Original Article

Bacterial Profile and Antimicrobial Susceptibility Pattern of Gram Negative Bacteria Isolated from Skin and Soft Tissue Infections in a Tertiary Care Hospital of Western Uttar Pradesh

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Abstract

Background: Pyogenic infections are one of the most common causes of morbidity and mortality among hospitalized patients. Gram negative bacteria (GNB)are predominantly isolated in Hospital settings across India. A study was planned to determine the profile and susceptibility pattern of Gram negative bacteria isolated from pus samples in a tertiary care Hospital.

Material and Methods: This prospective hospital based study was conducted over a period of one year. A total of 1623 pus samples received in Clinical Microbiology Laboratory were subjected to culture and identification of aerobic bacterial pathogen as per standard bacteriological method and antimicrobial susceptibility was carried out by Kirby-Bauer disk diffusion method as per CLSI guidelines 2020.

Result: The culture positivity rate was 467(28.77%).There was predominance of GNB (78.59%). *Klebsiella* species was the predominant GNB isolated. Most of the GNBs showed good susceptibility against imipenem. However, lower susceptibility was observed against cephalosporins, quinolones, aminoglycosides and cotrimoxazole. None of the isolated GNB exhibited resistance to colistin.

Conclusion: *Klebsiella* species was the predominant GNB isolated from pus samples from our hospital. Knowledge of bacterial profile and their antimicrobial susceptibility pattern is important for institution of empirical antimicrobial therapy for better patient outcome.

Keywords: Antibiotic susceptibility testing, Gram negative bacilli, Pus culture.

Introduction

Skin and soft tissue infections (SSTIs) are caused by invasion and multiplication of pathogenic microorganisms. *Staphylococcus aureus, Streptococcus pyogenes, Escherichia coli, Klebsiella* species, *Proteus* species and *Pseudomonas* species are the common etiological agents implicated in pyogenic infections[1]. These infections are characterized by local inflammation, abscess and pus formation[2]. Both aerobic and anaerobic bacteria are among the causative agents of pyogenic infections which occur in hospital environment and result in significant morbidity, prolonged hospitalization and economic burden[3].

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Knowledge of bacterial profile and their antimicrobial susceptibility pattern is important for institution of empirical antimicrobial therapy for better patient outcome till the laboratory culture reports are awaited[4]. The major concern in hospital environment is pyogenic infections due to more virulent strains circulating in healthcare setting, that are resistant to multiple antibiotics. These infections are difficult to treat because of their capacity to adapt to the changing environment[5,6]. Though the bacterial profile from pus samples remains more or less similar in various studies, there is a variation in the antibiotic susceptibility pattern of the isolates, highlighting the emergence of multidrug resistant (MDR) bacterial strains in pyogenic infections. This study was planned to determine the profile and susceptibility pattern of Gram negative bacteria isolated from pus samples in in our hospital setting.

Materials and Methods

This prospective hospital based study was conducted in a tertiary care Hospital of Meerut, Uttar Pradesh for a period of one year. A total of 1623 pus samples received in Clinical Microbiology Lab from various IPDs & OPDs were subjected to culture and identification of aerobic bacterial pathogen as per standard bacteriological method. [7] The pus samples werecultured on Blood agar, Chocolate agar and MacConkey agar plates. Isolates grown on culture after incubation at 37°C for 48 hours were identified by colony morphology and conventional biochemical tests[7]. Antimicrobial susceptibility was carried out by Kirby-Bauer disk diffusion methodon Mueller Hinton agar as per CLSI guidelines 2020[8]. Standard antibioticdisks of Ampicillin-sulbactum (10/10µg), aztreonam (30µg), ceftriaxone (30µg), cefotaxime (30 µg), ceftazidime (30 µg), cefuroxime (30 µg), imipenem (10 µg), meropenem (10 µg), ertapenem (10 µg), doripenem (10 µg), tobramycin (10 µg), ciprofloxacin (5 µg), gentamicin (10 µg), amikacin (30 µg), and piperacillin/tazobactam (100/10 µg) from HiMedia, Mumbai, India were used for AST.

Results

The culture positivity rate was 467(28.77%). There was predominance of GNB 367 (78.59%) followed by Gram positive bacteria 88 (18.84%) and *Candida* species 12 (2.57%)[Figure 1]. The GNBs were isolated predominantly from indoor samples (61.85%) as compared to outdoor samples (38.15%) [Table 1] and from male patients (57.22%) [Table2]. On location wise distribution most of the isolated GNBs were from surgery (43.17%) followed by Orthopedics (13.21%) and Surgical ICU (11.45%) [Figure 2].

The profile of Gram negative bacteria isolated from pus was almost similar in IPD and OPD samples. *Klebsiella* species was the predominant GNB isolated from IPD and OPD (39.20% and 37.85%) followed by *Escherichia coli* (35.24% and 32.14%), *Pseudomonas* species (15.41% and 21.43%), *Acinetobacter*species (5.28% and 7.14%)*Proteus* species(1.77% and 0.72%), *Citrobacter* species (1.77% and 0.72%) respectively. *Burkholderia* spp (1.33%) was isolated only from IPD samples.[Figure 3& Figure 4].

Most of the GNBs showed good susceptibility towardscarbapenems like imipenem & meropenem. However, lower susceptibility was observed against cephalosporins, quinolones, aminoglycosides and cotrimoxazole. None of the isolated GNB exhibited resistance to colistin except for the intrinsic resistant ones. [Table 3 & 4]

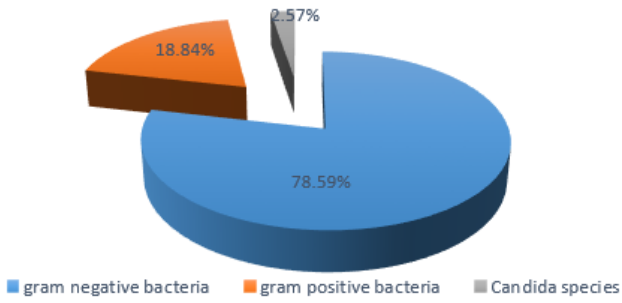

Figure 1: Distribution of culture positive isolate

Table 1: IPD and OPD Distribution of isolated GNB (n=367)

Unit	Number	Percentage (%)
IPD	227	61.85%
OPD	140	38.15%
Total	367	100%

Table 2: Gender wise distribution of Gram negative bacteria (n=367)

Gender	Number	Percentage (%)
Male	210	57.22%
Female	157	42.78%
Total	367	100%

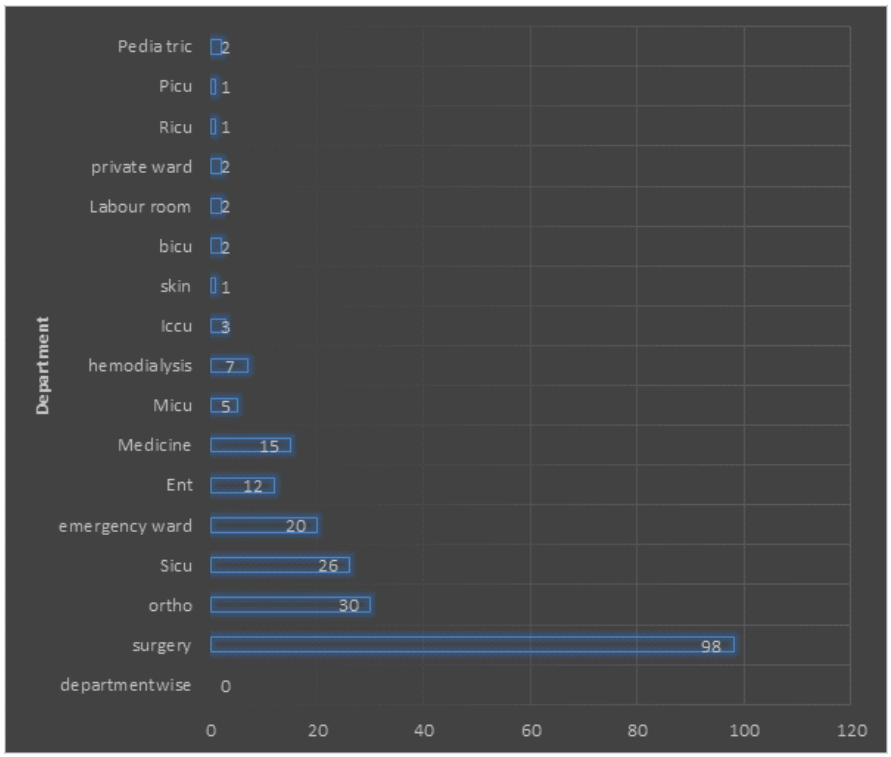

Figure 2: Location wise distriburion of isolates

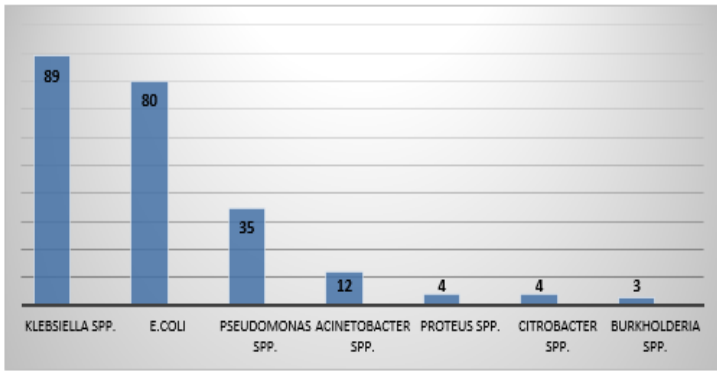

Figure 3: Profile of GNB from IPD samples

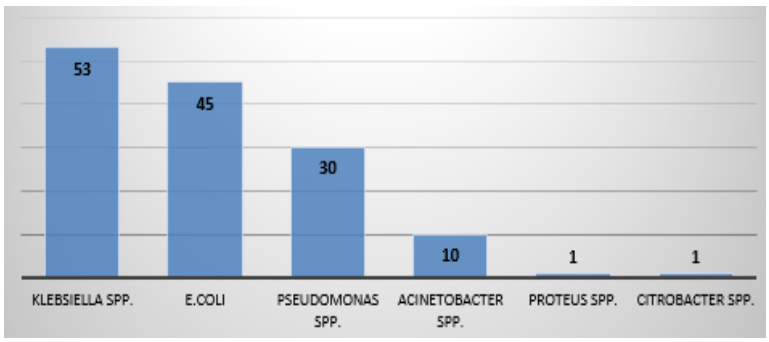

Figure 4 : Profile of GNB from OPD samples

Table 3: Sensitivity pattern of isolates from IPD samples (n=227) (%)

Antibiotics	*Klebsiella* species	Escherichia coli	*Acinetobacter* species	Proteus species	*Citrobacter* species	*Pseudomonas* species	*Burkholderia* species
AMP	3	0	NT	40	4	NT	NT
PI	4	0	14	42	3	4	2
AMC	30	16	NT	34	6	NT	NT
A/S	10	0	12	50	6	NT	NT
PIT	15	48	20	5	15	19	15
TE	10	32	NT	IR	10	NT	NT
COT	8	16	25	16	12	NT	NT
CIP	4	24	22	20	13	25	NT
CFM	12	4	NT	10	13	NT	NT
CAZ	5	6	40	9	13	4	5
CTR	4	9	36	6	25	NT	NT
AT	4	4	NT	8	30	8	5
CPM	8	6	31	25	30	34	29
GEN	22	20	40	39	25	39	40
AK	18	21	40	40	30	40	42
TOB	20	30	42	44	31	45	40
C	60	60	NT	50	30	NT	NT
ETP	88	79	NT	75	82	NT	NT
MRP	90	79	90	79	82	89	81
IPM	90	80	90	85	92	88	88
CL	100	100	100	IR	100	100	100

NT- Not Tested IR- Intrinsically resistance

Table 4: Sensitivity pattern of isolates from OPD samples (N=140)(%).

Antibiotics	*Klebsiella* species	Escherichia coli	*Acinetobacter* species	*Proteus* species	*Citrobacter* species	*Pseudomonas* species
AMP	8	1	NT	10	0	NT
PI	0	1	5	8	2	8
AMC	0	0	NT	4	2	NT
A/S	6	2	4	4	10	NT

Continue.....

PIT	8	2	4	4	10	4
TE	5	0	NT	5	15	NT
COT	6	13	0	8	20	NT
CIP	15	13	6	9	35	10
CFM	18	13	NT	6	20	NT
CAZ	20	0	15	18	42	12
CTR	13	8	10	15	30	NT
AT	13	6	NT	14	30	30
CPM	18	2	10	35	36	28
GEN	20	18	9	40	55	15
AK	12	19	12	30	42	16
TOB	18	20	11	20	50	15
C	17	23	NT	25	60	NT
ETP	55	60	NT	30	65	NT
MRP	60	65	70	30	65	70
IPM	80	82	85	75	85	75
CL	100	100	100	IR	100	100

NT- Not Tested IR- Intrinsically resistant

(AMP-ampicillin, PI-piperacillin, AMC-amoxicillin/clavulanic acid, A/S-ampicillin-sulbactam, PIT-piperacillin/tazobactam, TE-tetracycline, COT-cotrimoxazole, CIP-ciprofloxacin, CFM-cefixime, CAZ-ceftazidime, CTR-ceftriaxone, AT-aztreonam, CPM-cefepime, GEN-gentamicin, AK-amikacin, TOB-tobramycin, ETP-ertapenem, MRP-meropenem, IPM-imipenem, CL-colistin).

Discussion

The rate of culture positivity in the present study was 28.77%. Culture positivity rate varying from 89.47% to 93% have been reported in different Indian studies.[5,9,10,11] Comparatively high rate (71.23%) of culture negativity in the present study may be due to following reasons; firstly, our center being a tertiary care hospital patients usually come to us after having sought medical advice from local doctors and having taken multiple or incomplete course of antibiotics, which might have led to sterile cultures in clinically suspected cases of SSTIs. Secondly, these infections may have been caused by certain other microorganisms which were not looked for like the anaerobic bacteria.

Our study showed predominance of Gram negative bacilli (GNBs) (78.59%). Similar findings have been reported by various authors.[10,12,13,14] Male predominance was seen in this study in both IPD and OPD patients. Similar findings were observed in previous studies[14,15]. Higher incidence in males may be due to more indulgence of males in outdoor activities thus more prone to trauma leading to suppurative infections.

In the present study, maximum number of pus samples were received from Surgery (43.17%) followed by Orthopedics (13.21%), SICU (11.45%), Emergency ward (8.81%), Medicine ward (6.60%) and ENT 12 (5.28%). Similar findings have been reported by other workers.[11,14,15]

In both the IPD & OPD samples, *Klebsiella* spp, was the predominant isolate followed by *E.coli*, *Pseudomonas* spp, *Acinetobacter* spp, *Proteus* spp, *Citrobacter* spp and *Burkholderia* spp. These findings are in complete agreement to several earlier studies done by Sharma *et al*[7], Grace *et al*[10], Rao *et al*[11] and Rameshkannan *et al*[4]. They also reported *Klebsiella* species as the predominant organism present in wound infections.

Majority of the clinical isolates of GNBs were resistant to various groups of antimicrobial agents. Emerging antimicrobial resistance towards high end antimicrobials is a matter of great concern. Such high level of resistance to newer drugs like meropenem and imipenem is an alarming situation and calls for the judicious use of carbapenems. Knowledge of the spectrum of microorganisms causing SSTIs and their susceptibility pattern is important for constitution of antibiogram of a particular hospital and to formulate antibiotic policy which is important while selecting appropriate empirical antibiotic therapy to prevent misuse and overuse of antibiotics. However, all our clinical isolates of GNB showed 100% susceptibility towards colistin.

Limitation

Due to lack of resources microorganisms like anaerobes, fungi and other atypical organisms were not looked for in this study. Mixed etiology of infection was not looked for and this also requires attention as these cases need to be treated with both the antibiotic and antifungal agents.

Conclusion

High level of resistance to various antimicrobial agents was observed in cases of SSTI and the emergence of antibiotic resistant strains has led to treatment failure. Therefore, knowledge of the bacterial profile and their antimicrobial susceptibility pattern is important for institution of empirical antimicrobial therapy for better patient outcome and reduction in treatment costs.

Source Of Funding: Nil

Conflict Of Interest: Nil

Ethical Clearance: Approval from the University Ethics Committee (Medical) of Swami Vivekanand Subharti University Meerut was taken before the commencement of this study via letter No: SMC/ UECM/2019/55/68/04, dated:26/12/2019

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