

Prevalence of Multi-Drug Resistant Proteus Species from Isolates of Urine and Pus with Their Antibiogram



Medical Science

KEYWORDS:

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ABSTRACT

Aim: This study aims at determining the prevalence of different Proteus species in urine and pus samples and their antibiotic resistance pattern. Materials and methods: A total of 1620 samples comprising of 1230 urine and 390 pus were assessed by standard bacterial culture and biochemical reactions for Proteus. Antibiotic sensitivity testing was done by Kirby Bauer disc diffusion method according to CLSI Guidelines. Results: Out of 544 culture positive specimens from urine, 26 were identified as Proteus species. Similarly out of the 86 culture positive specimens from pus, 9 were Proteus species. From the 35 total Proteus isolates from urine and pus, 29 were MDR strains. Conclusion: It is important to identify Proteus isolates from clinical specimens promptly, due to their increasing multi-drug resistance. This will help the clinicians in starting specific therapy and also to prevent the emergence of drug resistance in the community.

Introduction:

The genus *Proteus*, a Gram negative pleomorphic bacilli belongs to the Tribe Proteae and Enterobacteriaceae family, widely spread in environment and forms the part of the normal microbial flora of gastrointestinal system⁽¹⁾. This saprophyte plays a major pathogenic role in human beings acquiring infection from community as well as hospital settings. *Proteus* has been positioned in third rank of causing nosocomial infection⁽²⁾. *Proteus vulgaris*, *Proteus mirabilis* being recognised widely as human pathogens among other species *myxofaciens* and *penneri*. *Proteus mirabilis* to be the most common cause of infection-related kidney stone, one of the serious complications of unresolved or recurrent bacteriuria⁽³⁾.

Proteus is one of the aetiological agents causing urinary tract infection (UTI) as it has predilection for upper UTI mainly because of structural abnormality in urinary tract, urinary bladder, kidney stone formation as it produces urease which liberates ammonia from urea. The alkaline conditions lead to the precipitation of phosphates and the formation of calculi in the urinary tract. Also it causes pyogenic lesions, wound infections, septicaemia, and meningitis rarely⁽⁴⁾. Various virulence factors which predisposes for its infection are fimbrial antigen adhering to uroepithelium, outer membrane proteins (OMP), hemolysin production, cellular invasive property, urease enzyme production, swarming motility through quorum sensing. All these factors are responsible for its colonization and progressive disease⁽⁵⁾.

More exposure of the bacteria to antibiotics resulting in its pharmacoresistance now-a-days. Broad spectrum β -lactam resistance mediated by extended spectrum β -lactam antibiotics is by the production of ESBL's enzyme which is plasmid mediated occurs by point mutation⁽⁶⁾. It resists even the third and fourth generation Cephalosporins making the bacteria multi-drug resistant⁽⁷⁾. Considering this public health problem evolves to introduce new therapy and use of higher antibiotics.

Material and methods:

Specimen: Samples received in diagnostic laboratory for investigation - Midstream urine (MSU) and Pus samples collected aseptically, obtained from patients attending private hospital.

Isolation:

Urine sample was inoculated in Blood agar, Mac Conkey agar. Pus sample in Blood agar, Mac Conkey agar and Chocolate agar. Inoculated culture medias was incubated at 37 C incubator aerobically for 24 hours.

Identification: The bacteria was identified by picking up the colony isolated from primary culture medium and Gram stain was done. Basic biochemical tests was performed for the confirmation of *Proteus* genus and its species.

Antibiotic Susceptibility Test:

The isolate was inoculated in peptone water and incubated at 37°C and was matched with 0.5 McFarland standard. β -lactam antibiotics including 1st, 2nd, 3rd generation cephalosporins, aminoglycosides, fluoroquinolones, trimethoprim-sulfamethoxazole were used to study the sensitivity and resistant pattern of *Proteus* spp.

Results:

Blood agar: Swarming growth

Mac Conkey agar: Non lactose fermenting colonies

Biochemical tests:

Indole	Positive- <i>Proteus vulgaris</i> Negative - <i>Proteus mirabilis</i>
Methyl red	Positive
Voges Proskauer	Negative
Citrate	Negative
Triple sugar iron agar	A/A with H ₂ S production
Urease	Positive
Mannitol motility medium	Fermented and motile
Phenyl pyruvic acid	Positive

Discussion:

In this study, we attempt to identify the number of *Proteus* spp in the samples of urine and pus. The total number of urine samples studied were 1230. out of this were 544 (44.2%) were culture positive. of which *Proteus* contributed to 26 (4.8%) of the positive cultures.

Among the pus samples, out of the 390, 86 (22.1%) were culture positive of which 9 (10.5%) were *Proteus* spp. This is similar to the study done by Nita and Nikita et al⁽⁸⁾, which shows higher incidence of *proteus* in urinary isolates than other specimens.

Out of the 26 urinary isolates and 7 isolates from the pus samples, males contributed to a higher number accounting for 65% and 77.7% respectively. This is in accordance with other studies done by Saxena and Bassett et al⁽⁹⁾, that shows higher incidence of *Proteus* infections in males compared to females.

Majority of the *Proteus* spp out of the total 35 were multi drug resistant showing resistance to Ampicillin, Amoxycylav, Cefuroxime and Ceftriaxone followed by resistance to Gentamycin, Ciprofloxacin, Ofloxacin, Cefpodoxime and Cotrimoxazole which is similar to the study published in 2013 by Jitendra Kumar et al⁽¹⁰⁾. Out of 35 *Proteus* strains isolated 29 (82.8%) were MDR. Among this the percentage of MDR strains isolated, *P.vulgaris* was 22(84.6%) and *P.mirabilis* was 7 (77.7%). Similar results were obtained in a study conducted at Ghana in 2006⁽¹¹⁾.

We isolated a total of 35 *Proteus* spp from urine and pus. Among them the predominant was *P.vulgaris* 26(74.3%) followed by *P. mirabilis* 9(25.7%) which is in contrast to other studies which revealed *Proteus mirabilis* as the most common species causing infections followed by *P. vulgaris* and *P. penneri*^(12,13,14)

Conclusion: *P. vulgaris*, *P. mirabilis*, *P. penneri* are the species implicated in *Proteus* infections. It is important to identify these isolates from clinical specimens promptly, due to their increasing multi-drug resistance. This will help the clinicians in starting specific therapy and also to prevent the emergence of drug resistance in the community.

Data Analysis:

Table 1: Distribution of the urine, pus sample and the positive cultures

Sample	No. of samples	No. of positive cultures	Percentage
Urine	1230	544	42.2%
Pus	390	86	22.1%
Total	1620	630	38.9%

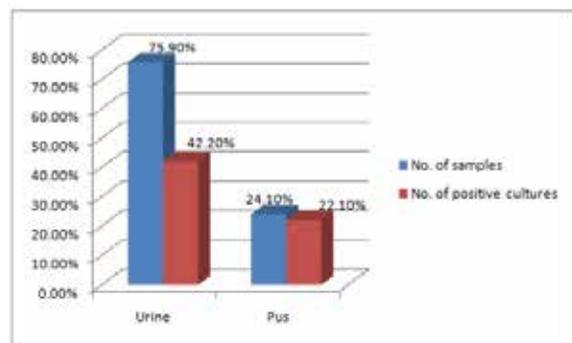


Table 2: Distribution of the urine sample population and the positive cultures

Sex	No. of urine sample	No. of positive urine cultures	Percentage	No. of <i>Proteus</i> spp. from urine	Percentage
Male	507	121	23.9%	17	14.1%
Female	723	423	58.5%	9	2.1%
Total	1230	544	44.2%	26	4.8%

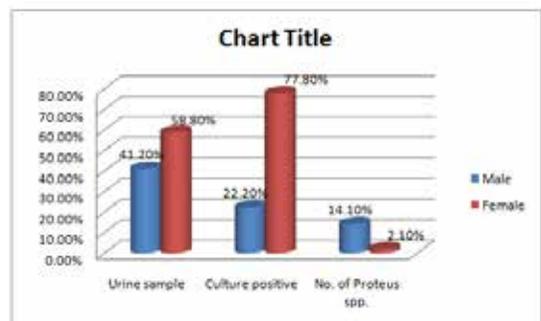


Table 3: Distribution of the pus sample population and the positive cultures

Sex	No. of pus sample	No. of positive pus cultures	Percentage	No. of <i>Proteus</i> spp. from pus	Percentage
Male	272	73	26.8%	7	9.6%
Female	118	13	11%	2	15.4%
Total	390	86	22.1%	9	10.5%

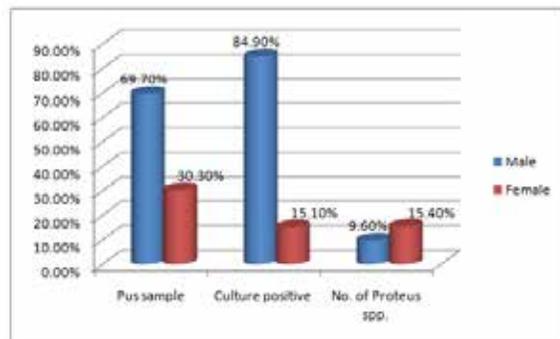
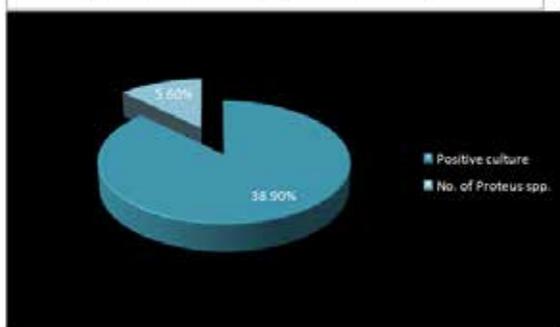
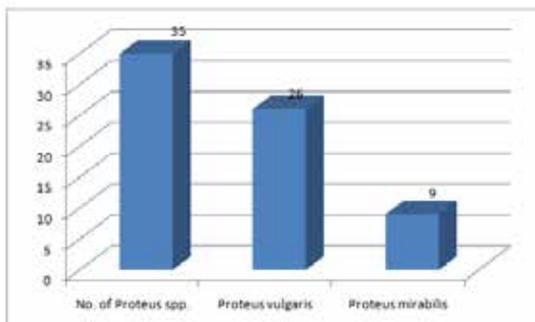
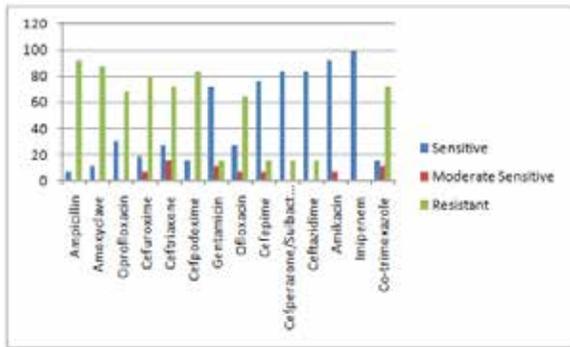


Table 4: Prevalence of *Proteus* species

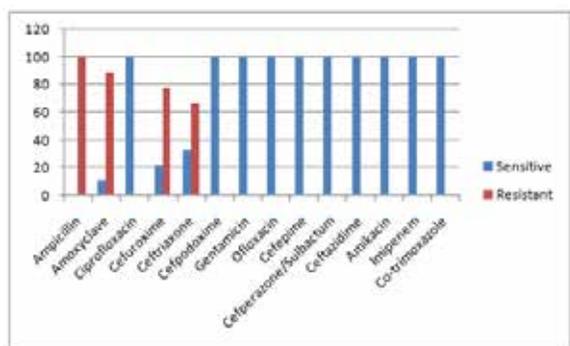
Culture	No.	Percentage
No. of positive cultures	630	
No. of <i>Proteus</i> spp.	35	
Prevalence of <i>Proteus</i> spp.		5.5%
<i>Proteus vulgaris</i>	26	74.3%
<i>Proteus mirabilis</i>	9	25.7%



Antibiotic resistance pattern of *Proteus vulgaris* in urine and pus samples



Antibiotic resistance pattern of *Proteus mirabilis* in urine and pus samples



REFERENCE

1. Jacobsen, S.M., Stickler, D.J., Mobley, H.L.T. and M.E. Shirtliff (2008). Complicated Catheter ---Associated Urinary Tract Infections due to *Escherichia coli* and *Proteus mirabilis*. *Clinical Microbiology Reviews*, 21(1): 26-59. | 2. De Champs, C., Bonnet, R., Siro, D., Chanal, C. and J. Siro (2000). Clinical relevance of *Pr. Mirabilis* in hospital patients: A two year survey. *J Antimicrob. Chemoth.* 45: 537-539 | 3. Coker, C.; Bakere, O.O. and H.L.T. Mobley (2000); H-NS is a repressor of the *Pr. mirabilis* urease transcriptional activator gene *ureR*. *J. Bacteriol.* 128 (9): 2649-2553 | 4. Orett (1999) Prevalence of *Proteus* species in urinary tract infections in a regional hospital in Trinidad. *Zhonghua Yi XueZaZhi (Taipei)*, 62:438-442 | 5. Foxman, B., 2000. Urinary Tract Infections: Incidence and risk factors. *Am. J. Pub. Health*, 80:331-333. | 6. Nawal, V.L., et al. 1994. In vitro antimicrobial activities against *Proteus* species isolated from patients in a tertiary care hospital in Jordan: Frequency of isolation and Epidemiology. *Scient.Res.Essay*. 3(4): 122-126. | 7. Reslinski, A., et al. 2005. Prevalence of multi-drug resistant *Proteus* species in clinical specimens and their susceptibility to antibiotics, *Med. Dosw. Microbial*, 57(2): 175-184. | 8. Nita Pal, Nikita Sharma, Rajni Sharma, SarojHooja, and Rakesh K Maheshwari et al. Prevalence of Multidrug (MDR) and Extensively Drug Resistant (XDR) *Proteus* species in a tertiary care hospital, India. *International Journal of Current Microbiology and Research*, volume 3 number 10 (2014) pp. 243-252 | 9. SaxenaS R, BassettD C et al. Sex-related incidence in *Proteus* infection of the urinary tract. *Arch Dis Child*. 1975 Nov; 50(11): 899-901. | 10. Jitendra Kumar Pandey, Akanksha Narayan, ShikharTyagi et al. Prevalence of *Proteus* species in clinical samples and ESBL production.. *International Journal of Current Microbiology and Applied Sciences*. Volume 2 Number 10 (2013) pp. 253-261 | 11. Newman M J, Frimpong E, Asamoah-Adu, A, Sampene-Donkor E. Resistance to antimicrobial drugs in Ghana. *The Ghanaian - Dutch collaboration for Health Research and Development*, 2006,1-6 | 12. Shweta M. Bhiwankar, Ashok V. Gomashe and Vijay N. Charde et al. Prevalence and Emergence of Multi Drug Resistance among *Proteus* species Isolated from Various Clinical Samples. *International Journal of Researches in Biosciences, Agricultural & Technology Dec 2014* 2347-517x | 13. Reslinski A, Gospodarek EL, MikuchaA. Prevalence of multidrug resistant *Proteus* species in clinical specimens and their susceptibility to antibiotics, *Med .Dosw. Microbial*.2005,57(2):175-84. | 14. Chung HI, Hsueh T, ChihT. Prevalence of *Proteus* species in urinary tract infections in a regional hospital in Trinidad.62:488-442.