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ORIGINAL RESEARCH ARTICLE

Sphingomonas paucimobilis:An emerging pathogen in intensive care units.

[1]Dr. nidhi bhalodia, [2]Dr. mihir bhalodia, [3]Dr.Tanuja javadekar, [4]Dr.Sucheta lakhani, [5]Dr. Himani pandya

(1) *Assistant Professor, Department of Microbiology, SBKSMI&RC, Sumandeep Vidyapeeth Piparia, Vadodara*
ORCID Registration No.:0009-0007-6255-6767

(2) *Assistant Professor, Department of Pathology, SBKSMI&RC, Sumandeep Vidyapeeth, Piparia, Vadodara*
ORCID Registration No.: 0009-0007-7023-125X

(3) *Professor and Head, Department of Microbiology, SBKSMI&RC, Sumandeep Vidyapeeth, Piparia, Vadodara*

(4) *Professor, Department of Microbiology, SBKSMI&RC, Sumandeep Vidyapeeth, Piparia, Vadodara*

(5) *Associate Professor, Department of Microbiology, SBKSMI&RC,Sumandeep Vidyapeeth, Piparia, Vadodara*

CORRESPONDING AUTHOR: DR. NIDHI BHALODIA

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ABSTRACT:

INTRODUCTION:
Sphingomonas paucimobilis is ubiquitous in nature and widely found in soil, water resources, and hospital environments. *Sphingomonas paucimobilis* is mostly associated with nosocomial infection in immunocompromised patients. Various studies showed that diabetes mellitus, alcoholism, and malignancy are significant risk factors for *S. paucimobilis* infection.

OBJECTIVES
The present study aimed to determine the clinical spectrum of *Sphingomonas paucimobilis* with its associated risk factors and antimicrobial susceptibility pattern**.**

MATERIAL AND METHODS:

In the present study, clinical and microbiological profile of *Sphingomonas paucimobilis* isolated from various samples collected between July 2021 to August 2023 were considered.

RESULTS:
The present study was conducted between July 2021 to August 2023 in which *Sphingomonas paucimobilis* was isolated in 40 patients. Out of 40 patients, 26 were male and 14 were female. Out of 40,20 patients belonged to age group more than 60 years. Our study analysis showed that , diabetes mellitus (odds ratio 0.3, 95% Confidence interval 0.239-0.839, *p* value= 0.0001), alcoholism (odds ratio 4.4, 95% CI 1.283-15.396, *p* value= 0.011324) , prematurity(odds ratio 16.07, 95% CI 1.994-129.5, *p value* = 0.001965) and chronic lung disease (odds ratio 2.80, 95% CI 1.1942-6.591, *p* = 0.0289) are significant risk factors for *S paucimobilis* infection. The organism showed 75% sensitivity to Cefepime,70% sensitivity to Amikacin, Meropenem, Ceftriaxone and Cefoperazone/sulbactam.

CONCLUSION:
S. paucimobilis is an emerging pathogen of clinical importance in both immunocompromised as well as immunocompetent host.. The major risk factors include diabetes, chronic lung disease, long-term steroid usage, and prematurity in newborns

.**KEYWORDS:** *Sphingomonas paucimobilis*, diabetes mellitus, prematurity

Introduction

The genus *Sphingomonas* includes 12 species out of which human pathogen of clinically importance is *Sphingomonas paucimobilis*.[1] This organism was formerly known as Pseudomonas paucimobilis [2]. It is ubiquitous in nature and widely found in soil, water resources and hospital environment.[3] The pathogen was recovered from nebulizers, haemodialysis fluid, sterile drug solution and various medical equipment.[4] *Sphingomonas paucimobilis* is mostly associated with nosocomial infection in immunocompromised patients [5]. It has a wide clinical spectrum which includes: community and hospital-acquired bacteraemia, catheter-related peritonitis, meningitis, ventriculoperitoneal shunt infection, surgical site infection, postoperative endophthalmitis, catheter-associated urinary tract infection, brain abscess and visceral abscesses.[6,7] Various studies showed that diabetes mellitus, alcoholism, and malignancy are leading cause for *Sphingomonas paucimobilis* infection [7,8]. Few cases of ventilator-associated pneumonia in intensive care units have been reported. Though *S. paucimobilis* is organism of low virulence mainly due to the absence of endotoxins but it can cause severe invasive infections like septic arthritis, necrotizing soft tissue infection and lower respiratory tract infection in cystic fibrosis patients.[7,8,10]

Sphingomonas paucimobilis is gram negative ,non fermentative, non sporing bacilli .It is a strict aerobe and shows a positive catalase test and weak oxidase test [7]. It possesses a single polar flagellum but exhibit weak motility. It produces characteristic yellow pigmentation on blood agar plate with no haemolysis. [1,9]

Sphingomonas paucimobilis can survive in low nutrient environment due to its ability to degrade various organic substances. Unlike other gram-negative bacilli it does not possess a lipopolysaccharide membrane but expresses different glycosphingolipids on its outer membrane.[1,7,10] The glycosphingolipids act as a substitute for lipopolysaccharide and protect bacteria from various antimicrobial agents. The exopolymers produced by *Sphingomonas paucimobilis* help in biofilm formation.[10,11]

The spectrum of antibiotics effective against *Sphingomonas paucimobilis* includes β-lactams, β-lactam/β-lactamase inhibitor, third and fourth generation cephalosporins, fluoroquinolones, and carbapenems.[2,10,11] Antibiotics like penicillin and first-generation cephalosporins are not effective due to the production of beta-lactamase enzyme.[1,13] Most of the patient showed good prognosis without any major complications .Few complicated lethal cases were reported in immunocompromised patients.

Objectives

The aim of present study was to determine clinical spectrum of *Sphingomonas paucimobilis* with its associated risk factors and antimicrobial susceptibility pattern**.**

Material & Method

In the present study, clinical and microbiological profile of *Sphingomonas paucimobilis* isolated from various samples collected between July 2021 to August 2023 were considered. The study was carried out at rural based tertiary care hospital Vadodara, Gujarat. All samples were collected with aseptic precaution and processed at diagnostic laboratory.

The clinical data was obtained from 40 patient which included age ,underlying co-morbid conditions, surgical interventions, clinical manifestation and outcome of patient. The information regarding prophylactic antibiotics administered to patient was also collected.
The blood culture bottle were processed in BD BACTEC FX 40 instrument.

The bacterial identification and antibiotic susceptibility testing was done by Vitek 2 Compact bioMérieux. The antibiotic test panel included Ampicillin, Minocycline, Amikacin ,Gentamicin , Ceftazidime, Ceftriaxone, Cefepime , Piperacillin/tazobactam, Meropenem, Imipenem, Ciprofloxacin, trimethoprim/sulfamethoxazole and cefoperazone/sulbactum. The susceptible breakpoints were considered according to Clinical and Laboratory Standards Institute guidelines 2023.

Staphylococcus aureus ATCC 25923, *Escherichia coli* ATCC 25922, and *Pseudomonas aeruginosa* ATCC 27853 were used as control strains .

Result

The present study was conducted between July 2021 to August 2023 in which *Sphingomonas paucimobilis* was isolated in 40 patients. Out of 40 patients, 26 were male and 14 were female. Out of 40,20 patients belonged to age group more than 60 years. The demographic characteristics are demonstrated in Table 1. Out of 40,10 patients had community-acquired infection and 30 patients showed hospital-acquired infection which was statically significant. In 40 patients

pneumonia (40%) was the major source of infection followed by urinary tract infection (22.5%) and Catheter-related bloodstream infection (15%) as shown in Table2.

Table:1

Demographics	**Particulars**	**Number (%)**
Gender	Male	26 (65%)
	Female	14(35%)
Age	Upto 1year	2 (5%)
	1-20	4 (10%)
	20-40	2 (5%)
	40-60	12 (30%)
	More than 60	20 (50%)

Table:2

Sr.No.	Source of infection	N =40 (%)	Community acquired infection	Hospital acquired infection	P value
1	Pneumonia	16 (40%)	2	14	0.025
2	CNS Infection	4 (10%)	1	3	0.412
3	Urinary tract infection	9 (22.5%)	4	5	0.08
4	Primary bacteremia	3 (7.5%)	2	1	0.079
5	Catheter related blood stream infection	6 (15%)	0	6	0.05
6	Soft tissue infection	2 (5%)	1	1	-

Our study analysis showed that , diabetes mellitus (odds ratio 0.3, 95% Confidence interval 0.239-0.839, *p* value= 0.0001), alcoholism (odds ratio 4.4, 95% CI 1.283-15.396, *p* value= 0.011324) , prematurity(odds ratio 16.07, 95% CI 1.994-129.5, *p value* = 0.001965) and chronic lung disease (odds ratio 2.80, 95% CI 1.1942-6.591, *p* = 0.0289) are significant risk factors for *S paucimobilis* infection. Table 3 shows the associated risk factors.

Table:3

Sr.No.	Underlying risk factors	N (%)	Adjustable Odd Ratio	95% CI	P value
1	Diabetes mellitus	29(72.5%)	0.3	0.239-0.839	0.0001(s)
2	Malignancy	2(5%)	0.714	0.143-3.559	0.680 (ns)
3	Alcoholism	8(20%)	4.4	1.283-15.396	0.011324(s)
4	Chronic lung disease	11(27.5%)	2.80	1.1942-6.591	0.028907(s)
5	Chronic kidney disease	3(7.5%)	0.764	0.198-2.948	0.696 (ns)
6	Prematurity	9(22.5%)	16.07	1.994-129.5	0.001965(s)
7	Long term steroid usage	4(10%)	0.676	0.200-2.284	0.527(ns)

The *S paucimobilis* showed maximum antibiotic sensitivity to Aminoglycosides, carbapenems and third and fourth-generation cephalosporins. The organism showed 75% sensitivity to Cefepime,70% sensitivity to Amikacin, Meropenem, Ceftriaxone and Cefoperazone and sulbactam.

Antibiotic sensitivity pattern of *Sphingomonas paucimobilis is depicted in Table 4.*

Name of antibiotic	% Sensitivity
Ampicillin	20%
Ciprofloxacin	50%
Minocycline	55%
Gentamicin	65%
Amikacin	70%
Imipenem	60%
Meropenem	70%
Piperacillin/tazobactam	50%
Ceftazidime	65%

Table:4

Ceftriaxone	70%
Cefepime	75%
Cefoperazone and sulbactum	70%
Trimethoprim/sulfamethoxazole	50%

DISCUSSION

The *Sphingomonas paucimobilis* was first isolated in 1979 and was renamed as *Sphingomonas paucimobilis* in 1990. It is ubiquitous in nature and widely found in soil, water resources and hospital environment. It causes variety of infections affecting both healthy and immunocompromised host. The clinical syndrome includes ventilator-associated pneumonia, primary bacteremia, urinary tract infection, soft tissue infections, septic arthritis, meningitis, and endophthalmitis.

The present study was conducted between July 2021 to August 2023 in which *Sphingomonas paucimobilis* was isolated in 40 patients. Out of 40 patients, 26 were male and 14 were female. Out of 40,20 patients belonged to age group more than 60 years. Out of 40 ,10 patients had community-acquired infections and 30 patients had hospital-acquired infections which was statistically significant. In 40 patients pneumonia (40%) was the major source of infection. Our study analysis showed that diabetes mellitus, alcoholism, prematurity, and chronic lung disease are leading causes for *S paucimobilis* infection.

The *S paucimobilis* showed maximum antibiotic sensitivity to Aminoglycosides, carbapenems and third and fourth-generation cephalosporins. The organism showed maximum sensitivity 75% to Cefepime. Thus third and fourth-generation cephalosporins can be used for empirical treatment. Antibiotics like penicillin and first-generation cephalosporins are not effective due to the production of beta-lactamase enzyme..

Our findings were similar to the study carried out by Ranjana Rohilla et al[(10)] in which Diabetes mellitus and long-term steroid usage were major associated risk factors. Third and Fourth-generation cephalosporins like ceftriaxone and cefepime were found to be the most susceptible drugs.

The antibiotic sensitivity in our study was similar to the study carried out by Shyamasree Nandy et al [(12)] in which the organism was found to be susceptible to quinolones, carbapenems and aminoglycosides.

In the study carried out by Han-Siong Toh et al diabetes, mellitus ($p = 0.03$), and alcoholism ($p = 0.05$) were significant risk factors for *S paucimobilis* primary bloodstream infection.

CONCLUSION

S. paucimobilis is an emerging pathogen of clinical importance in both immunocompromised as well as immunocompetent hosts. It is ubiquitous in nature and found in hospital environments. It can lead to both hospital and community-acquired infections. The major risk factors include diabetes, chronic lung disease, long-term steroid usage, and prematurity in newborns. Third and fourth-generation cephalosporins, carbapenems, and aminoglycosides can be used for prophylactic treatment.

CONFLICT OF INTEREST : NONE

SOURCE OF FUNDING: NONE

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