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Prevalence and Antibiotic Susceptibility in Proteus Species Isolated From Diverse Clinical Samples in a Tertiary Care Hospital

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Original Research Article

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Abstract: Proteus species are known to cause multitude of infections in both hospital and community based environment. Proteus species are known to be multidrug resistant and difficult to treat in various clinical situations. Improper antibiotic therapy and misuse of antibiotics in clinical settings is a major global concern in the recent years. This study aimed at investigating the prevalence and the antibiotic susceptibility pattern of proteus species in a tertiary care hospital isolated from various clinical samples.
Keywords: Proteus, antibiotic, hospital, multidrug resistant.

INTRODUCTION

The intestine of human beings harbors a variety of aerobic and mostly anaerobic organisms. Most of these organisms are normal commensals and symbionts. Outside the intestine, they have a role to play as pathogens which are the most frequent reasons of wound infections, urinary tract infections, nosocomial and various other types of infection. Proteus species are differentiated from most other genera of enterobacteriaceae by their ability to swarm on agar plates [1]. The *Proteus* spp. is characteristic in causing urinary tract infections involving struvite stones. *Proteus* spp. hydrolyzes urea into ammonia and carbon dioxide by production of enzyme urease and thereby raises urinary pH which induces precipitation of magnesium-ammonium phosphate salts resulting in the formation of struvite stones. These struvite stones serve as a nidus for the infection to persist or can lead to obstruction of the urinary tract promoting infection. Proteus ranks third as the cause of hospital-acquired infections [2].

MATERIALS AND METHODS

Different clinical samples such as Urine, wound swab, tracheal aspirate, ear swab, Body fluids and Blood, were collected from 1013 Patients from Sree Balaji Medical College and hospital, Chennai. Clinical samples were cultured to isolate the organisms. The clinical samples collected were aseptically inoculated on plates of Blood agar, Chocolate agar Cystine-Lactose-Electrolyte-Deficient (CLED) agar and MacConkey agar and incubated at 37ºC for 24 h. The morphological characteristics of the colonies including size, shape, colour, pigmentation and haemolytic nature were recorded. Suspected Proteus colonies were isolated and identified through biochemical tests. Antimicrobial susceptibility test Susceptibility to antimicrobial agents was determined by using the disk diffusion method. The following antimicrobial agents were used: ampicillin, Amoxy clav, gentamycin, cefoxitin, cotrimoxazole, amikacin, ceftazidime, aztreonam, piperacilline tazobactam, imipenem, ciprofloxacin, and meropenem. The diameter of zone of growth-inhibition observed was measured and compared to the chart provided by CLSI [3].

RESULTS AND DISCUSSION

Total 1013 clinical samples were collected in the period from 22/11/2017 to 22/3/2018 from Sree Balaji medical college and research institute, Chennai. Clinical samples were screened for Proteus spp. It is found that 59 isolates were identified as Proteus spp. representing about 5.82% of all positive samples isolated from Urine, pus, Blood, tracheal aspirate, ear swab and body fluids (Fig :1). The percentage of Proteus spp. isolated from clinical samples from various other studies has reported similar results. Satisfaction *et al*. reported that P. mirabilis accounts for approximately 3.04 % of nosocomial infections [4]. In the same trend Pandey et al. reported that P. mirabilis strains were isolated from 1.12% of all positive samples isolated from urine, wounds and ulcers [5]. Also, Feglo *et al*. reported a prevalence rate of 8.4 % of Proteus species collected from clinical samples [6], whereas Jaber MH *et al*. reported a high prevalence of 28.75%, in his study [7].

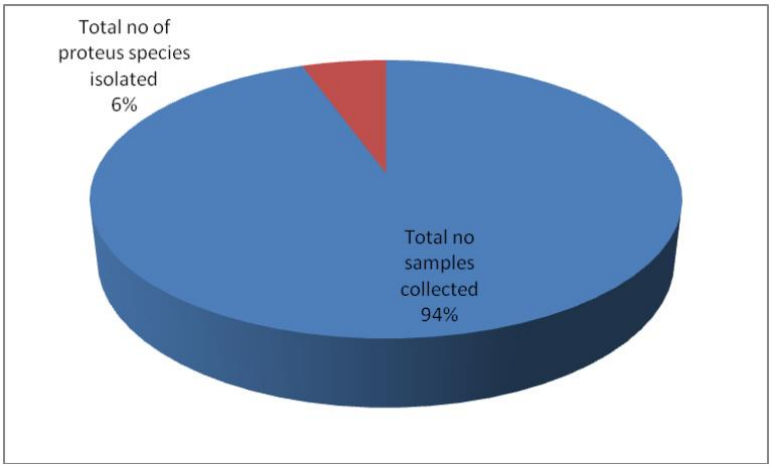

Fig-1: Percentage of total proteus spp. isolated from clinical samples

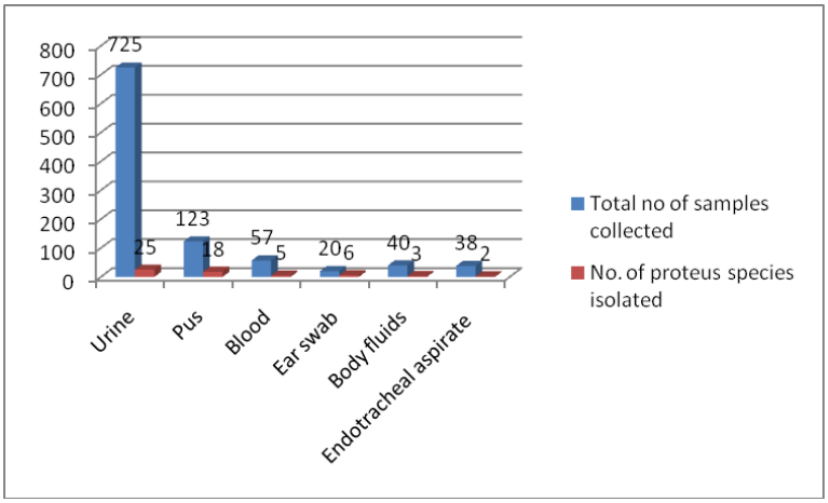

Fig-2: Total no: of positive Proteus spp. specimens isolated from different clinical samples

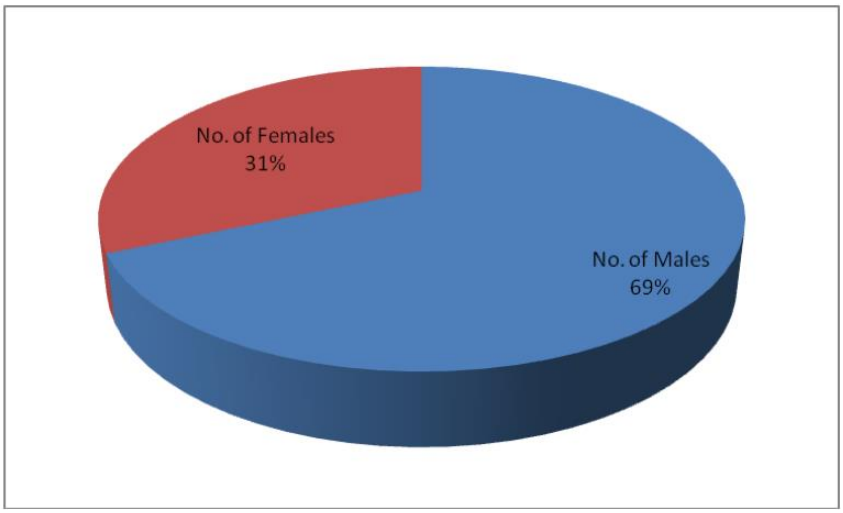

Fig-3: Percentage of gender wise distribution of males and females from proteus spp. isolated

In this study it was found that proteus species were isolated in high numbers from urine samples fig: 2.

It is found that forty four samples representing 75% of positive Proteus isolates were taken from male patients, while fifteen samples representing 25% of positive Proteus isolates were taken from female patients; (Fig: 3). Males were found

to be more susceptible than females in acquiring Proteus infections. Our prevalence in gender was similar to study done by Pandey *et al*. who showed 67.8% males and 32.14% females [5].

In our study, 3 Proteus species P. mirabilis, P. vulgaris & P. penneri were isolated at the rate of 52.54%, 30.5% & 16.94% respectively. (Fig: 4). P.mirabilis was the predominant species isolated from various clinical samples in different studies reported [5, 8]. *P. mirabilis* is associated commonly with both community-acquired and catheter-associated UTI, cystitis, pyelonephritis, prostatitis, wound infections, and infection in burns patients. They have also been associated less frequently in respiratory infections, chronic suppurative otitis media, endophthalmitis, and infections with CNS like. Meningitis and meningoencephalitis [9-12]. They are also frequently associated with UTI following catheterization [13]. Proteus species are also attributed in causing urinary calculi in patients with long standing UTI.

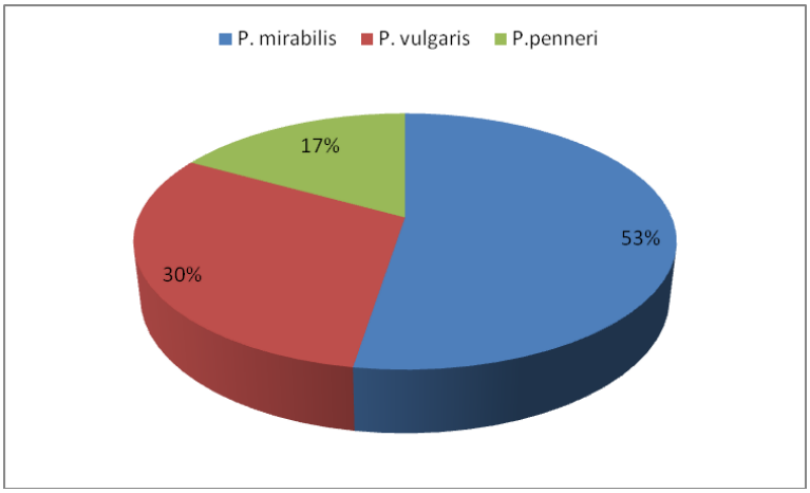

Fig-4: Species wise distribution of various proteus spp that was isolated

Imipenem is one of the most effective drug of resistant strains of gram negative bacilli [14]. In this study, results of antimicrobial susceptibility test revealed that Imipenem was the most effective antibiotic against Proteus spp with the sensitivity rate of 77.9%, which is followed by Meropenem with 74.8% sensitivity. Amikacin had a sensitivity rate of 76.3 % followed by Piperacillin- Tazobactam with 74.8 % (Table-5). Similar trends were seen in studies conducted by with Nita Pal *et al*. & Shenoy *et al*. [15, 16]. The Proteus spp in our study were moderately sensitive to ceftazidime, Amoxy clav Aztreonam, which were 65.35%, 66% & 63% respectively. All the isolates showed lower sensitivity rate of 18 % & 15.74% to Ampicillin & cotrimoxazole respectively. Resistance of 77-85% of Proteus spp. against ampicillin, cotrimoxazole, tetracycline, and chloramphenicol was reported by Feglo *et al*.[6] Similar kind of results were reported by Newman *et al*.[17].

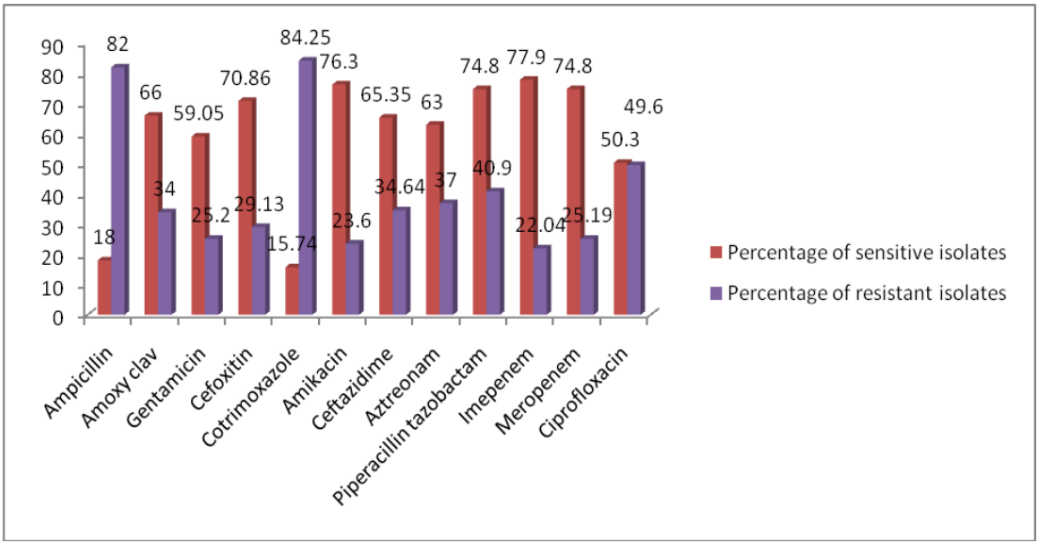

Fig-5: Percentage (%) of antimicrobial sensitivity of Proteus spp to various antibiotics

Based on the antibiotic resistance data provided trimethoprim or cotrimoxazole may no longer be viable treatment options for *P. mirabilis* infections. Quinolone resistance is also increasing, and *P. mirabilis* is almost uniformly resistant to nitrofurantoin, tetracycline, and polymyxins. The most appropriate treatment for *P. mirabilis* may be aminoglycosides, carbapenems (except imipenem), and 3rd generation cephalosporins. Recent *P. mirabilis* isolates were also mostly susceptible to augmentin, ampicillin-sulbactam, and piperacillin/ tazobactam. In general, treatment should be with intravenous agents (or oral therapy for quinolones) until fever has resolved. Correction of the underlying anatomical abnormality or removal of a urinary catheter is also frequently necessary [18].

In this study Proteus species were found to be multi drug resistant. Multidrug resistance in *P. mirabilis* is becoming increasingly common nowadays. SGI-1 (>*Salmonella* genomic island 1), an integrative mobilizable element of MDR *Salmonella* Typhimurim, has been detected in alarming numbers in Proteus mirabilis isolates in a study from france which in turn indicates that Proteus species could disseminate this MDR resistant element to other bacterial species [19, 20]. SGI-1 is indicated in resistance to a variety of older drugs which were previously used to treat infections but the MDR regions of SGI-1 from *P. mirabilis* isolates had complex moiety which is capable of mobilising these genes to other organisms jeopardizes use of third-generation cephalosporins and quinolones [21].

CONCLUSION

General Awareness about the resistance among the Gram negative bacterias especially in Proteus species is of concern because they are the potential reservoir of resistant genes that could be transferred to other pathogens. The rise in resistance to various commonly used antibiotics is alarming quite. Knowledge on the prevalence of species and their antibiotic resistance helps in administering appropriate antibiotic therapy.

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