central venous line. These are responsible for hospital acquired infections [9]. Pseudomonas spp was the most common microorganism collected from endotracheal tube. Most of the previous studies also had Pseudomonas species as the most common microorganism [10, 11]. E.coli was the most common bacteria causing urinary catheter related infection in our study, which has also been reported in the previous reports [12, 13]. Our study goes parallel with the reported similar studies [14]. Our study showed Staphylococcus aureus to be the most common micro organism causing infections in venous cutdown catheter. Earlier researcher had also isolated Staphylococcus aureus as the commonest organism colonizing the CVP [15, 16]. Other studies have also isolated Acinetobacter, E.coli and Klebsiella as a commonest but also isolateed Staphylococcus aureus in some CVP tips [17]. This shows similarity with the previous report of Gregory et al, which explains the presence of these microbial strain in the CVP tips [18]. Pseudomonas species isolated from the endotracheal tube tips were highly susceptible to Imipenem and Amikacin in our study. E.coli was the commonest organism causing UTI in our study and had maximum susceptibility to Imipenem and Amikacin. Staphylococcus aureus was the commonest organism isolated from CVP tips and was maximally susceptible to Vancomycin and Linzolid. We had also isolated MRSA which were 57.14% of total 7 cases of Staphylococcus aureus. In our study mostly Gram Negative bacteria showed maximum susceptibility to Imipenem and Amikacin. This shows similarity with the previous studies [19]. Ecoli was isolated as the commonest organism in UTI with 90.32% ESBL and with maximum susceptibility to Colistin 100% and Amikacin, Imipenem 77.14%. This result agreed with the findings of Al Zahrani et al [20]. They also found Imipenem as a highly sensitive antibiotic against Ecoli in their study. Naeem et al. (2010) also had found Imipenem (95%) sensitive to E.coli in his study [21]. As regards the antibiotic used the present study showed that the most effective antibiotic against Gram positive isolates was found to be Vancomycin and Linezolid. Similar results were reported by Courvalin et al., Rubin et al. and Laclercq et al. [22-24]. The identification of bacterial strain on the basis of various biochemical tests have been widely studied previously [25, 26]. The coagulase test and the gram staining procedure has been considered as the preliminary screening nowadays for the categorization of bacterial strain [27]. Similarly, the indwelling devices have been the core habitat of variety of bacterial species since the inappropriate practice of handlings during surgical procedures [28]. Multiples reports reveal that the indwelling devices have been the cause of serious health complications due to secondary infections [29, 30]. In the sensitivity testing, some of the bacterial strains showed sensitivity to all the antibiotics while some were showing no sensitivity to the broad spectrum antibiotics. There could be numerous factors involved in the no sensitivity of certain bacterial strains [31, 32]. Resistance could be the serious factor among variety of factors

[33-36]. The resistance of a specific microorganism to antibiotics results due to multiple factors. Numerous reports have been published which describes the factors responsible for the development of resistance to different antibiotics [37-40]. Different types of infections associated with fungi or bacteria have been sorted out by various types of laboratory screenings. The bacterial infections which are mostly systemic can easily be figured out from the the blood or urine routine examinations [41]. While the fungal infections cannot be easily screened with the help of blood or urine samples. Though the fungal infections can be screened from the physical appearance of the infection or by taking a sample from the infection site and culturing the inocolum and then identifying the sample with the magnifying glass or by microscopic examination. The growth pattern of the culture can also specify the type of fungi. Similarly, the bacterial infection can also be screened for the type of bacteria by going through various culture tests [42]. The identification of specific bacteria or fungi may be sufficient for the choice of treatment. Mostly the antibiotics are employed in the therapy of different microbial infections and all the microbes have been individually tested against different types of antibiotics for their susceptibility [43]. So keeping in mind the susceptibility pattern of specific microbe, the choice of antibiotic can easily be find out for treatment. The treatment should also be focussed on the patient history and the type of infection. If the patient has gone through certain types of liver or kidney surgeries then it become difficult for the physician to sort out specific regimen of drugs to treat the underlying disease. So this is not that simple to choose an antibiotic that is active against specific type of bacteria. For the treatment of specific microbial infection, first of all the infection should be sorted out, whether that is fungal, bacterial or protozoal. Secondly, the drugs of choice should be selected for that identified infection. Thirdly based on the age, stage, nature and history of patient, the drug should be selected from the drugs of choice for the said patient [44]. If the patient require some surgical interventions then these interventions should be carried out through professional, expert and reliable staff who follow standard operationg procedure during the whole intervention.

## Conclusion

From the literature survey and the results of current investigations it may be deduced that the ratio of hospital acquired infections is very high due to different interventional procedures i.e., Gram negative bacteria which were the common causes of catheter related infections. From the results it may also be inferred that Pseudomonas was the most common isolate with maximum sensitivity to Imipenem. Similarly, the antimicrobials like imipenem, amikacin, Sulzone, vancomycin, Tigicycline and Linzolid were concluded to be the most effective provided that these should be used in appropriate dosage and regimen. The study also revealed that the indwelling devices may be the inhabitant of variety of bacterial strains so there is an urgent need for clinical studies to evaluate strategies for the prevention and management of such infection in critically ill patients.

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