IOSR Journal Of Pharmacy And Biological Sciences (IOSR-JPBS)
e-ISSN:2278-3008, p-ISSN:2319-7676. Volume 19, Issue 6 Ser. 2 (Nov. – Dec. 2024), PP 18-23
www.Iosrjournals.Org

A Retrospective Study On Bacteriological Profile And Antimicrobial Sensitivity Pattern Of Pathogens Causing Pyogenic Infections At A Tertiary Care Teaching Hospital

C. Pavithra, P. Sravya, R. Pravalika, D. Suresh, Dr. S. Gireesh Kumar Reddy
[1.] Pharm D Intern, Krishna Teja Pharmacy College, Tirupati, Andhra Pradesh, India.*
Pharm D Intern, Krishna Teja Pharmacy College, Tirupati, Andhra Pradesh, India.
Assistant Professor, Department Of General Surgery, Sri Balaji Medical College, Hospital And Research Institute, Renigunta, Tirupati, Andhra Pradesh, India.

Abstract
Pyogenic infections characterized by the presence of pus are of great concern to the health care providers especially in the hospital set up after injuries, burns and operations. It is necessary to understand the bacterial pathogens and their antibiotic susceptibility and resistance. The objective of this Retrospective study, conducted over a period of 6 months in tertiary care teaching hospital, was to establish the bacterial profile of pathogens causing pyogenic infections and their antimicrobial susceptibility. A total of 128 pus samples were collected, 102 of them showed positive growth. Only 102 out of 128 (79.7%) samples showed negative growth. The most affected population was men (59%) between the age of 31 and 40 years (34%). Escherichia coli topped the list of pathogens cultured at 31%, followed by Pseudomonas aeruginosa – 17%. There was significant resistance to broad-spectrum antibiotics such as Amoxiclav, Cefotaxime, especially among the Gram-negative isolates. Linezolid and Colistin were still active against resistant strains. The presence of multidrug resistant organisms such as MRSA, resistant Klebsiella pneumoniae and others complicated the treatment practice. These data emphasize need to control and prevention of the ever-growing problem of multi-drug-resistant organisms and the use of the most effective antibiotics on general population.

Keywords*: Antibiotic susceptibility, Escherichia coli, Klebsiella pneumoniae, MRSA, Pseudomonas aeruginosa, Pyogenic infections.*

Date of Submission: 04-12-2024 Date of Acceptance: 14-12-2024

I. Introduction

Skin acts as an effective deterrent for infections, a break in the skin causes invasion of microorganisms on underlying subcutaneous tissue of a host constitutes infection [1,2&3]. The human skin and soft tissue infections (SSTIs) caused by microbial pathogens during or after trauma, burn injuries, and surgical procedures result in the production of pus, characteristic of pyogenic infections [4].

Pyogenic infections or Suppurative infections that are characterised by local and systemic inflammation refers to a bacterial infection that can arise from various sources including wounds, abscesses, and other localized infections, leads to the production of pus or Suppuration (protein-rich fluid called liquor puris, usually whitish-yellow, yellow, or yellow brown in colour formed by aggregation of dead leucocytes, cellular debris, necrotic tissues) and are generally caused by one of the pyogenic bacteria [5,6,7,8&9]. Pus formation is one of several cardinal indicators of suppurative infections and it is the common sequel of acute inflammation result in delayed healing and may cause several complications like wound dehiscence or wound breakdown [2,10&11]. They may be endogenous or exogenous, Exogenous infections are usually associated with traumatic injuries, burns etc, whereas Endogenous infections and abscesses may be associated with appendicitis, cholecystitis etc, and it can be PATOS (present at time of surgery) or pus can be seen in patient who had surgery within past 30 days or 90 days with implants [9,12].

Infectious diseases still remain an important cause of morbidity and mortality among humans worldwide especially in developing countries [8]. It is estimated that antimicrobial resistance kills at least 1.27 million people every year and it may increase up-to 10 million people per year by 2050 [6]. The factors that contribute to pyogenic infections include pre-existing illness, duration of operation, wound contamination, microbial load and the host defence mechanism [13]. Both aerobic and anaerobic bacteria have been implicated in wound infections which commonly occur under hospital environment resulting in prolonged hospitalization and huge economic burden [4]. Various bacterial pathogens, both Gram positive and Gram negative are often responsible for such infections,

if the infection is caused by Resistant bacteria, then it leads to great economic loss encompassing use of more expensive antibiotics to treat infection as well as threat of resistance to them [6,14].

II. Objectives:

- To identify the bacterial pathogens most commonly associated with pyogenic infections in the hospital.
- To analyse the antimicrobial sensitivity patterns of these pathogens, determining which antibiotics are most and least effective.
- To analyse the resistance patterns of the isolated bacteria to commonly used antibiotics and identify any emerging resistance trends.

III. Materials And Methods

The Retrospective, Observational, single centred study conducted for a period of 3 months (i.e. from May 2024 to November 2024) in the department of General surgery at Sri Balaji Medical College Hospital and Research Institution Renigunta, Tirupati. Total 128 samples were collected based on the study criteria. Out of 128 samples, 102 samples show positive for growth and 26 samples shows no growth.

Method of Sample Collection:

Pus samples were collected using by sterile swabs and sterile syringe aspiration and were immediately sent to the bacteriology section of microbiology laboratory and were further processed. Samples were inoculated on and Mac Conkey agar (MA) and the plates were incubated at 37°C for 24 to 48 hours and all bacterial isolates are examined for colony characteristics, Gram staining, motility and biochemical reactions as per standard conventional microbiological methods on TSI agar. Antibiotic sensitivity testing was done by Kirby–Bauer disc diffusion method on Mueller-Hinton agar, as per Clinical and Laboratory Standards Institute guidelines (CLSI)

Inclusion Criteria:

- Laboratory records of patients with bacterial isolates from pus samples tested for antibiotic susceptibility during the period from May 2024 to November 2024.

Exclusion Criteria:

- Laboratory records with incomplete data
- Laboratory records with bacterial isolates not tested for antibiotic susceptibility.
- Laboratory samples of patients with other co-morbidities like Diabetes mellitus has been excluded
- Laboratory records of patients with extremes of age.
- Laboratory samples of Immunocompromised and cachexic patients.

Statistical analysis:

Analysis was done using MS Excel 2019. The level $P < 0.05$ was considered as the significance.

IV. Results

The Retrospective, Observational, single centred study conducted for a period of 6 months (i.e. from May 2024 to November 2024) in the department of General surgery at Sri Balaji Medical College Hospital and Research Institution Renigunta, Tirupati. Total 128 samples were collected based on the study criteria. Out of 128 samples, 102 samples show positive for growth and 26 samples shows no growth. Out of 128 subjects 75(59%) were Males and 53(41%) were Females, ***Figure 4.1, explains the distribution of gender of total study subjects.*** Out of 128 subjects 43(34%) were from the age group of 31-40 years, followed by 32(25%) from 21-30 Years, 26(20%) from 41-50 Years, 11(9%) from 51-60 Years, 8(6%) from 11-20 and 61-70 Years. ***Figure 4.2, explains the Distribution of subjects based on their Age group***. The gram-positive species were more isolated compared to gram-negative species. The most common isolated was E. coli (32, (31%)). All the isolated pathogens have been listed based on their prevalence in the ***Table 4.1. explains the Prevalence of isolates in pus cultures in the study. Figure 4.3: explains the distribution of bacterial isolates. Figure 4.4 explains the Prevalence of isolates in pus cultures in the study*** The antibiotic sensitivity of the isolated pathogens showed that majority of them were resistant to Amoxiclav and all were sensitive to linezolid. The sensitivity patterns of gram-negative pathogens and gram-positive pathogens are listed in ***Table 4.2 and Table 4.3 respectively.***

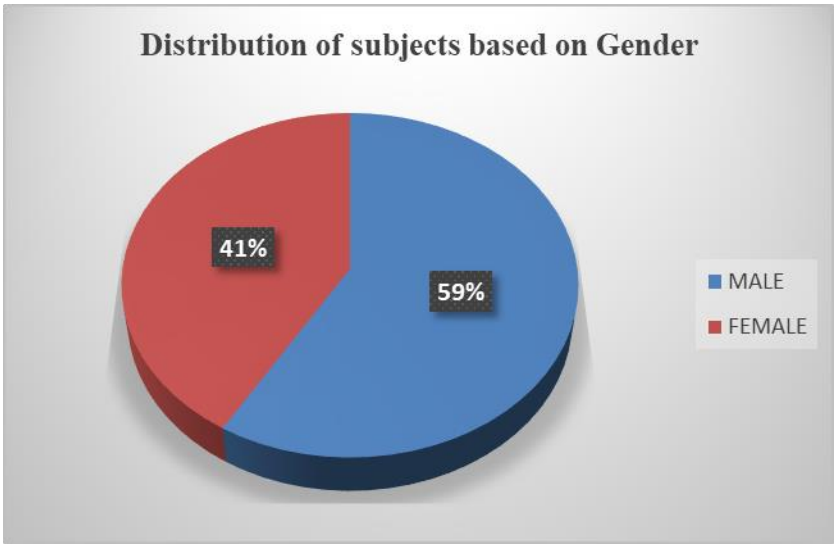

Fig 4.1: Explains the distribution of subjects based on Gender

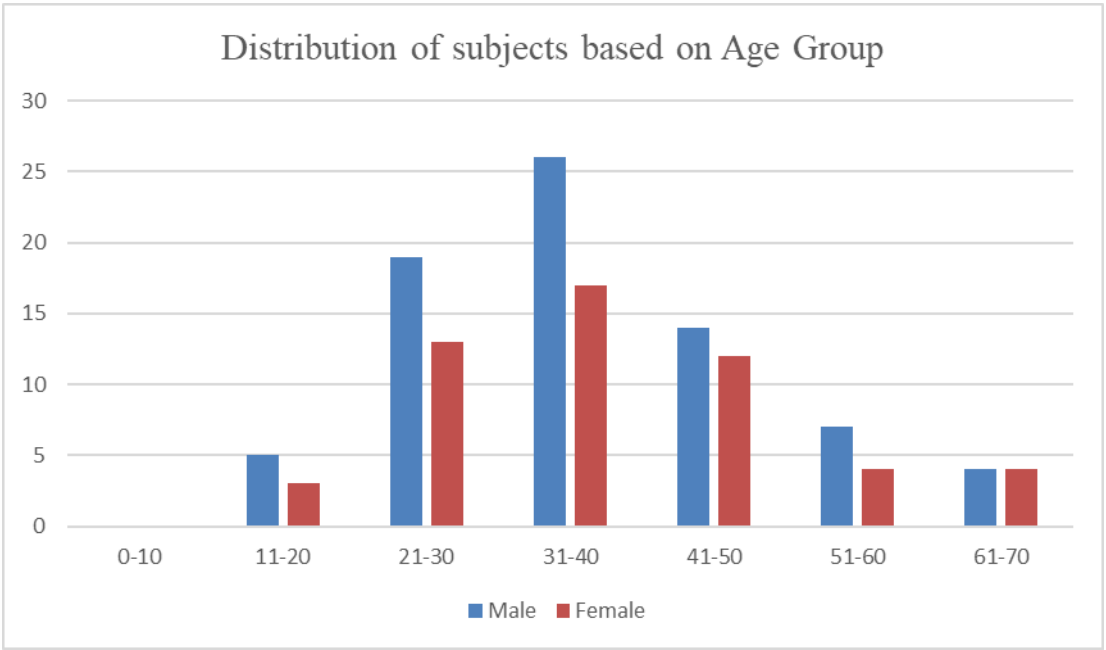

Fig 4.2: Distribution of subjects based on their Age group

Table 4.1: Prevalence of isolates in pus cultures in the study

S. No	Organism Isolated	Number of Isolates (N)	Percentage (%)	
1	Escherichia coli	32	31	
2	Pseudomonas Aeruginosa	18	17	
3	Klebsiella Pneumoniae	10	10	
4	Acinetobacter species	8	8	
5	Methicillin Resistance Staphylococcus Aureus	8	8	
6	Proteus Vulgaris	6	6	Mean=9.2727 SD=8.7303
7	Staphylococcus Aureus	6	6	
8	Streptococcus Pneumoniae	6	6	
9	Klebsiella Oxytoca	4	4	
10	Enterococci	2	2	
11	Proteus Mirabilis	2	2	
Total		**102**	**100**	

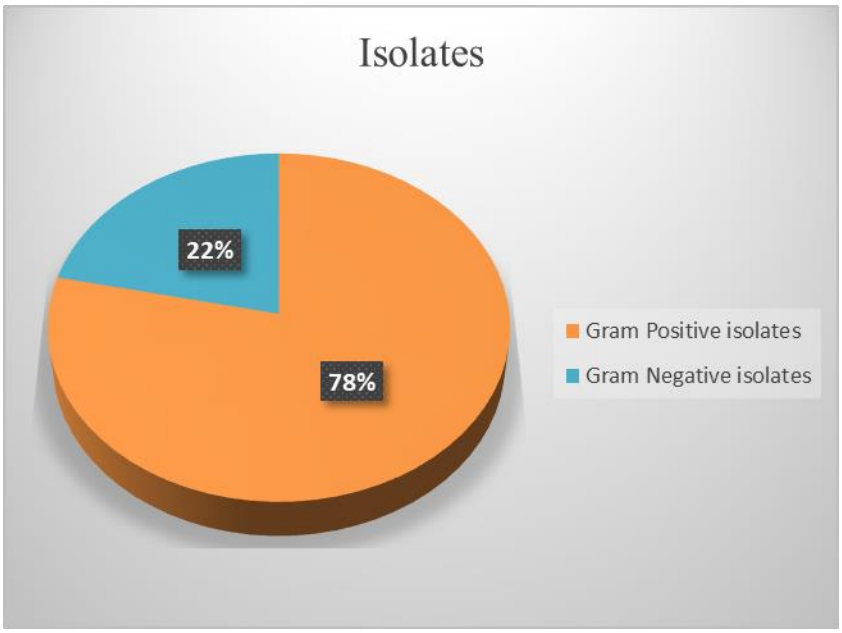

Fig 4.3: Distribution of bacterial isolates

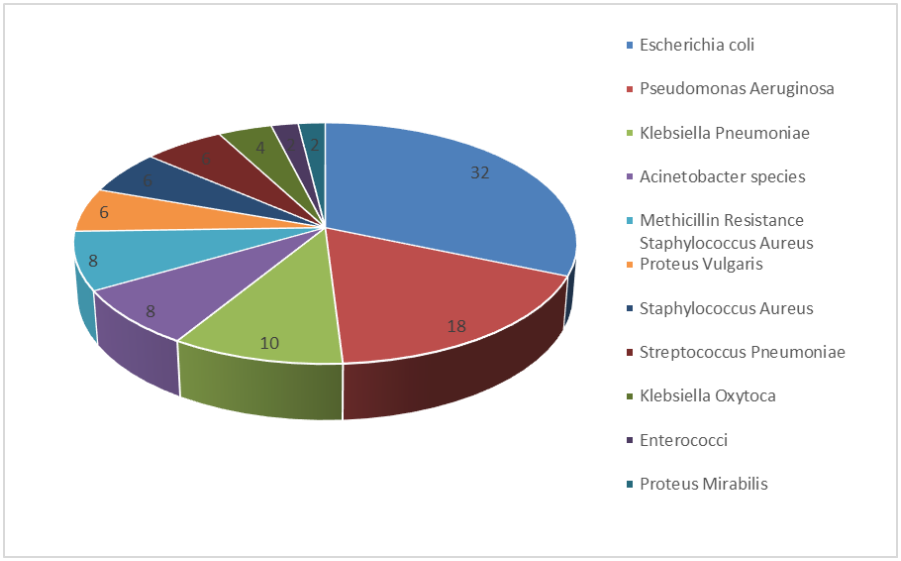

Fig 4.4: Prevalence of isolates in pus cultures in the study

Table 4.2: Distribution of study subjects based on Antibiotic sensitivity of gram-positive isolates in pus culture

S. No	Organism / Antibiotic	Staphylococcus Aureus (N=6)	Methicillin Resistant Staphylococcus Aureus (N=8)	Streptococcus Pneumoniae (N=6)	Enterococcus Species (N=2)
1	Amikacin	100%	100%	83.33%	50%
2	Ampicillin	66.66%	0	50%	0
3	Amoxicillin+ Clavulanic acid	83.33%	50%	66.66%	0
4	Cefoxitin	100%	0	0	50%
5	Ciprofloxacin	50%	50%	33.33%	0
6	Clindamycin	66.66%	100%	66.66%	100%
7	Co-Trimoxazole	83.33%	75%	83.33%	0
8	Erythromycin	33.33%	0	66.66%	50%
9	Gentamicin	100%	37.5%	33.33%	0
10	Imipenem	66.66%	75%	0	50%
11	Linezolid	100%	100%	100%	100%
12	Meropenem	50%	75%	0	50%
13	Tetracycline	66.66%	100%	50%	0
14	Vancomycin	100%	37.5%	33.33%	0

Table 4.3: Distribution of study subjects based on Antibiotic sensitivity of gram-Negative isolates in pus culture

S.NO	Organism / Antibiotic	Proteus Vulgaris (N=6)	Acinetobacter species (N=8)	Proteus Mirabilis (N=2)	Escherichia coli (N=32)	Pseudomonas Aeruginosa (N=18)	Klebsiella Pneumoniae (N=10)	Klebsiella Oxytoca (N=4)
1	Amikacin	0	75%	0	50%	22.22%	80%	100%
2	Amoxiclav	0	0	0	12.5%	0	0	0
3	Cefepime	100	25%	0	43.75%	66.66%	60%	0
4	Cefotaxime	33.33%	0	0	0	0	0	0
5	Cefotaxime+ Clavulanate	0	50%	100	43.75%	22.22%	20%	0
6	Cefixime	0	25%	0	12.5%	0	20%	0
7	Cefeperazone+ Sulbactam	33.33%	50%	100	43.75%	11.11%	60%	0
8	Ceftazidime	0	0	0	6.25%	11.11%	40%	0
9	Ciprofloxacin	0	50%	0	37.5%	0	60%	0
10	Colistin sulphate	0	75%	0	56.25%	55.55%	100%	100%
11	Cotrimoxazole	0	25%	0	37.5%	0	80%	0
12	Gentamicin	0	50%	100%	50%	33.33%	100%	100%
13	Imipenem	0	25%	0	12.5%	0	20%	0
14	Imipenem+ cilastin	0	25%	0	25%	22.22%	60%	0
15	Piperacillin+ Tazobactam	33.33%	25%	100%	37.5%	11.11%	40%	0
16	Polymixin-B	0	75%	0	50%	55.55%	40%	100%
17	Tobramycin	0	0	0	0	22.22%	0	0

V. Discussion

Pyogenic infections are commonly associated with pus which remains as predominant cause of morbidity, especially in the hospital setting where trauma, burns, or surgical procedures are common. This study conducted at Sri Balaji Medical College Hospital and Research Institution to analyse the bacterial pathogens causing pyogenic infections and their patterns of antibiotic susceptibility. A total of 128 subjects were recruited in the study, which shows higher prevalence of infection in males (59%) compared to females (41%) same was reported by ***Manoj Kumar et al, Manish Kumar Diwakar et al, Qursheed sultana et al***. Most of the study subjects with infections are in the age group of 31-40 years (34%) followed by 21-30 (25%) and 41-50 years (20%). Such distribution of population may be seen in younger people who are more physically active and more exposed to occupational hazards which lead to trauma that may rise to pyogenic infections. Out of 128 samples, 102 showed the presence of growth. The most common pathogen isolated was E. coli strains at (31%) Same was reported by ***C. Roopa et al, S. Ramesh Kannan et al, Rugira Trojan et al*** and P. aeruginosa (17%) and K. pneumoniae (10%). Both Gram-negative and Gram-positive bacteria were identified. However, the Gram-negative isolates were more prevalent same was reported by ***Rugira Trojan et al, Qursheed sultana et al***. The study showed that Escherichia coli dominates in number, hence it is more associated with wound infection, particularly in surgery and traumatic patients. Aerobic gram-negative bacilli, Pseudomonas aeruginosa in particular and known for its resistance patterns and high atmospheric humidity, hospitals took the second place among the isolated strains. Antibiotic Sensitivity Patterns shows that gram-negative isolates are more prevalent than gram-positive isolates. Specifically, Gram positive isolates such as Staphylococcus aureus MRSA were primarily sensitive Amikacin whereas the resistant strains had response to Amoxiclav with MRSA being completely resistant to Ampicillin and a low sensitivity to Ciprofloxacin. Gram negative pathogens such as E. coli, Klebsiella pneumoniae showed relatively high cross-resistance to such antibiotics as Amoxiclav and Cefotaxime, which are broad-spectrum antibiotics that are frequently prescribed. Colistin and Polymixin-B were still active against the resistant strains but those interactions have to be restricted so there's no further buildup of resistance. There is an alarming trend in that Amoxyclav is being resisted in the majority of cases which are caused by Gram-negative organisms. Additionally, the study revealed that Linezolid was very active against all of the Gram-positive isolates tested and its use should be considered. Other findings include the resistance profile to the commonly used antibiotics such as Ciprofloxacin, Amoxyclav, and Cefotaxime increasing among the Gram-negative bacterial pathogens. More specifically, treating infections due to Pseudomonas aeruginosa and Klebsiella pneumoniae has become increasingly more difficult. The treatment of such patients usually takes longer time as they may manifest a new infection caused by another a multi drug resistant pathogen such as MRSA or Klebsiella resistant strain. Such resistance patterns induce to utilize more powerful and costly antibiotics such as Colistin whose severe adverse effects due to toxicity.

VI. Conclusion

The study shows the prevalence of bacterial infections are more in men and specifically in the age group of 31-40 years with Escherichia coli as the most common organism involved in our study. The management of hospital-acquired infections by the appearance of multidrug-resistant organisms such as MRSA and resistant Klebsiella pneumoniae are becoming difficult. Significant antibiotic resistance like Amoxiclav resistance, and others against Cefotaxime also reminds us on the need of antimicrobial stewardship in the hospital. The measures that are required against this resistance would include regular monitoring, optimized use of antibiotics, and strengthened infection prevention in the hospital which may finally help in better patient care.

References

[1] Qursheed Sultana Et Al. Bacteriological Profile And Antibiotic Sensitivity Pattern Of Bacterial Pathogens Isolated From Pus Samples, International Journal Of Current Microbiology And Applied Sciences, Volume 9 Number 7, 2020.
[2] Nasreen Huda Et Al. Antimicrobial Sensitivity Pattern Of Bacteria Isolated From Pus Sample Collected From A Private Diagnostic Laboratory In Rangpur District Of Bangladesh, Bangladesh Journal Of Infectious Diseases, Volume 8, Number 2, Page 64-70, December 2021.
[3] Kulandhaivel Murugesan Et Al. Study On Antibiotic Susceptibility Testing Against Pyogenic Organisms From Wound Infections, International Journal Of Pharmaceutical Sciences Review And Research, Volume 45, No. 1, Page No: 262-265, 2017.
[4] Dr. Raj Kumar Wasan Et Al. Study Of Bacteria In Pus With Antimicrobial Sensitivity Pattern, International Journal Of Clinical And Diagnostic Pathology Volume 3, Issue 3, 255-258, 2020.
[5] Swati Duggal Et Al. Antibiogram Of Various Bacterial Isolates From Pus Samples In A Tertiary Care Centre In Rajasthan, International Journal Of Science And Research, Volume 4 Issue 5, Page No: 1580-1584, May 2015.
[6] Farhan Kursheed Et Al. The Antibiogram Of Pus Cultures In Federal Tertiary Care Hospital, Islamabad And Its Utility In Antimicrobial Stewardship, Iranlan Journal Of Microbiology, Volume 16, Number 1, Page No: 56-61, February 2024.
[7] Roopa. C Et Al. Pus Culture Isolates And Their Antibiotic Sensitivity At A Tertiary Care Hospital In Hyderabad Karnataka Region, International Journal Of Medical Microbiology And Tropical Diseases, Volume 3, Issue 4, Page No:140-145, 2017.
[8] Nureen Zahra Et Al. Evaluation Of Bacterial Culture And Their Resistant Pattern In Pus Containing Patients Of Different Wards Of The Hospital, Lahore, Pakistan, African Journal Of Microbiology Research, Vol. 13, No.3, Page No:50-54, 21 January, 2019.
[9] Manoj Kumar Et Al. Bacterial Profile And Antibiogram Of Pus Isolates In A Tertiary Care Hospital, Iosr Journal Of Dental And Medical Sciences, Volume 19, Issue 5 Ser.15, Page No: 09-14, May 2020.
[10] Shivra Batra Et Al. Bacteriological Profile And Antimicrobial Susceptibility Pattern Of Pus Culture Isolates From A Tertiary Care Hospital, Sms Medical College Jaipur, European Journal Of Molecular & Clinical Medicine, Volume 07, Issue 11, Page No: 7502-7508, 2020.
[11] Rameshkannan S Et Al. Pattern Of Pathogens And Their Sensitivity Isolated From Pus Culture Reports In A Tertiary Care Hospital, Puducherry, Indian Journal Of Basic And Applied Medical Research, Volume 4, Issue 1, Page Bo: 243-248, 2014.
[12] Vijetha Sajjanar Et Al. Study Of Bacteriological Profile And Antibiotic Susceptibility Pattern Of Pus Isolates In Tertiary Care Hospital, Ip International Journal Of Medical Microbiology And Tropical Diseases, Volume 9, Issue 4, Page No: 253-257, 2023.
[13] Qader Ahmed Jalily Et Al. Bacteriological Profiles Of Pus With Antimicrobial Sensitivity Pattern At A Teaching Hospital In Vikarabad, International Journal Of Current Microbiology And Applied Sciences, Volume 8 Number 07, Page No: 1556-1564, 2019.
[14] Rajiv Kumar Et Al. Antimicrobial Susceptibility Pattern Of Pus Culture In A Tertiary Care Hospital Of Jharkhand, India, International Journal Of Basic & Clinical Pharmacology, Volume 6, Issue 5, Page No: 1184-1192, May 2017.