

# Bacterial Isolates of Infected Wounds & Their Sensitivity to Antibiotics

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## ABSTRACT

**Background:** Infection of the wounds has got definite role in delaying wound healing and development of chronicity. Various studies have been carried to identify & study the pattern of pathogens present in infected wounds and efficacy of antibiotics against these organisms. **Objectives:** To identify the most common pathogens involved in infections of the wounds after surgical procedures, patterns of their sensitivity and resistance to the different antibiotics. **Setting & Duration:** The study was carried out in Surgical Unit (3) of Lahore General Hospital, Postgraduate Medical Institute (PGMI) Lahore for the period of Six months from October, 2016 to March, 2017. **Methodology:** Wound swabs were collected using sterile cotton swabs after obtaining consent from patients. The isolated samples were identified by using standard parameters. Kirby baur disk diffusion method used to determine sensitivity. Tube dilution method was used for minimum inhibitory and bactericidal concentration. **Results:** Total 150 bacterial isolates were collected from infected wounds whereas 145(96.67%) were culture positive & 5(3.33%) were bacteriologically sterile. The most common bacteria were Staphylococcus aureus 47(32.4%) followed by Escherichia coli 29(20%), Proteus species 23(16%), Coagulase Negative Staphylococci 21(14.5%), Klebsiella pneumoniae 14(10%) and Pseudomonas aeruginosa 11(8%). All isolates showed high frequency of resistance to Ampicillin, penicillin, cephalothin and tetracycline. **Conclusions:** Staphylococcus Aureus has been found as the most common pathogen involved in wound infection. The antibiotics belonging to the group of Cephalothin, Ampicillin, Penicillin and Tetracycline are the least effective against pathogens isolated from infected wounds whereas Piperacillin alongwith Tazobactam; Amikacin & Norfloxacin are the most effective antibiotics against those pathogens.

**Keywords:** Bacteria, pathogens, drug resistance, infected wound, sensitivity.

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## INTRODUCTION

The skin plays vital role against entry of pathogenic organisms into the body and disruption of the skin layers may provide entry for microorganisms. It exposes the underlying subcutaneous tissue that provides a warm, moist and nutritious environment for microbial colonization and proliferation. The sequence of wound infection depends on various factors; which are most commonly observed may include accidental injuries as well as postoperative wounds. The infection of wounds impairs the process of healing and has adverse effects on the rate of wound healing and quality of patient life. Infected wound causes pain and hypersensitivity causing discomfort for patient.<sup>1</sup> Wound infections are one of the most common hospital acquired infections which account for morbidity and 70-80% mortality.<sup>2</sup> Microorganisms commonly found in wound infection are Staphylococcus aureus<sup>3</sup> (S.aureus) which accounts for 20 to 40 % of various study, Pseudomonas aeruginosa (P.aeruginosa)

accounts for 15% of the hospital acquired infections and isolated mainly from surgery and burn patients. In immunocompromised and abdominal surgery patients, pathogens like enterococci and enterobacteria have been implemented.<sup>3</sup>

Use of antibiotics has played important role by reducing the number of fatalities resulting from wound sepsis. While on the other hand; injudicious use of antibiotics as well as self-medication has resulted to drug resistance and negative impacts on the practice of family physicians. Due to emerging problem of bacterial resistance to the multiple drugs, tendency of wound sepsis has increased may folds.<sup>4</sup> This situation is on rise especially in underdeveloped countries having poor control on the sale of drugs / antibiotics.<sup>5</sup> This study will be helpful to find out the incidence of wound sepsis in Lahore General Hospital, Lahore and will also determine the susceptibility of pathogens to the commonly prescribed antibiotics.

## METHODOLOGY

A prospective study conducted in the Department of Surgery and the Patients were enrolled after informed consent. For the purpose of collecting the wound swabs, the aseptic techniques were adopted by cleaning the surface exudates / contaminants with sterile gauze & normal saline. The wounds already dressed by the bandages were also cleaned with sterile normal saline solution. Wound swab / samples obtained by using sterile cotton swab & applying adequate rotational pressure. Two swabs collected from each wound to minimize the possibility of defilement of the samples. The collected samples were submitted to the laboratory for further proceedings & results obtained thereof.

## RESULTS

Total 150 specimens were collected from patients with clinical evidence of wound infection (patients with complaints of discharge, pain, swelling, foul smelling and chronic wound) from October, 2016 to March, 2017. The study included 107(71.3%) males and 43(28.7%) females. The ages of the patients ranged from 20 to 80 year. (Table 1)

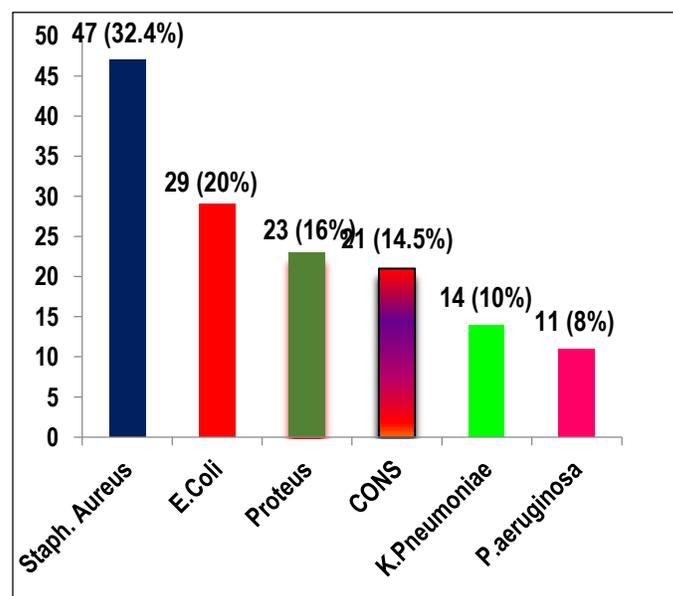
Forty five (30%) samples were obtained from the leg, while 22(14.7%) wounds affected the abdomen. Sixty five (43.3%) cases were caused due to trauma, followed by 34(22.7%) postoperative wounds. (Table 2). Of the total 150 swabs 145(96.66%) were culture positive for bacterial pathogens, while 5 (3.34%) samples were found bacteriologically sterile. Of the 145-culture positive bacterial isolates, 77(53.10%) were gram negative & 68(46.90%) gram positive. Staphylococcus Aureus was the predominant organism isolated in 47(32.4%) cases, followed by Escherichia coli (E.coli) 29(20%), Proteus species 23(16%), coagulase negative Staphylococci 21(14.5%), Klebsiella pneumoniae 14(10%) whereas 11(8%) cases belonged to Pseudomonas aeruginosa (Figure 1)

**Table 1: Wound infection & socio-demographic characteristics of the patients at PGMI, Lahore**

Demographic Characters	Infected No. (%)	Not infected No. (%)	Total (%)
<b>Male</b>	96 (89.72)	11 (10.28)	107 (71.33)
<b>Female</b>	35 (81.40)	8 (18.60)	43 (28.67)
<b>Total</b>	131 (87.33)	19 (12.67)	150 (100)
<b>Age in years</b>			
<b>20-30</b>	54 (87.1)	8 (13)	58 (41.3)
<b>31-44</b>	35 (86.2)	4 (13.8)	29 (19.3)
<b>45-59</b>	27 (89.5)	3 (10.5)	32 (12.7)
<b>More than 60</b>	15 (87.5)	2 (12.5)	31 (10.7)
<b>Total</b>	131 (87.3)	19 (12.7)	150 (100)

**Table 1: Wound type and location of the patients with infected sites**

Wound location	Number (%)
Leg	45 (30.0)
Abdomen	22 (14.7)
Hand	13 (8.7)
Buttocks	13 (8.7)
Foot	13 (8.7)
Others	3(2)
<b>Total</b>	150 (100%)
Type of wound	
Trauma	65(43.3)
Postoperative wound	34(22.7)
Abscess	31(20.7)
Ulcers	10(6.7)
Burn wound	5(3.3)
Diabetic foot ulcers	5(3.3)
<b>Total</b>	150 (100%)



**Figure 1: Percentage of Bacterial Isolates out of culture positive samples (n=145)**

## DISCUSSION

The difference between male and female wound infection is minimum however it was a little higher in males (89.7%) than in females (81.4%). This might be due to males being highly involved in outdoors physical work like construction, manufacturing, industrial and agricultural work having increased risk of trauma. Different bacteria can be easily introduced in the wound by incision into the skin including S. Aureus and E. coli, 32.4% and 20% respectively as per our study. These findings are also in agreement with the retrospective findings by Amoran et al.<sup>6</sup> Multiple bacteria have been reported in burn injuries but the most commonly observed are

S. Aureus as well as Ps. Aeruginosa. These findings are consistent with those of Mashita et al.<sup>7</sup> According to this study, the most commonly found bacteria in an infected wound was Staph Aureus followed by E.coli, Proteus, Coagulase Negative Staphylococcus, K. pneumoniae & Pseudomonas aeruginosa. These findings are in line with those reported by Golia S et al<sup>8</sup> as well as by Tariq A et al<sup>9</sup> whereas the studies conducted by Bashir et al,<sup>10</sup> Bibi et al<sup>11</sup> and Kaiser et al<sup>12</sup> reported the high prevalence of E. coli as the causative agent of surgical wounds infections along with Pseudomonas aeruginosa, Staphylococcus aureus and Klebsiella species. The reasons for their presence in surgical wounds are the presence of bacterial contaminants in the hospital environment and constitute a severe problem of infected wounds as clean and sterile operations get infected as well.

This study indulges into the presence of Gram negative Bacteria in hospitals. These endemic organisms easily infect the wounds as they are easily transferable. In most of the cases these are the endogenous flora of a patient however wound opening as in gastrointestinal tract during an operation increases the likelihood of gram-negative bacteria to enter and infect the wound. Surgical Site Infections increase in such an infected environment as gram-negative bacilli are resistant to antiseptics thus becoming highly difficult to be eliminated from hospitals. According to the report of CDC, the most common organism involved in surgical site infection is Staphylococcus aureus, followed by Escherichia coli, Coagulase Negative Staphylococci (CONS), Ps. aeruginosa, Enterococci, Enterobacteria, Klebsiella pneumoniae, Proteus mirabilis, and Streptococcus.<sup>13</sup>

Surveillance is considered as an essential step to minimize the rate of sepsis because it highlights the intensity of problem and facilitate for taking appropriate actions.<sup>14</sup> For the purpose of decreasing the rate of surgical site infections, creation of a safer environment is mandatory by controlling the major sources of infection, which include: patient's risk factors, other personnel in the area, equipment and the environment.<sup>15</sup> The advent of antibiotic resistant bacteria is basically due to ineffective anti-microbial treatment which not only fails to eliminate these bacteria but also becoming breeding ground for endemic organism.<sup>16</sup> The major reasons behind the ineffectiveness of antimicrobial treatments may include: Self-medication with antibiotics, Overcrowding in Hospitals, Extended stay at infected places & inefficient hospital control practices.

One of the most important broad-spectrum antibiotics Amoxicillin has been rendered less effective against gram-negative bacteria in the studied isolates. This ineffectiveness of Amoxicillin is directly related to the abuse of this drug in the society.<sup>17</sup> The drug is easily and widely available over the counter and a large number of populations can be rendered immune to the effects of this drug. However, it has been noted that the level of resistance is extremely low in the newly introduced Ceftriaxone. Isolates of Pseudomonas aeruginosa also showed the low level of resistance against Ceftriaxone. This third-generation broad spectrum Cephalosporin as well as Ciprofloxacin and Gentamicin are still effective against these wound infections. It can be safely said that bacteria are becoming immune to the wide range of broad spectrum antibiotics and only few antibiotics are effective against them. Therefore hygienic, clean and sterile environment is highly essential in surgical sites to avoid wound infections.

## CONCLUSION

Staphylococcus Aureus is found as the most common pathogen involved in wound infection whereas E. coli, K. Pneumoniae & Proteus species also played their role in wound sepsis. These pathogens are highly resistant to the antibiotics like Penicillin, Cephalothin, Ampicillin and group of Tetracycline whereas, Piperacillin+tazobactam, Amikacin and Norfloxacin were the most effective antibiotic against them. The pathogens belonging to Gram negative organisms are very common in causing postoperative wound infection because of their resistance against multiple drugs.

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<b>Dr. Shahbaz Ali</b> House Officer General Surgery Lahore General Hospital, Postgraduate Medical Institute, Lahore.	Tabulation of Results Discussion & Reference Writing & Statistical Analysis	
<b>Dr. Altaf Pervez Qasim</b> Associate Professor / Head Department of Forensic Medicine, Sahiwal Medical College, Sahiwal	Review of Literature Lay out of manuscript Proof Reading	
<b>Junaid Altaf Qasim</b> Student of M.B;B.S Aziz Fatima Medical College, Faisalabad	Helped in typing the manuscript Proof Reading	
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