Antibiotics Sensitivity Profile of proteus species Associated With Specific Infections at University of Ilorin Teaching Hospital, Ilorin.

[1]A.A.Akanbi II, [1]A.Nyamngee, [2]A.A.Adedoja, [3]A.A.Njan, [4]S.K.Olubiyi, [4]F.M. Rejuaro, [4]S.A. Imam, and [5]A.G. Giwa.

[1]Department of Medical Microbiology and Parasitology, College of Health Sciences, University of Ilorin, Ilorin. Nigeria. [2]Department of Medical Microbiology and Parasitology, University of Ilorin Teaching Hospital, Ilorin. Nigeria. 3. Department of Pharmacology, Faculty of Basic Medical Sciences, University of Ilorin, Ilorin. 4. Department of Nursing, Faculty of Clinical Sciences, College of Health Sciences, University of Ilorin. 5. Department of Clinical Pharmacy, Faculty Pharmaceutical Sciences, University of Ilorin, Ilorin.

Abstract

Proteus is a prominent member of the family Enterobacteriaceae responsible for a variety of infections in human, such infections include urinary tract infection and many other opportunistic infections in human. The threat of antimicrobial resistance among important isolates is of great concern. This study was conducted to determine the prevalence and antibiotic sensitivity pattern of *Proteus spp* associated with its specific infections at the University of Ilorin Teaching Hospital Ilorin. A retrospective review of cultures results of urine, wound swabs, ear and throat swabs were analysed. A total of 1,500 clinical samples were examined for identification of bacteria and their antimicrobial susceptibility. The greatest number of *Proteus spp* isolates were from wound swabs, 57.1%, followed by mid-stream urine 20.4%. Males were found to be more vulnerable than females in acquiring Proteus infections, 53.1% and 46.9% respectively. Results of the antimicrobial sensitivity testing showed that Imipenem and Piperacillin antibiotics were the most effective against *Proteus spp* with each having 100%, followed by Ceftazidime 79.2%, and Ofloxacin 76.5%. The least effective antibiotic against Proteus was Augmentin 58.1% sensitivity. It is therefore recommended that Imipenem and Piperacillin should be used in the treatment of Proteus infections, and where both are not affordable, Ceftazidime and Ofloxacin could be used in the study area for the treatment of infections caused by Proteus. Regular monitoring of antimicrobial susceptibility is recommended.

Key words: Proteus, infection, antibiotics, Sensitivity pattern

Correspondence to:

Dr. A. Nyamngee
Department of Medical Microbiology and Parasitology,
Faculty of Basic Medical Sciences,
College of Health Sciences,
University of Ilorin, Ilorin, Nigeria.
anyamngee2010@yahoo.com
nyamngee.a@unilorin.edu.ng
+2348128285031

Introduction

Proteus is a member of the family Enterobacteriaceae, and the genus Proteus consists of motile, aerobic and facultative anaerobic Gram-negative rods.[1] Proteus is a member of the tribe proteae, which also include Morganella and Providencia. A striking microbiological characteristic of Proteus species is their swarming activity. Members of the genus Proteus are wide spread in the environment and are found in human gastro intestinal tract.[2] The most common infections caused by Proteus species are urinary tract infections(UTIs),[3] and in addition *Proteus spp* are the causative agents of a variety of opportunistic nosocomial infections including those of the respiratory tract, ear, nose, skin, burns and wounds. It may also cause gastroenteritis.[4] *Proteus spp* can be found to colonize the vaginal introitus prior to onset of bacteriuria, therefore like *E.coli, Proteus spp* cause urinary tract infections by ascending from the rectum to the peri urethra and the bladder.[5]

Proteus mirabilis is by far the most common species identified in clinical specimens. [6] *Proteus spp*, possess several virulence factors that explain their uropathogenic potential. They have Pilli or fimbriae for adherence to the uroepithelium. *Proteus spp* can be naturally resistant to antibiotics, there have been numerous reports of production of extended spectrum beta lactamases (ESBLS) by *Proteus spp.* The ESBL can confer resistance to the third generation cephalosporins. A Study done in Benin shows that *Proteus mirabilis* was resistant to Cloxacillin, Erythromycin and Cephalexin but highly sensitive to Peflacine, Ciprofloxacin, Cephalexin and Cefotaxime.[7] Aisha et al in a study done in Kano, reported Proteus to be resistant to Ceftazidime, Gentamicin and Ciprofloxacin. The threat of antimicrobial resistance among important clinical isolates is of growing concern. This study therefore reports the antibiotics sensitivity pattern of *Proteus spp* associated with specific infections at the University of Ilorin Teaching Hospital, Ilorin.

Materials And Method

This research was a retrospective study carried out between January 2015 and June 2015 and was exempted from ethical approval. Different clinical samples such as urine, purulent materials from wound or abscesses, ear swabs and sputum were cultured to isolate the organisms. A total of 1500 clinical samples were obtained during the study period. Demographic

data such as age, sex were extracted from the laboratory data base.

***Culture*:**

The clinical samples collected were aseptically inoculated on plates of blood agar, Cysteine-Lactose-Electrolyte-Deficient agar, and MacConkey agar; all incubated at 37°C for 24hours.The morphological characteristics of the colonies including size, shape, colour and hemolytic nature were recorded. Suspected Proteus colonies were isolated and identified through biochemical tests according to Cheesbrough,[9] based on whether they were positive for nitrate reduction;H2S gas production: methyl red and urease reactions and negative for lactose fermentation.

Antimicrobial Susceptibility Test

Susceptibility of *Proteus mirabilis* to different antimicrobials was done using the modified Kirby-Baeur disk diffusion method. The following antibiotics Sulbactam, Augumentin, Imipenem, Piperacillin, Gentamicin, Cefuroxime, Ofloxacin, Ceftriaxone, Ceftazidime and Ciprofloxacin were used. The inocula were prepared by growing various Proteus species on separate agar plates and colonies from the plates were transferred with inoculating loop into 3mls of normal saline in a test tube. The density of the suspension was adjusted to 0.5 Mc farland standard. The surface of the sensitivity agar was evenly inoculated with the organisms using a sterile swab, and the antibiotics were applied to the surface of the agar. The plates were incubated over night at 37°C. The zone diameter of growth inhibition was measured and compared with that of NCCLS .[10]

Results

Ninety eight (98) isolates from various clinical specimens were analysed in this study. Table 1 shows the distribution of isolates according to diagnosis. A total of 49(50.0%) of the isolates were from wound infections, followed by urinary tracts infections 20(20.4%) and which was closely followed by otitis media 18(18.3%).Table 2,depicts the source related prevalence, the dominant specimen was wound,56(57.1%),followed mid-stream urine sample 20(20.4%) and the least sample was throat swab 4(4.1%).

Table 3, highlights the age and gender distribution of the isolates. Majority of the specimen came from the 31-40years of age. 23(23.5%), followed by the 21-30years, 19(19.4) %.The least specimen was from 80 years and above 5(5.1%). A total of 52(53.1%) were from males and 46(46.9%) from females.

Table 4, explains the isolates sensitivity in relation to the drugs. All isolates were sensitive to Imipenem 9(100.0%) and Piperacillin 5(100.0%).The isolates were moderately sensitive to the cephalosporins, Ceftazidime 61(79.2%),Ceftriaxone 64(69.5%).The isolates of Proteus were more sensitive to Ofloxacin 13(76.5%)than ciprofloxacin 44(57.9%) .

Table1. Percentage prevalence of the isolates according to diagnosis

Diagnosis	Frequency	Percentage
Wound infections	49	50.0
Urinary tract infections	20	20.4
Otitis media	18	18.3
Post surgical wound infections	4	4.1
Pharyngitis	4	4.1
Umbilical cord infection	3	3.1
Total	**98**	**100%**

Table 2. Source related prevalence of the isolates

Specimens	No tested	Positive for Proteus	Positive percentage
Wound swabs	150	56|98	57.1
Mid stream urine	1200	20|98	20.4
Ear swabs	150	18|98	18.4
Throat swabs	40	4|98	4.1
Total	**1540**	**98|1540**	**6.4%**

Table 3. Age and gender distribution of the isolates

AGE(YRS)	F(%)	M(%)	Total
<1	3(3.1).	7(7.1)	10(10.2)
1-20	10(10.2)	2(2.0)	12(12.2)
21-30	8(8.2)	11(11.2)	19(19.4)
31-40	7(7.1)	16(16.3)	23(23.5)
41-50	2(2.0)	8(8.2)	10(10.2)
51-60	4(4.1)	3(3.1)	7(7.1)
61-70	1(1.0)	5(5.1)	6(6.1)
71-80	6(6.1)	0(0.0)	6(6.1)
>80	5(5.1)	0(0.0)	5(5.1)
Total	**46.0(46.9)**	**52.0(53.1%)**	**98**

Table 4. Isolates sensitivity and resistance in relation to the drugs

Antibiotics	No Tested	No(Sensitive)	No(Resistant)
Sulbactam	30	18(60.0)	12(40.0)
Augumentin	74.	43(58.1).	31(41.9)
Imipenem	9.	9(100.0).	0(0.0)
Piperacillin	5.	5(100.0).	0(0.0)
Gentamicin	55.	35(63.6).	20(36.4)
Cefuroxime	75.	47(62.7).	28(37.3)
Ofloxacin	17.	13(76.5).	4(23.5)
Ceftriaxone	92.	64(69.5).	28(30.4)
Ceftazidime	77.	61(79.2).	16(20.8)
Ciprofloxacin	76.	44(57.9).	32(42.1)
Total	**510.**	**339(66.5).**	**171(33.5)**

Discussion

This study ascertains the antibiotics susceptibility pattern of Proteus species to commonly used antibiotics in our laboratory. Proteus are important pathogenic organisms in the family Enterobacteriaceae. It has some virulence factors that explain their ability to cause infections in human. The isolation rate of Proteus in this study was 6.5 %.This finding correlates with

other reports where similar isolation rate was obtained.[11,12] However these findings differ from the report of other studies where lower isolation rate of Proteus species was obtained. [13,14] Many studies as well have reported higher prevalence of Proteus species in clinical samples. [15,16] Usually in most laboratories the frequency of isolation of Proteus compared to other members of the Enterobacteriaceae is usually very low.

Wound samples in this study, contributed the highest percentage of Proteus (57.1%), followed by urinary samples which accounts for (20.4%). This agrees with the findings of Jitendra *et al* [17] where wound samples account for (67.85%). Similar report from Ghana also reported wound swabs to be the predominant source of Proteus isolates. Our findings is however at variance with reports from other parts of the World where Proteus are more frequently isolated from urine.[18,19] Usually Proteus have been implicated in many community acquired infections and can also be isolated in individuals in hospitals and in those that are immunocompromised, but are more frequently isolated in wounds and urine in our area of study. They have some virulence factors such as Pilli which allows them to attach to epithelial surfaces and this favours their ability to cause urinary tract infections.

Majority of the isolates were recovered from males (53.1%) closely followed by 46.9% from females. The age group with the highest yield of Proteus was the 31-40years of age, and followed by the 21-30 years of age. No age group were spared from Proteus infection. This findings differ from other studies where Proteus was found to be predominant (21.2%) in young males less than 14years.[20] The higher incidence to sexual activities, since this age group are the sexually active age group, and so also vulnerable to development of wound. In this study, as the age increases; the incidence of Proteus as an agent of infection diminishes more especially in the males and are more noticeable in the females. This findings can be attributed to short urethra which can easily predispose to the develop of urinary tract infections.

In our survey, the antibiotics with the highest sensitivity to Proteus isolates are Piperacillin and Imipenem, all isolates of Proteus were sensitive to these two antibiotics (100%). Similar studies conducted with report comparable to ours, where Imipenem and Piperacillin were 100% effective was seen in India and North America.[21,22,23.] The proteus species were much sensitive to Ofloxacin (76.5%) than ciprofloxacin (57.9%). Among the fluoroquinolones, Ciprofloxacin is much common than Ofloxacin, readily available and often much prescribed by physicians than Ofloxacin. The reduced susceptibility to ciprofloxacin can be attributed to over use misuse of this particular antibiotics. This findings however agrees with a report from India where ciprofloxacin and Ofloxacin were found to be (71.0%) and (74.0%) sensitive respectively. Similar studies done in other part of the country have reported Proteus species to be sensitive to Ciprofloxacin and Ofloxacin.[25,8,26]

The isolates of Proteus were moderately sensitive to cephalosporins. This findings correlates with the result of the workers where ceftazidime, cefuroxime and ceftriaxone (55.0%) were moderately sensitive to Proteus.[27] Meanwhile other studies in the country have also reported moderate sensitivity of Proteus species to cefuroxime (53.0%), ceftazidime (58.0%) and ceftriaxone(55.0%).[28] However our findings are at variance to a report in the South-South part of the country where Proteus are found to be resistant to some Cephalosporins such as cephalexin and cefotaxime.[7, 29] Resistance if these production of Extended Spectrum Beta Lactamases(ESBLS) and in part due to over consumption of this group of antibiotics. Cephalosporins are one of the antibiotics most often prescribed by physicians particularly the general practitioners. In Ibadan, isolates of Proteus have been demonstrated as ESBL producers,[28] but however horizontal transfer of resistance genes among pathogens cannot be over ruled.

Conclusion

In conclusion, Proteus remains a common pathogen among patients with wound infections, urinary tracts infections, otitis media and some other infections as well. It exhibits high sensitivity to Imipenem and Piperacillin and are moderately sensitive to commonly used antibiotics such as the cephalosporins and fluoroquinolones. However the resistance rate of Proteus towards the common antibiotics is low, compared to the sensitivity pattern of the isolates. However further prospective study to document the rate of production of ESBL by these isolates should be consider.

references

1. Pal N. Sharma N. Hooja S and Maheshwari RK. Prevalence of multidrug (MDR) and Extensively Drug Resistant(XDR)Proteus species in a tertiary care hospital. India. Int J. Curr. Micrbiology.App Sci.2014;10:243-252.

2. Bahashwan SA. Shafey HME. Antimicrobial Resistance Patterns of Proteus Isolates from Clinical Specimens. European Scientific Journal 2013:9:27:188-202.

3. Jacobsen SM. Stickler DJ. Mobley HLT and Shirtliff ME. Complicated Cather-associated urinary tract infections due to Escherichia coli and Proteus mirabilis. Clin. Microbiol. Rev 2008.21:1:26-59.

4. Wasan WA and Abdul-Kareem AK. The Isolation and characteristics of Proteus mirabilis from Different Clinical Samples. Journal of Biotechnology Research Centre 2013.7:2:24-30.

5. Dharmadhikari SM and Reshwe AS. Molecular

level studies on multiple antibiotics and serum resistance in UTI pathogens. Indian J. Biotechnol 2009.8:40-50.
6. Mishra MP. Debata NK. Padhy RN. Surveillance of multidrug resistant uropathogenic bacteria in hospitalized patients in India. Asian Pac J Trop Biomed 2013:3:315-324.
7. Orhue OP. Antibiogram Study of Proteus Spp. Bacterial Isolates from Uropathogenic Infections in University of Benin Teaching Hospital, Nigeria. Current Research in Bacteriology,2014:7:12-21.
8. Aisha M. Gbonjubola OA and Yakuba KI. Incidence and Antibiotics Susceptibility Pattern of Bacteria Isolates from wound Infections in a Tertiary Hospital in Nigeria. Tropical Journal of Pharmaceutical Research. 2013:12:4:617-621.
9. Cheesbrough M. Laboratory practice in tropical countries.2nd edition 2006.Pp 62-70.
10. Clinical and Laboratory Standard Institute Performance Standards for Antimicrobial Disc Susceptibility tests. Approved standard 2006.M2-A8 CLSI, Wayne, Pa USA.
11. Patrick KF. Stephen YA . Solomon NAQ. Yaw AS and clement OO. Occurrence species distribution and antibiotics resistance of Proteus isolates. A case study at the Komfo Anokye Teaching Hospital (KATH) in Ghana. International Journal of Pharma Sciences and Research 2010. (IJPSR)1/9:347-352.
12. El-Baghdady KZ. Abooul Wafa M. Ghobasy MO. and Gebreel HM. Plasmid mediated virulence factors of some Proteus isolates. Egypt Acad.J.biolog, Sci. 2009;L:7-22.
13. Senthamarai S. Sivan Sankari S. Anitha C. Kumudavathri MS. Amshavathi SK. Venugopal V and Thenmoztri Valli PR. A study on the antibiotics susceptibility pattern of Proteus spp among various Samples. International Journal of Advances in Pharmacy. Biology and chemistry 2015:4:2:355-360.
14. Saleh AB and Halem MES. Antimicrobial resistance patterns of Proteus isolates from clinical Specimens. European Scientific Journal. 2013:9:27:188-202.
15. Foxman B and Brown P. Epidemiology of urinary tract infections! Transmission and risk factors, Clinics of North America. 2003:17:2:227-241.
16. Orrett FA. and Daris GK. A comparison of antimicrobial susceptibility of urinary agents of infections. Indian Medical Journal, 2006: 54:2:85-96.
17. Jitendra KP. Akanksha N and Strikhar T. Prevalence of Proteus species in clinical samples, antibiotics sensitivity pattern and ESBL production.Int.J.Curr.Microbiol.App.Sci.2013:2:10:253-261.
18. Enrico M. Vitorio G. Loredana D. Antonio IL. Roberto M. Paolo R and Clemetina EC. Gender and Age-dependent Etiology of community -Acquired Urinary Tract Infections. The Scientific World Journal.2012:Article ID 349597.
19. Guneysel O. Onur O. Erdede M and Denizbasi A. Trimethoprim/Sulfamethoxazole resistance in urinary tract infections. Journals of Emergency Medicine. 2009:36:4:338-341.
20. Sekowska A. Janicka G, Wrobleska J. and E Kruszynka. Prevalence of Proteus mirabilis strains in clinical specimen and evaluation of their resistance to selected antibiotics. Pol Merkur Lekarski2004. 17 (10);538- 40.
21. Devanand P and Ram Chandra SS. Distribution and Antimicrobial susceptibility Pattern of Bacterial Pathogens causing Urinary Tracts infections in Urban Communities of Meerut city ,India. International Scholarly Research Notice 2013.Article ID,749629.
22. Biswas D. Gupta P. Prasad R. Singh V . Anya M. and Kumar A. Choice of antibiotics for empirical therapy of acute cystitis in a setting of high antimicrobial resistance. Indian Journal of Medical Sciences, 2006,60: 2:38-58.
23. Sabharwal ER. Antimicrobial Susceptibility Pattern of uropathogens in obstetric patients. North American Journal of Medical Sciences 2012:4:316-319.
24. Giannoula ST. Starvours A and Matthew EF. Evaluation of Antimicrobial susceptibility of Enterobacteriaceae causing urinary tract infections in Africa. Antimicrobial agents and chemotherapy 2013:57:8:3628-3639.
25. El- Mahamood. AM. Issa H. Mohammed A and Tirimdhi AB. Antimicrobial susceptibility of some respiratory tract pathogens to commonly used antibiotics at the specialist Hospital Yola, Adamawa state, Nigeria. Journal of clinical Medicine and Research 2010:2:8135-142.
26. Dada –Adegbola HO and Muili KA. Antibiotic Susceptibility pattern of of urinary tract pathogens in Ibadan Nigeria, Afr J Med Sci 2010; 39;3;173-179.
27. Siegel JD. Rhinechart E. Jackson M and Chiarella I. Management of multidrug resistant organism in health care settings. Am. J. Infect.Cintrol,2007:35:2:S165-S193.
28. Okesola AO and Adeniyi TW. Pattern if Extended Spectrum Beta Lactamase Production Among clinical Isolates of Proteus species in Western Nigeria. Wood Journal of Medical Sciences 2010:5:4:94-97.
29. Motayo BO. Ogiogwu JI. Aboderin BW. Okerebtugba PO. Innocent Adiele HC. Nwanze JC and Onoh CC. Bacterioligical review of multidrug-Drug Resistance (MDR) Pathogens in Respiratory Tract infections (RTIs) in Abeokuta, Nigeria. Researchers 2012:4:5:49-55.