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BACTERIAL PROFILE AND ANTIMICROBIAL SUSCEPTIBILITY PATTERNS OF SUSPECTED COMMUNITY-ACQUIRED PNEUMONIA PRESENTING IN TERTIARY CARE HOSPITAL IN SOUTH GUJARAT

Medical Microbiology

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ABSTRACT

We are presenting an original research article , depicting the prevalent bacterial profile and antimicrobial susceptibility patterns of suspected community acquired pneumonia presenting in tertiary care hospital in south Gujarat and prepare a local antibiogram based on it, so that antibiotics can be used judicially. A retrospective study was conducted for sputum samples collected at SMIMER, Surat during a span of 14 months , with a total 773 samples collected. Most of the organisms were found to be sensitive to fluoroquinolones , third and fourth generation cephalosporins, Carbapenems, aminoglycosides in our study.

AIMS

- To isolate most common bacterial pathogen causing Community Acquired Pneumonia (CAP) in our region
- To prepare local antibiogram for suspected CAP for the institute
- To help guide the judicious and rational use of antimicrobials while treating community acquired pneumonia

KEYWORDS

antibiogram , community acquired pneumonia , susceptibility

INTRODUCTION

Majority of suspected Community Acquired Pneumonia patients are treated empirically.Selection of appropriate antibiotic treatment is becoming increasingly difficult because the epidemiology of CAP is changing due toantimicrobial resistance and the causative CAP pathogens differ between countries and regions.

Misuse of antibiotics has resulted in increased antibiotic selection pressure that can affect resistance locally and globally by clonal dissemination .

METHODOLOGY

This institutional-based retrospective study was conducted for sputum samples collected and sent to the Bacteriology Laboratory at SMIMER, Surat from January 2021 to April 2022. A total of 773 sputum samples were evaluated for patients who presented to the OPD and were admitted in SMIMER hospital with suspected pneumonia.

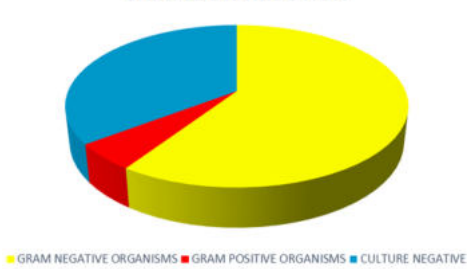
To be eligible, patients were required to have sputum culture and sensitivity results available.

Sputum samples received at the lab Gram's stain of sputum smear done to ensure sample is good quality according to BARTLETT's Grading system? Good quality sputum cultured on Blood agar and MacConkey agar Species identification done on the basis of biochemical reactions and Antibiotic Sensitivity testing done by Modified Kirby Bauer Disk Diffusion method and standard CLSI(Clinical Laboratory and Standards Institute) guidelines used to measure sensitivity zones .

Observations And Analysis

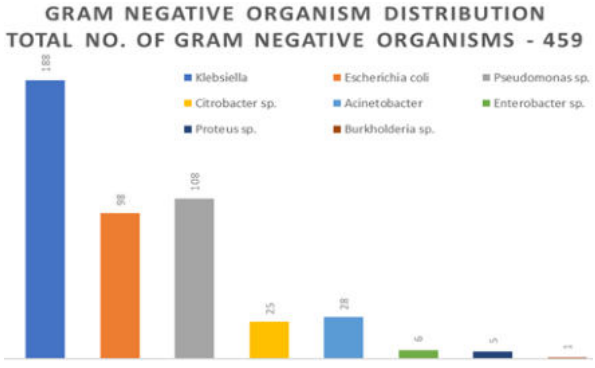
Out of 773 sputum samples evaluated, 65% were culture positive (n=500) .

Out of 500 culture positive samples, 459 showed Gram-negative organism isolates and only 41 Gram positive isolates were found



Graph1 showing sample distribution of organisms (Gm negative - 59% , Gm positive - 5 %

Culture negative - 35%)



Graph 2 : depicting distribution of Gm negative organisms

Table 1 depicting the Gm negative antibiogram for CAP-for year Jan 2021-2022

GRAM NEGATIVE ANTIBIOGRAM COMMUNITY ACQUIRED PNEUMONIA FOR JANUARY 2021 TO APRIL 2022

TOTAL NO. OF SPUTUM SAMPLES : 773

% OF ISOLATE	GRAM NEGATIVE ORGANISM	NO. OF ISOLATES	ANTIBIOTICS																				
			CEFUROXIME (CRX)	CEFIXIME(CFM)	CEFTRIAXONE (CTR)	CEFOTAXIME (CTX)	CEFOPERAZONE (CPZ)	CEFTAZIDIME (CAZ)	CEFEPIME (CPM)	AMOXICILLIN + CLAVULANIC ACID (AMC)	PIPERACILLIN TAZOBACTAM (PTZ)	CEFOPERAZONE SUBACTAM (CPS)	AMIKACIN (AK)	GENTAMICIN (GEN)	CIPROFLOXACIN (CIP)	LEVOFLOXACIN (LE)	CO-TRIMOXAZOLE (COT)	ERTAPENEM (ETP)	MEROPENEM (MRP)	DORIPENEM (DOR)	AZITHROMYCIN (AT)	POLYMYXIN B (PB)	COLISTIN (CL)
37.60%	Klebsiella	188	41%	23%	65%	62%	60%	59%	62%	20%	66%	100%	75%	80%	82%	69%	73%	30%	75%	88%	-	66%	-	100%
19.60%	Escherichia coli	98	13%	11%	27%	21%	13%	13%	39%	25%	59%	-	70%	85%	81%	28%	39%	24%	55%	91%	-	39%	-	100%
21.60%	Pseudomonas sp.	108	-	-	-	93%	94%	89%	90%	26%	93%	83%	95%	93%	92%	93%	93%	33%	58%	93%	92%	87%	98%	100%
5%	Citrobacter sp.	25	60%	57%	86%	59%	70%	40%	44%	57%	50%	-	80%	78%	61%	61%	72%	36%	100%	83%	-	67%	-	100%
1.60%	Acinetobacter	28	29%	17%	33%	30%	29%	18%	15%	25%	38%	-	46%	44%	44%	63%	88%	23%	17%	75%	-	27%	-	100%
1.20%	Enterobacter sp.	6	100%	100%	100%	50%	100%	60%	60%	17%	80%	-	83%	80%	80%	60%	60%	25%	100%	80%	-	60%	-	100%
0.20%	Burkholderia sp.	1	-	-	100%	100%	-	-	-	100%	-	-	100%	-	-	-	-	-	-	-	-	-	-	100%
0.20%	Proteus sp.	5	50%	33%	67%	50%	75%	-	50%	20%	100%	-	80%	100%	100%	100%	100%	60%	67%	100%	-	-	-	100%
	TOTAL	459																						

Table 2 depicting the Gm positive antibiogram for CAP-for year Jan 2021-2022

GRAM POSITIVE ANTIBIOGRAM COMMUNITY ACQUIRED PNEUMONIA FOR JANUARY 2021 TO APRIL 2022

TOTAL NO. OF SPUTUM SAMPLES : 773

% OF ISOLATE	GRAM POSITIVE ORGANISM	NO. OF ISOLATES	ANTIBIOTICS											
			AZITHROMYCIN (AZM)	COTRIMOXAZOLE (COT)	LINEZOLID (LZ)	CIPROFLOXACIN (CIP)	LEVOFLOXACIN (LE)	CLINDAMYCIN (CD)	AMOXICILLIN + CLAVULANIC ACID (AMC)	TEICOPLANIN (TEI)	PENICILLIN (P)	CEFOXITIN (CX)	VANCOMYCIN (VA)	CEFUROXIME (CXM)
2.60%	Staphylococcus aureus	13	17%	42%	100%	85%	92%	85%	25%	100%	38%	54%	100%	62%
0.20%	CONS	1	-	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
3%	Enterococci	15	13%	33%	80%	53%	73%	40%	27%	87%	27%	27%	87%	33%
2.40%	Streptococcus sp.	12	17%	8%	92%	50%	50%	67%	-	100%	25%	-	100%	17%
	SUM	41												

In our study we found high culture positivity rate for suspected community acquired pneumonia.

The most common CAP causing bacterial pathogen was Klebsiella pneumoniae (n=188, 37.6%) followed by Pseudomonas aeruginosa (n=108, 21.6%) followed by Escherichia coli (n=98, 19.6%).

Klebsiella and Pseudomonas isolates were found to be sensitive to third and fourth generation cephalosporins, fluoroquinolones (ciprofloxacin, levofloxacin) , aminoglycosides (gentamicin, amikacin), Carbapenem, and combination drugs such as Piperacillin/Tazobactam , Ticarcillin Clavulanic acid, Cefoperazone sulbactam , Monobactam antibiotics.

Resistance was found against Cefuroxime(43%), Cefixime(77%), Amoxicillin Clavulanic acid (80%), Co-trimoxazole (70%) among Klebsiella isolates.

Pseudomonas isolates were resistant to Co-trimoxazole (67%)

Escherichia coli showed resistance to a lot of antibiotics commonly used in empirical treatment of CAP – second, third & fourth generation cephalosporins (almost 70%, Fluoroquinolones (ciprofloxacin [72%], levofloxacin [61%]), Amoxicillin Clavulanic acid (80%), Co-trimoxazole (70%)

Figure 1 showing Growth of Pseudomonas aeruginosa on MacConkey agar

Figure 2 showing Growth of Klebsiella pneumoniae on MacConkey agar

DISCUSSION

In this study, we found high culture positivity rate of around 65% for suspected community acquired pneumonia patients , with majority of Klebsiella pneumoniae, Pseudomonas aeruginosa and Escherichia coli isolates. Only 2.4% of isolates were Streptococcus species and 2.6% were Staphylococcus aureus. Gram negative organisms were sensitive to Piperacillin-tazobactam (72%), Ticarcillin clavulanic acid (90%), Cefoperazone sulbactam(80%), fluoroquinolones (Levofloxacin-68.3% , Ciprofloxacin-63%), aminoglycosides (Amikacin – 86% , Gentamicin -85%), Carbapenems (76%), third and fourth generation cephalosporins(60%) . Gram positive organisms showed sensitivity towards Linezolid (90%), Vancomycin (95%), Teicoplanin, Clindamycin.

As per Gupta, et al., National pneumonia guidelines, yield of sputum culture varies from 34% to 86% .In our study, organism was found in 65% of sputum culture reports; it is recommend sending a routine sputum culture with Gram stain to optimize antibiotic therapy for each individual patient as well as to monitor for drug-resistance among pathogens.

Woodhead et al., in a study found that in non-severe CAP oral β lactam antibiotics, macrolides, or fluoroquinolones are equally effective when judged by clinical cure and mortality. They recommended that β lactam antibiotic (with macrolides and tetracyclines as good alternatives in individuals who are hypersensitive to penicillin) should usually remain the preferred therapy for patients with non-severe community acquired pneumonia managed in the community or in hospital and among β lactam antibiotics, as oral cephalosporins have poor pharmacokinetics it would seem that amoxicillin or amoxicillin clavulanate should usually be the first choice for therapy. In our study population, Amoxicillin Clavulanic acid has shown only 20% sensitivity.

Promoting the practice of sending sputum samples for culture and antibiotic sensitivity testing before beginning the antibiotic therapy for the patient is important . Identification of an unexpected pathogen allows narrowing of initial empiric treatment , thereby decreasing antibiotic selection pressure & lessening the risk of resistance. DE-ESCALATION or MODIFICATION of antibiotic therapy after the organism has been known is becoming a highly recommended approach as a part of antimicrobial stewardship practices. Without culture and susceptibility data , trends in resistance cannot be followed accurately and appropriate empirical therapeutic regimen are harder to devise.

Choosing the proper antibiotics as initial empiric therapy & later streamlining as per the culture sensitivity pattern is critical in outcome of CAP. Important considerations include penetration into respiratory secretions, spectrum of activity and antimicrobial resistance. These factors limit the usefulness of drugs such as amoxicillin, erythromycin and trimethoprim-sulfamethoxazole

Extended-spectrum β-lactamase (ESBL)-producing bacilli are the generic designation for Gram-negative bacilli producing β-lactamase that have acquired the ability to degrade third- and fourth-generation cephalosporins and monobactams. This class of bacteria includes four species (Escherichia coli, Klebsiella pneumoniae, Klebsiella oxytoca, and Proteus mirabilis) that the Clinical Laboratory and Standards Institute (CLSI) suggests should be targeted for the detection of ESBL. Fluoroquinolones or Carbapenems should be used to treat ESBL producing bacteria.

CA-MRSA

(COMMUNITY ACQUIRED METHICILLIN RESISTANT STAPHYLOCOCCUS AUREUS)CAP due MRSA may be caused due to classic hospital acquired strains or genotypically and phenotypically distinct community acquired strains.Most infections with these strains have been acquired by either directly or indirectly by contact with the healthcare environment . However, in some hospitals CA-MRSA strains are displacing the classic hospital acquired strains –a trend suggesting that newer strains may be more robust and blurring this distinction. Linezolid or Vancomycin plus Clindamycin is used to treat CA-MRSA.

In our study :

- 6 out of 13 Staphylococcus aureus isolates tested Methicillin Resistant
- 11 ESBL positive out of 77 Klebsiella pneumoniae isolates tested for ESBL
- 23 ESBL positive out of 52 Escherichia coli isolates tested for ESBL

CONCLUSIONS

- ✓ Sputum culture is an essential step in knowing microbiological profile and drug sensitivity among patients with CAP.
- ✓ Most of the organisms were found to be sensitive to fluoroquinolones (Levofloxacin), third and fourth generation cephalosporins, Carbapenems, aminoglycosides (Amikacin,

Gentamicin), Piperacillin-tazobactam , Ticarcillin clavulanic acid , Cefoperazone sulbactam.

- ✓ De-escalation or Modification of antibiotic therapy after the organism and AST profile has been known remains an important step Antimicrobial Stewardship programme.

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