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Original Research Article

A Study of Bacteriological Profile of Pus in a Tertiary Care Hospital in Western UP

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Abstract:

Introduction: Pus formation is typically caused by a bacterial infection. Surgical Site Infection (SSI) is one of the most common causes of nosocomial infections. Resistance to commonly prescribed antibiotics for pus infection is an expanding global problem. So, this study was done to determine the prevalence of pus infection and bacterial profile of organism causing pus infection.

Material and methods: All samples were processed by standard microbiological procedures including Aerobic culture, Morphology, Gram Stain, Motility, Biochemical tests and Antimicrobial susceptibility test.

Results: Culture positive pus samples were found to be 90.7%. There were 43% Gram positive cocci and 57% Gram negative bacilli isolated. Klebsiella species was found to be most common.

Conclusion: Increasing multidrug resistance in pus infections is an important and emerging public health problem. The empirical treatment guidelines must be adjusted accordingly.

Keywords: Pus culture, SSI, Empirical treatment, MDR, Klebsiella.

Introduction

Pus is a thick fluid containing dead tissue, cells, and bacteria. Your body often produces it when it's fighting off an infection, especially infections caused by bacteria. Depending on the location and type of infection, pus can be many colors, including white, yellow, green, and brown. While it sometimes has a foul smell, it can also be odorless.

The inflammatory cells that participate in the body's immune response at the site of an infection eventually degrade and die, creating the substance known as pus. One of the most common types of bacteria that cause pus formation is Staphylococcus aureus, although any bacterial infection may produce pus. An infection that leads to the production of pus is called a purulent infection.

When pus forms within enclosed spaces in the tissues, it causes abscesses. When it forms on the skin surface, it causes lumps known as pustules or pimples. Pus can also form when infections develop in internal organs, such as the bones, brain, lungs, and gastrointestinal tract. Because the formation of pus usually indicates a bacterial infection, people with conditions that weaken the immune system have a higher risk of infection and subsequent pus formation.

What causes pus?

Pus-causing infections can happen when bacteria or fungi enter your body through:

- Broken skin
- Inhaled droplets from a cough or sneeze
- Poor hygiene

When the body detects an infection, it sends neutrophils, a type of white blood cell, to destroy the fungi or bacteria.

During this process, some of the neutrophils and tissue surrounding the infected area will die. Pus is an accumulation of this dead material. Many types of infection can cause pus. Infections involving the bacteria Staphylococcus aureus or Streptococcus pyogenes are especially pronetopus.

Both of these bacteria release toxins that damage tissue, creating pus. (Tsuchida Y et al., 2019)

Where does it form?

Pus generally forms in an abscess. This is a cavity or space created by the breakdown of tissue.

Abscesses can form on your skin's surface or inside your body. However, some parts of your body are exposed to more bacteria. This makes them more vulnerable to infection.

These areas include:

The Urinary Tract: Most urinary tract infections (UTIs) are caused by Escherichia coli, a type of bacteria that's found in your colon. You can easily introduce it into your urinary tract by wiping from back to front after a bowel movement. It's pus that makes your urine cloudy when you have a UTI.

The Mouth: Your mouth is warm and moist, making it the perfect environment for bacterial growth. If you have an untreated cavity or crack in your tooth, for example, you might develop a dental abscess near the root of the tooth or your gums. Bacterial infections in your mouth canal so cause pus to collect on your tonsils. This causes tonsillitis.

The Skin: Skin abscesses often form due to a boil, or an infected hair follicle. Severe acne—which is a buildup of dead skin, dried oil, and bacteria—canal so result in pus-filled abscesses. Open wounds are also vulnerable to pus-producing infections.

The Eyes: Pus often accompanies eye infections, such as pink eye. Other eye issues, such as a blocked tear duct or embedded dirt or grit, can also produce pus in your eye.

Symptoms occur with Pus

Pus formation is typically caused by a bacterial infection and may accompany other symptoms, which vary depending on the underlying disease, disorder or condition. (Negi V et al., 2015)

Localized symptoms that may occur along with pus:-

Pus may accompany localized symptoms including:

- Lump or mass felt beneath the skin
- Oozing or leakage of fluid
- Pain or tenderness
- Skin redness or the presence of red streaks on the skin
- Skin warmth
- Swelling

Systemic symptoms that may occur along with pus:-

Pus may accompany symptoms that affect the whole body including:

- Bodyaches
- Coughing up clear, yellow, light brown, or green mucus
- Difficulty breathing or rapid breathing
- Discharge from the eye
- Fainting or change in level of consciousness or lethargy
- Fatigue
- Fever and chills
- Frequent infections
- Headache

Symptoms that might indicate a serious condition:-

In some cases, pus may occur with other symptoms that might indicate a serious condition that should be immediately evaluated in an emergency setting. Coughing up clear, yellow, light brown, or green mucus

- Difficulty breathing or rapid breathing
- Fainting or change in level of consciousness or lethargy
- Headache
- High fever (higher than 101 degrees Fahrenheit)
- Severe pain
- Severe swelling

Pus after surgery (SSI)

Any cuts or incisions made during surgery can develop a type of infection called a surgical site infection (SSI). Surgical Site Infection (SSI), one of the most common causes of nosocomial infections are common complication associated with surgery. (Hohmann C et al., 2012)

Infections after surgery are caused by germs. The most common of these include the bacteria Staphylococcus, Streptococcus, and Pseudomonas. These infections are usually caused by exogenous and/or endogenous microorganisms that enter the operative wound either during the surgery (primary infection) or after the surgery (secondary infection). Primary infections are usually more serious, appearing within five to seven days of surgery. (Pradhan GB, Agrawal J, 2009)

SSI risk factors(Owens CD, Stoessel K, 2008)

Number of patients related factors: -

- Having diabetes
- Smoking
- Being Overweight
- Having Cancer

Procedure related factors:

- Poor surgical technique
- Prolonged duration of surgery
- Pre-operative part preparation
- Inadequate sterilization of surgical instruments

Staphylococcus aureus, gram positive cocci, is a major human pathogen and a predominant cause of SSI worldwide. Infection with S. aureus is most

likely associated with endogenous source as it is a member of the skin and nasal flora and also with contamination from environment, surgical instruments or from hands of health care workers.

Special interest in S. aureus SSI is mainly due to its predominant role in hospital associated infection and emergence of methicillin resistant S. aureus (MRSA) strains. (Aggarwal S et al., 2019)

Gram negative isolates comprised of 49.6% of all the aerobic bacterial isolates. E. coli (46.4%) was the commonest gram-negative bacteria isolated followed by P. aeruginosa (15.9%) and Citrobacter spp (15.9%).

The etiology of pus infection and the antibiotic resistant pattern of uropathogens have been changing over the past years; resistance to commonly prescribed antibiotics for pus infection is an expanding global problem both in developed and developing countries. So, this study was done to determine the prevalence of pus infection and bacterial profile of organism causing pus infection in Rama Medical College, Hospital and Research Centre, Hapur.

Materials and Methods

Place of Study

The study was carried in department of Microbiology in Rama Medical College, Hospital & Research Centre, Hapur.

Duration of study

Samples were collected from 1-Feburary 2022 to 30-July 2022 from the inpatient departments of the hospital.

Inclusion Criteria: All IPD Patients Suspected of Pus

Exclusion Criteria: All OPD patients

Sample

Pus samples were collected in variety of ways according to the collection site and patient type such as closed abscesses, fine needle aspiration, open wounds, pus and swabs. The ideal specimen is an aspirate from a previously undrained abscess, or a tissue biopsy. Ideally, a minimum volume of 1mL (up to 5 mL) of pus should be collected.

Clinical History

1) Risk Factor

- Age: Very young and very old are more at risk
- Having diabetes
- Smoking
- Obesity
- Having a weakness that weakness your immune system
- Having cancer
- Pre-existing infection
- Co-morbid illness

2) Associated Symptoms

- Bodyaches
- Coughing up clear, yellow, light brown, or green mucus
- Difficulty breathing or rapid breathing
- Discharge from the eye
- Fainting or change in level of consciousness or lethargy
- Fatigue
- Fever and chills
- Frequent infections
- Headache

Specimen Transport

Label the specimen and deliver it to the laboratory as soon as possible with a completed request form. The volume of specimen and the nature of the suspected organism influences the acceptable transport time. If processing is delayed, refrigeration is preferable to storage at ambient temperature.

Laboratory examination of Pus sample

1. Describe the appearance of the specimen: Describe presence/ absence of sulphur granules (needed only for the suspected cases of mycetoma or actinomycosis, when requested).
2. Preparation of the Smear:

If Pus swab is sent-

- Only one aerobic pus swab: Inoculate the culture media first before using the swab to make smears for Gram staining
- If swabs (one anaerobic and two aerobic) are submitted for culture, use the second swab for making gram stain.
- If tissue sample is submitted- make Gram stain from ground tissue.
- Is pus aspirate is sent: using a sterile pipette place one drop of pus onto a clean microscope slide. Spread this using a sterile loop to make a thin smear for Gram staining.

1) Gram Staining: Make an evenly spread smear of the specimen on a clean, grease-free slide. Allow the smear to air-dry in a safe place. Heat fixes the specimen and stain by Examine the smear for the presence of bacteria and pus cells (PMNs) using 100x objective lens and look especially for:

- Gram negative rods (Possible pathogens are E. coli, Proteus or Bacteroides species)
- Gram positive cocci in pairs, chains or clusters (possible pathogens are anaerobic Streptococci or Enterococci).
- Gram positive large rods with square ends

(possible pathogens are Clostridium perfringens or Bacillus anthracis)
- In the case of anaerobic infections large number of pleomorphic bacteria (streptococci, Gram positive and Gram-negative rods of various size and fusiform bacteria) may be seen. Sometimes, Gram positive yeast cells with psuedohyphae may be seen.

Culture Media

Wound specimens collected on aerobic swabs or pus aspirate should be cultured on to the following media:

- Blood agar: (to isolate S.aureus and Streptococcus pyogenes or other streptococci)
- Mac Conkey Agar: (to isolate Gram negative rods)

Culture method: Streak Culture (Surface Plating) method is routinely used for the isolation of bacteria in pure culture from clinical specimens.

All the culture plates were incubated at 37°C aerobically for 18-24 hrs. When the growth was obtained on Blood agar and MacConkey Agar medium, the identification of the responsible pathogen was done by the observation of colony characteristics such as shape, size, elevation, margins, surface, edges, color, structure, consistency and Emulsifiablity.

Gram staining was used to identify Gram-negative bacteria and Gram-positive bacteria, their morphology (cocci or bacilli), shape (circle, oval, or rod) & any specific arrangement (chain, cluster or pair).

Motility Test was done by Hanging Drop Preparation. Biochemical identification was done by Catalase, Coagulase, Oxidase, Indole, MR, Citrate, Urease, Triple Sugar Iron (TSI) tests.

Antimicrobial Susceptibility Test (AST)

Antimicrobial susceptibility testing was done by using the Kirby –Bauer Disc Diffusion method. Presumptive identification was on the basis of Gram Stain, Catalase, Coagulase, Oxidase, and Motility.

The bacterium was swabbed on the Mueller-Hinton agar and the antibiotic discs were placed. The zone of inhibition of each antibiotic is measured; known as zone size. The zone sizes are looked up on a standardized chart to give a result of sensitive, resistant, or intermediate using CLSI, 2022 M100-Ed32.

Antibiotic Discs

Antibiotics (GPC)	**µg**	**Antibiotics (GNB)**	**µg**
• Ampicillin (AMP)	10	• Amikacin (AK)	30
• Amoxicillin-clavulanate (AMC)	20/10	• Amoxicillin-clavulanate (AMC)	20/10
• Ciprofloxacin (CIP)	5	• Cefepime (CPM)	30
• Cefoxitin (CX)	30	• Ceftriaxone (CTR)	30
• Clindamycin (CD)	2	• Cefuroxime (CXM)	30
• Ceftazidime (CAZ)	30	• Ciprofloxacin (CIP)	5
• Doxycycline (DO)	30	• Fosfomycin (FO)	200
• Erythromycin (E)	15	• Gentamicin (GEN)	10
• Gentamicin (GEN)	10	• Imipenem (IPM)	10
• Highlevel Gentamicin (HLG)	100	• Meropenem (MRP)	10
• Linezolid (LZ)	30	• Nitrofurantoin (NIT)	300
• Nitrofurantoin (NIT)	300	• Tobramycin (TOB)	10
• Trimethoprim-sulfamethoxazole (COT)	1.25/23.75	• Trimethoprim- sulfamethoxazole (COT)	1.25/ 23.75
• Tetracycline (TE)	30		
• Vancomycin (VA)	30		

Results: In the study period from 1st February 2022 -30th June 2022, 323 Pus samples were collected from patients who were admitted in different wards of Rama Medical College, Hospital and Research centre, Hapur.

Sex Distribution: A total of 323 pus samples were cultured, among the all samples 170 (52.6%) were male and 153 (47.3%) were females.

Table 1: Distribution of Patients according to their Age Group &Sex

Age	**Male**	**Female**	**Total**
Below12	9	6	15
12to18	51	33	84
18to50	63	89	152
Above50	47	25	72
Total	170	153	323

Majority of Patients were between 18-50 yrs (47.05%) followed by 12 to 18 yrs (26%), above 50 yrs (22.29%) and below 12 yrs (4.46%).

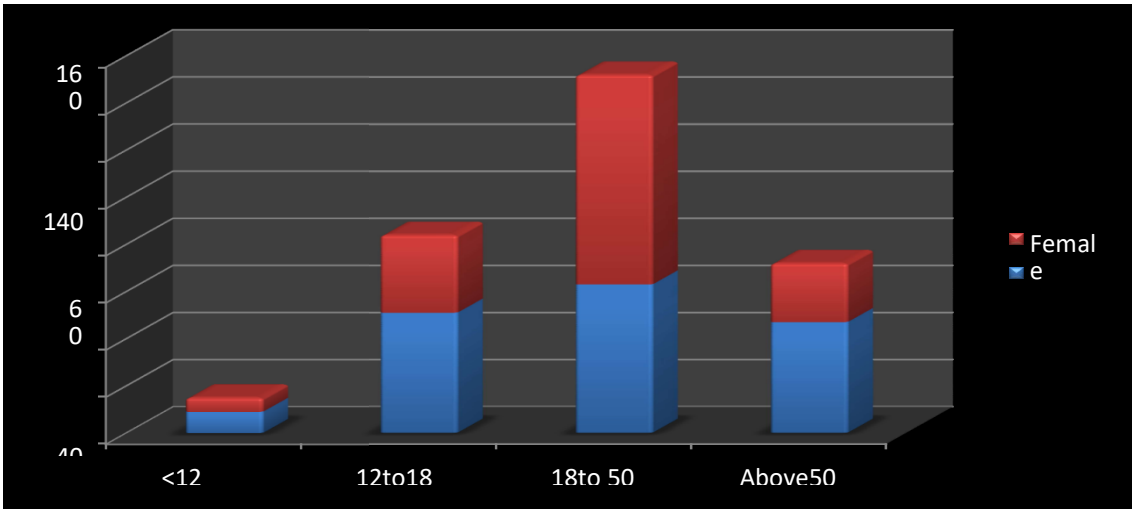

Figure 1:

Table.2 Number of Samples Collected from Patients in Different Wards

Ward Name	No. of Patients
Male Surgery Ward	102
Female Surgery Ward	58
Orthopedic Male	46
Obstetrics &GynaeWard	39
Orthopedic Female	29
Female Medicine Ward	19
Male Medicine Ward	15
Pediatrics Ward	15
Total	323

Majority of samples collected from patients admitted in male surgery ward is 31% (102) followed by Female surgery ward 17.9% (58), Orthopedic Male ward 14.24% (46), Obstetrics &Gynaeward 12% (39), Orthopedic Female 8.9% (29), Female medicine ward 5.8% (19), least no. of patients were from the Male medicine ward 4.6% (15), and 4.6% (15) were from the Pediatric ward.

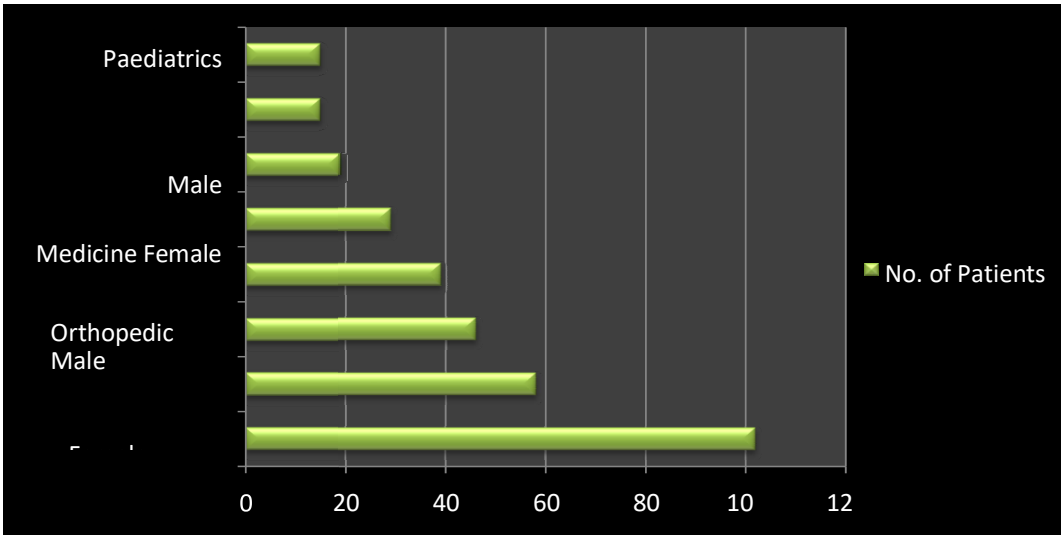

Figure 2:

Culture Results: A total of 323 pus samples were cultured, of which 293 (90.7%) samples were positive and 30 (9.2%) were negative. Among the culture-positive cases, 132 (45.05%) were females and 161 (54.9%) were males.

Table 3: Culture Result

Results	No. of Patients	Percentage
Positive	293	90.7%
Negative	30	9.2%
Total	323	100%

Table 4: Distribution of Culture Results According to Sex

Gender	Positive	Negative	Total
Male	161	11	172
Female	132	19	151
Total	293	30	323

Table 5: Distribution of Culture Results according to Age Group

Age	Positive	Negative	Total
Below 12yr	12	3	15
12 To 18yr	79	5	84
8 To 50yr	135	17	152
Above 50yr	67	5	72
Total	293	30	323

Majority of Positive Patients Age group were between 18-50yrs (51.8%), followed by 12 to 18 yrs (28.66%), above 50yrs (24%), and below 12 yrs (5.11%).

Table 6: Culture Positivity in Pregnant Women

Pregnancy	Positive	Negative	Total
Pregnant	33	9	42
Not- Pregnant	99	12	111
Total	132	21	153

Out of total 153 pregnant females, pus was present in 33 (21.56%).

Correlation of Associated Risk Factors with Positive Pus Culture

Table 7.1:

Surgery	Positive	Negative	Total
Yes	151	9	160
No	142	21	163
Total	293	30	323

Among the culture positive cases patients, the pus after surgery was present in 151 (51.53%) patients and 142(48.45%) patients had negative results.

Table 7.2:

Injury	Positive	Negative	Total
Present	68	7	75
Absent	225	23	248
Total	293	30	323

Out of total positive culture there were 68 (23.20%) patients had injury and 225 (73.7%) were non-injured patients.

Table 7.3:

Diabetes	Positive	Negative	Total
Present	39	7	46
Absent	254	23	277
Total	293	30	323

Out of total positive culture there were 39 (13.31%) Diabetic patients and 254 (86.6%) were non-Diabetic patients.

Table7.4:

Immunocompromised	Positive	Negative	Total
Present	171	17	188
Absent	122	13	135
Total	293	30	323

Among the Immunocompromised patients, 171 (58.36%) were culture positive cases and 17 patients had renal stone whereas 122 (78.60%) were culture positive in absence of renal stone.

Table 8: Distribution of Total Isolates

Isolates	No. of Isolates	Percentage
Gram positive cocci	126	43.00%
Gram negative bacilli	167	56.9%
Total	293	100%

Out of 293 positive samples, Gram positive cocci 126 (43.0%), Gram Negative bacilli 167(56.9) were isolated.

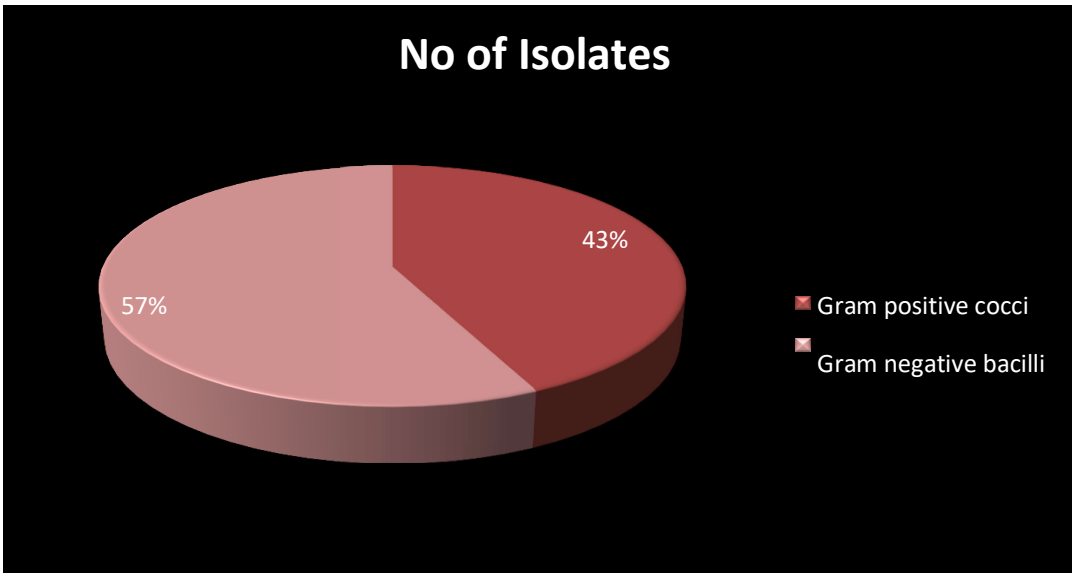

Figure 3:

Table 9: Distribution of Bacterial Isolates

Bacterial Isolates	No. of Isolates	Percentage
Klebsiella species	77	26.27%
MRSA	51	17.40%
Escherichia coli	49	16.72%
Staphylococcus aureus	35	11.94%
Pseudomonas aeruginosa	29	9.8%
Enterococcus species	23	7.84%
CONS	17	5.8%
Proteus species	12	4.09%
Total	293	100%

Eight different types of bacteria were isolated off the 293 isolates. Klebsiella species was isolated in 77 (26.27%) cases and found to be most common. This was followed by the MRSA in 51 (17.4%).

Antimicrobial Susceptibility Pattern of Gram Negative Bacilli

Gram Negative bacteria were tested against thirteen antibiotics.

- Escherichia coli was highly sensitive to Colistin (91.8%), Tetracyclin (48.9%) and Levoflaxacin (46.9%) and showed high resistance to Tobramycin (81.6%) and Cefepime (79.6%).
- Klebsiella species was highly sensitive to Colistin (88.3%), Dorepenem (49.3%), Tetracyclin (49.3%) and showed high resistance to Levoflaxacin (71.4%) and Cefotaxime (66.2%).
- Pseudomonas species was highly sensitive to Colistin (89.6%), Amikacin (72.4%) and Polymyxin B (72.4%) and showed high resistance to Ceftazidime (93.1%) and Levoflaxacin (72.4%).
- Proteus species was highly sensitive to Imipenem (100%), Tigecycline (75%), Polymixin B (66.6%) and showed high resistance to Co-trimoxazole (100%) and Ertapenem (83.3%).

Table 10: Antimicrobial Susceptibility Pattern of E.Coli& Klebsiella pneumoniae

Group	Antibiotics	Escherichia coli (n=49)			Klebsiella Species (n=77)		
		S	I	R	S	I	R
Aminoglycosides	Amikacin	12 (24.5%)	6 (12.4%)	31 (63.3%)	8 (10.4%)	-	17 (22.1%)
	Gentamicin	9 (18.3%)	7 (14.2%)	33 (67%)	19 (24.6%)	1 (1.2%)	5 (6.4%)
	Tobramycin	5 (10.2%)	4 (8.2%)	40 (81.6%)	21 (27.3%)	-	4 (5.2%)
Penicillin	Amoxiclav	9 (18.4%)	-	40 (81.6%)	17 (22.1%)	11 (14.3%)	49 (63.6%)
	Piperacillin-Tazobactum	13 (26.5%)	8 (16.3%)	28 (57.1%)	23 (29.8%)	9 (11.6%)	45 (58.4%)
Cephalosporin	Ceftazidime	5 (10.2%)	8 (16.3%)	36 (73.5%)	16 (20.8%)	-	9 (11.6%)
	Cefepime	6 (12.2%)	4 (8.2%)	39 (79.6%)	21 (27.3%)	-	4 (5.2%)
	Cefuroxime	13 (26.5%)	6 (12.2%)	30 (61.2%)	11 (14.3%)	7 (9.1%)	59 (76.6%)
Carbepenems	Meropenem	11 (22.4%)	14 (28.6%)	24 (48.9%)	16 (20.8%)	4 (5.2%)	57 (74.0%)
	Ertapenem	17 (34.7%)	5 (10.2%)	27 (55.1%)	34 (44.6%)	7 (9.1%)	36 (46.7%)
	Doripenem	18 (36.7%)	5 (10.2%)	26 (53.1%)	38 (49.3%)	3 (3.9%)	36 (46.7%)
	Imipenem	19 (38.7%)	7 (14.3%)	23 (57.1%)	2 (2.5%)	-	23 (29.8%)
Quinolones	Ciprofloxacin	8 (16.3%)	17 (34.6%)	26 (53.1%)	17 (22%)	1 (1.3%)	7 (9.1%)
	Levoflaxacin	23 (46.9%)	9 (18.4%)	17 (34.7%)	15 (19.5%)	6 (7.8%)	55 (71.4%)
Foliate pathways antagonist	Co-trimoxazole	9 (18.4%)	7 (14.3%)	33 (67.3%)	NT	NT	NT
Cephalosporin	Cefotaxime	12 (24.5%)	7 (14.3%)	30 (61.2%)	21 (27.3%)	5 (6.5%)	51 (66.2%)
Monobactam	Aztreonam	18 (36.7%)	3 (6.1%)	28 (57.1%)	24 (31.1%)	8 (10.4%)	45 (58.4%)
Tetracyclines	Tetracycline	24 (48.9%)	5 (10.2%)	20 (40.8%)	38 (49.3%)	6 (7.8%)	43 (55.8%)
Polymyxins	Colistin	45 (91.8%)	-	4 (8.2%)	68 (88.3%)	-	9 (11.6%)
Glyclycycline	Tigecycline	13 (26.5%)	6 (12.2%)	30 (61.2%)	21 (27.3%)	-	48 (62.3%)

Table 11: Antimicrobial Susceptibility Pattern of Proteus species

Group	Antibiotics	Proteus species (n=12)		
		S	I	R
Aminoglycosides	Amikacin	4 (33.3%)	-	8 (66.6%)
	Gentamicin	7 (58.3%)	1 (8.3%)	4 33.3%)
	Tobramycin	4 (33.3%)	1 (8.3%)	7 (58.3%)
Penicillin	Amoxyclav	4 (33.3%)	-	8 (66.6%)
Cephalosporins	Ceftazidime	3 (25%)	2 (16.6%)	7 (58.3%)
	Cefepime	5 (41.6%)	2 (16.6%)	5 (41.6%)
Carbepenems	Meropenem	5 (41.6%)	-	7 (58.3%)
	Doripenem	2 (16.6%)	1 (8.3%)	9 (75%)
	Imipenem	12 (100%)	-	-
	Ertapenem	2 (16.6%)	-	10 (83.3%)
Quinolones	Ciprofloxacin	-	4 (33.3%)	8 (66.6%)
	Levoflaxacin	7 (58.3%)	1 (8.3%)	3 (25%)

Folate pathways antagonist	Co-trimoxazole	-	-	12 (100%)
Nitrofurans	Polymyxin-B	8 (66.6%)	2 (16.6%)	2 (16.6%)
Cephalosporin	Cefotaxime	3 (25%)	2 (16.6%)	7 (58.3%)
Monobactam	Aztreonam	2 (16.6%)	4 (33.3%)	5 (41.6%)
Tetracyclines	Tetracycline	7 (58.3%)	1 (8.3%)	4 (25%)
Polymyxins	Colistin	3 (33.3%)	2 (16.6%)	6 (50%)
Glyclycycline	Tigecycline	9 (75%)	-	3 (33.3%)

Table 12: Antimicrobial Susceptibility Pattern of Pseudomonas species

Group	**Antibiotics**	**Pseudomonas species (n=29)**		
		S	**I**	**R**
Aminoglycosides	Amikacin	21 (72.4%)	2 (6.8%)	6 (20.6%)
	Gentamicin	8 (27.6%)	5 (17.2%)	16 (55.1%)
	Tobramycin	5 (17.2%)	7 (24.1%)	17 (58.6%)
Penicillin	Amoxyclav	7 (24.1%)	4 (13.7%)	18 (62.1%)
Cephalosporins	Piperacillin/ Tazobactam	19 (65.5%)	4 (13.7%)	6 (20.6%)
	Ceftazidime	-	2 (6.8%)	27 (93.1%)
Carbepenems	Cefepime	4 (13.7%)	7 (24.1%)	18 (62.1%)
	Levofloxacin	8 (27.6%)	-	21 (72.4%)
	Meropenem	7 (24.1%)	3 (10.3%)	19 (31%)
	Doripenem	13 (44.8%)	5 (17.2%)	11 (37.9%)
Quinolones	Imipenem	13 (44.8%)	4 (13.7%)	12 (41.3%)
	Ciprofloxacin	8 (27.5%)	5 (17.2%)	16 (55.1%)
Folate pathways antagonist	Co-trimoxazole	4 (13.7%)	7 (24.1%)	18 (62.1%)
Nitrofurans	Polymyxin-B	21 (72.4%)	-	8 (27.5%)
Fosfomycin	Colistin	26 (89.6%)	-	3 (10.3%)

Antimicrobial Susceptibility Pattern of Gram Positive Cocci:

Table 13: Antibiotic Sensitivity Pattern of Staphylococcus aureus & Coagulase Negative Staphylococcus species:

Group	**Antibiotic**	**Staphylococcus aureus (n=86)**			**CONS (n=17)**		
		S	**I**	**R**	**S**	**I**	**R**
Aminoglycosides	Gentamicin	31 (36.4%)	11 (12.7%)	44 (51.1%)	10 (58.8%)	1 (5.8%)	6 (35.3%)
Penicillin	Amoxyclav	23 (26.7%)	13 (15.1%)	50 (58.1%)	5 (29.4%)	-	12 (70.6%)
Cephalosporin	Cefoxitin	41 (47.6%)	9 (10.4%)	36 (41.8%)	NT	NT	NT
Tetracycline	Doxycycline	76 (88.3%)	2 (2.3%)	8 (9.3%)	10 (58.8%)	1 (5.8%)	6 (35.3%)
	Tetracycline	65 (75.5%)	9 (10.4%)	12 (13.9%)	17 (100%)	-	-
Quinolones	Ciprofloxacin	5 (5.8%)	8 (9.3%)	22 (25.5%)	9 (52.9%)	3 (17.6%)	5 (29.4%)
Folatepathwaysantagonist	Co-trimoxazole	23 (26.7%)	18 (20.9%)	45 (52.3%)	11 (64.7%)	-	6 (35.2%)
Macrolides	Erythromycin	27 (31.3%)	19 (22.1%)	40 (46.5%)	-	-	17 (100%)
Lincosamides	Clindamycin	26(30.2%)	18(20.9%)	42 (48.8%)	12	1	4
Glycopeptides	Vancomycin	86 (100%)	-	-	17 (100%)	-	-
Oxazolidinones	Linezolid	86 (100%)	-	-	17 (100%)	-	-

Table 14: Antibiotic Sensitivity Pattern of Enterococcus

Group	Antibiotics	Enterococcus species (n=23)		
		S	I	R
Aminoglycosides	High Level Gentamicin	4 (17.3%)	-	19 (82.6%)
Penicillin	Ampicillin	13 (15.1%)	-	10 (43.4%)
Tetracyclines	Doxycycline	2 (8.6%)	3 (13.4%)	18 (78.3%)
	Tetracycline	21 (91.3%)	-	2 (8.6%)
Quinolones	Ciprofloxacin	9 (39.1%)	-	14 (85.7%)
Glycopeptides	Vancomycin	23 (100%)	-	-
Oxazolidinones	Linezolid	23 (100%)	-	-

Gram positive Bacteria were tested against fourteen antibiotics.

- Staphylococcus aureus was highly sensitive to Vancomycin (100%), Linezolid (100%), Doxycycline (88.3%), and showed high resistance to Amoxyclav (58.1%) and Co-trimoxazole (52.3%).
- Coagulase Negative Staphylococcus species was highly sensitive to Vancomycin (100%), Linezolid (100%), Tetracycline (100%) and showed high resistance to Erythromycin (100%), Amoxyclav (70.6%).
- Enterococcus species was highly sensitive to Vancomycin (100%). Linezolid (100%), Tetracycline (91.3%) and showed high resistance to Ciprofloxacin (85.7%), High Level Gentamicin (82.9%), and Doxycycline (78.3%).

Discussion

In this study out of all sample's majority 293 (90.7%) are growth positive. It is consistent with a study by Khanam RA et al., 2018 where 83% of the cultures were positive. The reason is that the suppurative infection of the skin, ear, and eye are common occurrences in hospitalized patients as well as in the out-patient's department. Furthermore, wound infection is regarded as the most common nosocomial infection among surgical patients.

This study shows, both gram positive and gram-negative pathogens were isolated from samples. The predominant pathogens were gram negative bacteria (56.9%). It was agreed with studies done by Swati Duggal et al., 2015 and Mary Shama et al., 2018 which showed dominant pathogens as Gram negative bacteria. Klebsiella Species was the most common bacterial isolate. This finding is consistent with the studies conducted by Mantravadi HB et al., 2015 and Tiwari HK et al., 2009.

The second most common organism in our study was MRSA. This has also been demonstrated by Khanam RA et al., 2018. E. coli in our study was isolated in 16.72% of the positive samples similar to that reported by Rai S et al., 2017.

Staphyloccus aureus was the third most common isolate in our study, which is in accordance with the study conducted by Adhikari R et al., 2017 S.aureus showed very high resistance to Co-trimoxazole. S. aureus showed 100% sensitivity to vancomycin, Linezolid and Doxycycline in our study similar to the study conducted by Adhikari R et al., 2017. Staphylococcus aureus was most resistant to Erythromycin and most sensitive to Vancomycin.

E. coli in our study showed high resistance to Tobramycin whereas, in the findings reported by Trojan R et al., 2016 showed high resistance to ceftriaxone. E. coli was found to be highly sensitive towards Colistin as compared to the findings shown by Trojan et al. which reported the similar bacterial sensitivity towards both of these drugs.

P. aeruginosa was found to be highly resistant towards Ceftazidime in our study and Sensitivity for Colistin respectively. These alarming findings are compared with the findings reported by Tiwari HK et al., 2009.With bacterial resistance towards ceftriaxone. On the other hand, bacteria were found to be sensitive to ciprofloxacin. Klebsiella was found to be more sensitive towards Colistin. This was found to differ from findings of Garba I et al., 2012.The resistance against and ceftriaxone was high. This is corroborated by Garba I et al., 2012 reporting similar resistance towards these drugs.

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