Int.J.Curr.Microbiol.App.Sci (2021) *10*(07): 514-524

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 10 Number 07 (2021)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2021.1007.056

Emerging Non Fermentative Gram Negative Bacteria and their Antibiogram from Various Clinical Samples Collected from Patient Admitted to Medical Intensive Care Units

Anirudh*, Anil Bilolikar and Sukrutha Gopal Reddy

Department of Microbiology, Krishna Institute of Medical Sciences, Minister Road, Secunderabad - 500003, T.S., India

**Corresponding author*

Keywords

NFGNB, MICU, MIC, *Pseudomonas aeruginosa*, *Elizabethkingia meningoseptica*

Article Info

Accepted:
20 June 2021
Available Online:
20 July 2021

A B S T R A C T

Non fermentors are important noscomial pathogens causing opportunistic infections in immunocompromised patients. They cause infections with patients having humidifiers, ventilators and catheter devices especially in medical intensive care units. To isolate identify in which age group, sex, risk factors of non fermentative gram negative bacteria The study was performed from September 2018 to February 2019 for a period of 6 months in Department of Microbiology& Medical Intensive Care Units. The samples were inoculated on Blood agar, Mac Conkey agar and incubated at 37℃ for overnight. Non-lactose fermentation was noted on MacConkey agar. The isolates were identified and Antimicrobial susceptibility testing was done by using GN card and AST N281 respectively by using Vitek 2 compact (Biomerieux). A total of 3143 clinical samples were obtained from medical intensive care units. 100 NFGNB were isolated with prevalence of 3.18. Males are more predominant than females. The most common age group in which non fermenters were isolated is 61-70 years followed by 51-60 years. Among the *Acinetobacter baumanii* (n=40) maximum sensitivity is seen in colistin followed by tigecycline. And among Pseudomonas aeruginosa (n=38) maximum sensitivity is for colistin and gentamycin.

Introduction

Non fermenting gram negative bacteria (NFGNB) are non sporing, aerobic bacteria which do not ferment glucose and and have positive cytochrome oxidase test and usually they do not grow on MacConkey agar[1]. They account for 10-15% of all bacterial isolates and cause life threatening infections such as septicemia, surgical site infection, wound infection, meningitis, osteomyelitis and pneumonia[2].

Majority of non fermentating gram negative bacteria emerged as important nosocomial pathogens causing opportunistic infections in immune compromised patients[3]. The source of establishing infections for these non

fermentating gram negative bacteria are dialysis units, humidifiers, ventilator machines, catheter devices[4].The predominant non fermentors are *Pseudomonas aeruginosa, Acinetobacter baumanni followed by Burkholderia cepacia, Stenotrophomonas maltophila, Elizabethkingae, Chryseobacterium and Alcaligenes* species. Routinely they are identified only in a few laboratories in India as they grow slowly and require special culture media and other biochemical tests for identification[5]. *Pseudomonas aeruginosa* infection is prevalent among patients with, acute leukemia, organ transplants and intravenous injections. Infections usually tends to accumulate where moisture occurs in sites such as tracheostomy site, indwelling catheters, burns, the external ear and weeping cutaneous wounds. Intensive care units(ICU) are more prone to vulnerable population and the emergence of non fermenting gram negative bacteria and their resistance to several antibiotics has raised a severe issue in predicting patient treatment outcomes.

The aim of the study is to identify in which age group, sex and risk factors are present to, isolate, identify and characterize, prevalence of non fermenting Gram negative bacteria and their antibiotic sensitivity from various clinical samples in Medical Intensive Care Units. Among the NFGNB isolated most common was *Acinetobacter baumanii* (40) followed by *Pseudomonas aeruginosa* (38), *Elizabethkingia meningoseptica* (7), *Burkholderia cepacia* (4), *Stenotrophomonas maltophila* (4), *Ralstonia picketti* (2), *Pseudomonas* spp (2), *Sphingomonas* spp (3).

Materials and Methods

It was a prospective, analytical, observational study performed in the Krishna Institute of Medical Sciences. The study was performed from September 2018 to February 2019 for a period of 6 months in Department of Microbiology & Medical Intensive Care Units. The samples were inoculated on Blood agar, Mac Conkey agar and incubated at 37° for overnight. Non-lactose fermentation was noted on MacConkey agar. Preliminary identification of non fermenting gram negative bacteria was done by Gram staining, motility, oxidase and catalase test.

The isolates were identified and Antimicrobial susceptibility testing was done by using GN card and AST N281 respectively by using Vitek 2 compact (Biomerieux). The quality control of GN card (identification testing) was done by using ATCC 700323 *Enterobacter hormaechei*, ATCC 17666 *Stenotrophomonas maltophilia*, ATCC 700327 *Enterococcus casseliflavus*, ATCC BAA 750 *Staphylococcus saprophyticus*. The quality control of AST N281 card (Antimicrobial susceptibility testing) was done by using ATCC 25922 *Enterococcus fecalis*, ATCC 27853 *Pseudomonas aeruginosa*, ATCC 35218 *Escherichia coli*. Antimicrobial susceptibility testing in which MIC values were reported as per CLSI 2018 & 2019 guidelines[29].

Results and Discussion

A total of 3143 clinical samples were obtained from medical intensive care units. 100 NFGNB were isolated with prevalence of 3.18. Males n=77(77%) and females were n =23(23%). Males are more predominant than females.

The most common age group in which non fermenters were isolated is 61-70 years followed by 51-60 years,71-80 years and 81-90 years.

Among the NFGNB isolated most common was *Acinetobacter baumanii* (40) followed by *Pseudomonas aeruginosa* (38),

Elizabethkingia meningoseptica (7), *Burkholderia cepacia* (4), *Stenotrophomonas maltophila* (4), *Ralstonia picketti* (2), *Pseudomonas* spp (2), *Sphingomonas* spp (3).

Among the *Acinetobacter baumanii* (n=40) maximum sensitivity is seen in colistin followed by tigecycline and maximum resistance is piperacillin tazobactum, amikacin and aztreonam. And among Pseudomonas aeruginosa (n=38) maximum sensitivity is for colistin and gentamycin.

Among the risk factors, most common risk factor for isolation of NFGNB is catheter associated and more number of isolates are presented with more than 5 risk factors.

Non fermenters are intrinsically resistant to various antimicrobials and are known to produce Extended spectrum beta lactamases (ESBL's) and metallobeta lactamases (MBL's).

In the present study maximum NFGNB were isolated in the age group of 61-70years(29%) which is comparable to study done by Mushtaq [6]*et al.,* where maximum number of NFGNB are obtained in the age group above 60 years 21(39.6%). This could be due to comorbidities present in the geriatric age group, making them prone to diseases due to lesser immunity. This differs from studies conducted by Maniyan[7] *et al.,* showing maximum number of non fermentors isolated in age group of less than 10 years 23(20.91%) followed by 21-30 years 21(19.09%) and least in age 60 years 21(19.09%).

In this study, NFGNB are observed more in males (77%) than in females (23%), which correlates to studies done by Ridhima[8] *et al.,* where NFGNB isolated in males and females were 69.7% and 30.3% respectively. In a study conducted by Kalidas[9] *et al.,* NFGNB were isolated in 55% males and 45% females. In the present study, the prevalance of NFGNB was 3.18%, which is comparable to Benachinmardi[10] *et al.,* (3.5%) and Bruno[11] *et al.,* (2.18%). In studies conducted by Bhuvaneshwari G[12], Khante[13] *et al.,* the prevalence was 6.85% and 8.67% respectively. This is due to demographic and epidemiological variation of other studies mentioned as they have included all the intensive care units because of which their rate of NFGNB isolation is high. The low isolation rate in our study may be due to strict infection control practices and implementation of antibiotic stewardship programme.

In the present study maximum number of isolates are obtained from Endotracheal secretion (50%) followed by Sputum (19%), bronchial wash (8%) and blood(8%). The study is comparable to study done by Mushtaq [6]*et al.,* and Harris *et al.,* where respiratory samples accounted for 39.6% and 50% respectively.

The organisms isolated are *Acinetobacter baumanii* (40%), followed by *Pseudomonas aeruginosa* (38%), *Elizabethkingae meningoseptica* (7%), *Burkholderia cepacia* (4%), *Stenotrophomonas malthophilia* (4%), *Ralstonia picketti* (2%), *Sphingomonas paucimobilis* (2%), *Pseudomonas putida*(1%), *Pseudomonas luteola* (1%), *Sphingomonas spiritivorum*(1%).

In the present study *Acinetobacter baumanii* (40%) is the most common isolate followed by *Pseudomonas aeruginosa(*38%). This is comparable from study done by Samanta[14] *et al.,* where *Acinetobacter baumanii* and P*seudomonas aeruginosa* accounted for 66% and 26% of the isolates respectively.

Table.1 The various antibiotics and their minimal inhibitory concentration (MIC) interpretive criteria with susceptible, intermediate and resistant MICs for *NFGNB* as given by CLSI (2018-2019) as mentioned in the table.

S.No.	Name of the Antibiotic	MIC Interpretive Criteria (µg/Ml)		
		S	I	R
01	Ticarcillin+Clavulanic acid	≤ 16	32-64	≥128
02	Piperacillin+Tazobactum	≤16	32-64	>128
03	Ceftazidime	≤8	16	≥32
04	Cefaperazone+Sulbactum	≤8	-	≥32
05	Cefepime	≤8	16	≥32
06	Aztreonam	≤8	16	≥32
07	Doripenem	≤2	4	≥8
08	Imipenem	≤2	4	≥8
09	Meropenem	≤2	4	≥8
10	Amikacin	≤16	32	≥64
11	Gentamycin	≤4	8	≥16
12	Ciprofloxacin	≤0.5	1	≥2
13	Levofloxacin	≤1	2	≥4
14	Minocycline	≤4	8	≥16
15	Tigecycline	≤2	4	≥8
16	Colistin	≤2	-	≥4
17	Cotrimoxazole	≤40	-	≥80

Fig.1 Age wise distribution of patients

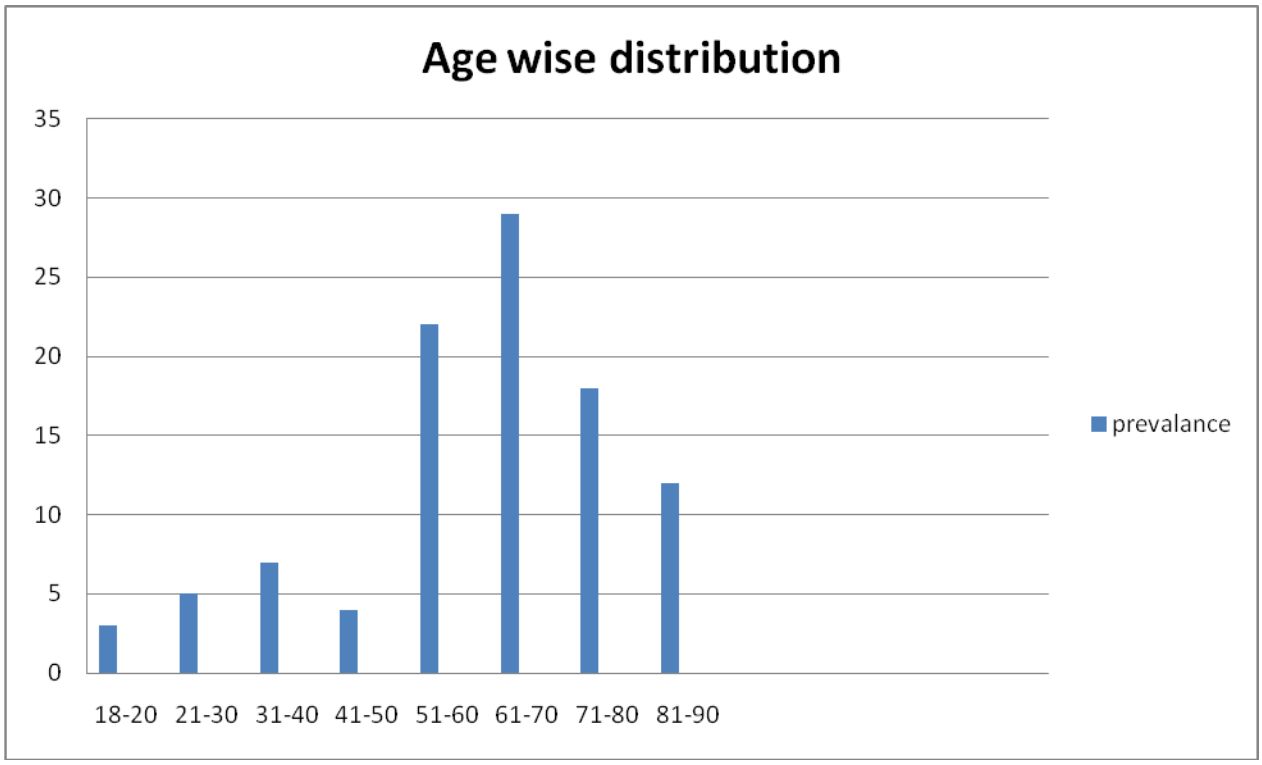


Table.2 Age wise distribution of patients in whom NFGNB were isolated.

Age group	18-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90
prevalance	3(3%)	5(5%)	7(7%)	4(4%)	22(22%)	29(29%)	18(18%)	12(12%)

Table.3 Prevalance of NFGNB from various clinical samples .

Organism	Et secretion	Blood	Urine clean	Urine catheter catch	Pus	Bronchial wash	Sputum	Body fluids	Catheter tip	Total
Pseudomonas aeruginosa	15	2	2	1	3	1	12	1	1	38
Acinetobacter baumanii	21	2	0	0	2	6	6	2	1	40
Burkholderia cepacia	2	2								4
Elizabethkingae meningoseptica	6	1								7
Ralstonia picketti	1	1								2
Stenotrophomonas maltophila	3					1				4
Sphingomonas paucimobilis							1		1	2
Pseudomonas luteola	1									1
Pseudomonas putida				1						1
Sphingomonas spiritivorum	1									1
Total	50	8	2	2	5	8	19	3	3	100

Table.4 Antibiotic susceptibility pattern of *Acinetobacter baumanii* and *Pseudomonas aeruginosa* to various antibiotics tested

Antibiotic	***Pseudomonas aeruginosa* (n=38)**			***Acinetobacter baumanii* (n=40)**		
	sensitive	intermediate	resistant	sensitive	intermediate	resistant
Ticarcillin+ clavunilic acid	14(36.8%)	7(18.4%)	17(44.7%)	2(5%)		38(95%)
Piperacillin Tazobactum	21(55.2%)	2(5.2%)	15(39.4%)	1(2.5%)		39(97.5%)
Ceftazidime	26(68.4%)	2(5.2%)	10(26.3%)	2(5%)		38(95%)
Cefaperazone sulbactum	24(63.1%)	3(7.8%)	11(28.9%)	3(7.5%)	5(12.5%)	32(80%)
Cefepime	26(68.4%)	2(5.2%)	10(26.3%)	2(5%)		38(95%)
Aztreonam	17(44.7%)	5(13.1%)	16(42.1%)	1(2.5%)		39(97.5%)
Doripenem	25(65.7%)	3(7.8%)	10(26.3%)	2(5%)		38(95%)
Imipenem	26(68.4%)		12(31.5%)	2(5%)		38(95%)
Meropenem	24(63.1%)	1(2.6%)	13(34.2%)	1(2.5%)	1(2.5%)	38(95%)
Amikacin	27(71.1%)	1(2.6%)	10(26.3%)	1(2.5%)		39(97.5%)
Gentamycin	28(73.6%)	1(2.6%)	9(23.6%)	3(7.5%)	2(5%)	35(87.5%)
Ciprofloxacin	23(60.5%)	1(2.6%)	14(36.8%)	2(5%)		38(95%)
levofloxacin	21(55.2%)		17(44.7%)	2(5%)	1(2.5%)	37(92.5%)
Minocycline				18(45%)	4(10%)	18(45%)
Tigecycline				37(92.5%)	2(5%)	1(2.5%)
Colistin	38(100%)			40(100%)		
Cotrimoxazole						

Table.5 Antibiotic susceptibility pattern of *Burkholderia cepacia* and *Stenotrophomonas maltophilia* to various antibiotics tested.

Antibiotic	*Burkholderia cepacia* (n=4)			*Stenotrophomonas maltophilia* (n=4)		
	S	I	R	S	I	R
Ticarcillin+ Clavunalic acid			4(100%)	4(100%)		
Ceftazidime	4(100%)			3(75%)		1(25%)
Meropenem	2(50%)	1(25%)	1(25%)	NA	NA	NA
levofloxacin	1(25%)	2(50%)	1(25%)	4(100%)		
Minocycline	2(50%)	1(25%)	1(25%)	4(100%)		
Cotrimoxazole	3(75%)		1(25%)	4(100%)		

Table.6 Antibiotic susceptibility pattern of *Elizabethkingae meningoseptica* to various antibiotics tested

Antibiotic	*Elizabethkingae meningoseptica* (n=7)		
	S	I	R
Rifampicin	6(85.7%)		1(14.2%)
Cotrimoxazole	6(85.7%)		1(14.2%)
Ciprofloxacin	4(57.1%)	1(14.2%)	2(28.5%)
Clindamycin	5(71.4%)		2(28.5%)
vancomycin	7(100%)		
Minocycline	7(100%)		

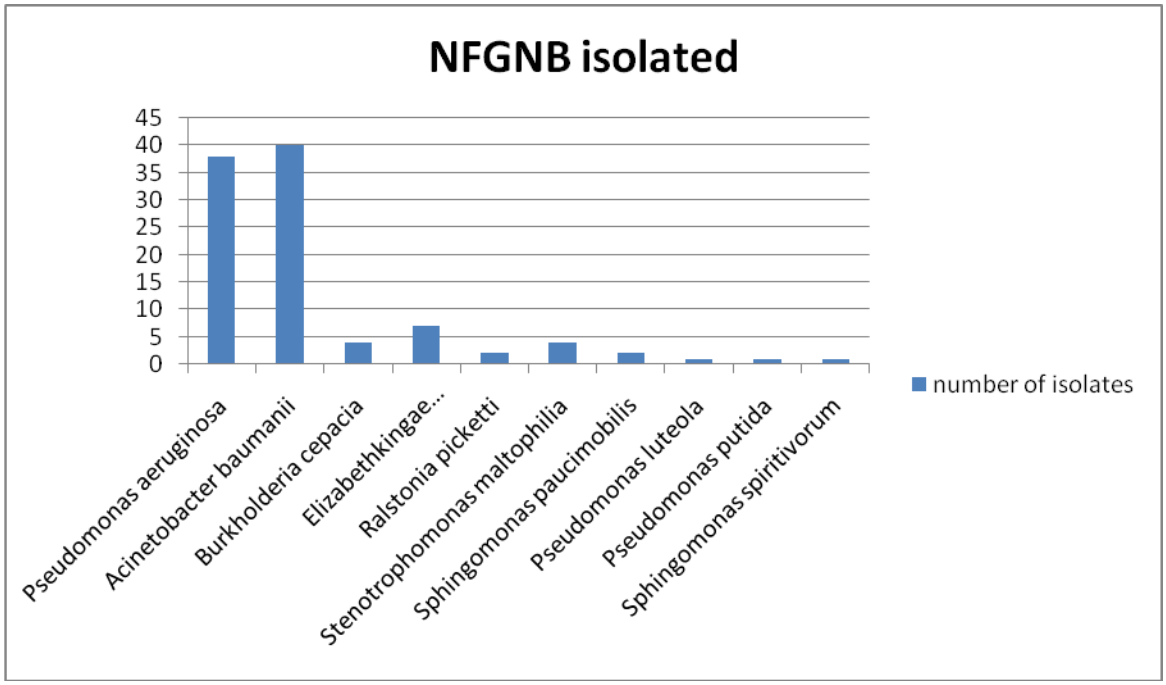
Table.7 Number of Risk factors in study population.

Total no of patients	1 risk factor	2 risk factors	3 risk factors	4 risk factors	5 risk factors	6 risk factors	7 risk factors
100	1	9	21	17	24	22	6

Table.8 Risk factor wise distribution of patients of NFGNB isolated

Risk factor	Number of patients
Hypertension	47
Diabetes	52
Catheter associated	98
Iv canula associated	75
Central line associated	64
Ventilator associated	75
wound associated	34

Fig.2 Total number of NFGNB isolated



However, this differs from studies done by Eltahawy and khalaf[15] where *Acinetobacter baumanii* and *Pseudomonas aeruginosa* accounted for 34% and 31% respectively. Also, in studies conducted by Wang H[16] *et al.*, *Acinetobacter baumanii* was isolated in 56% of the isolates, followed by *Pseudomonas aeruginosa* (46.9%). These studies are more of western in origin and they have considered all the intensive care units whereas our study is only medical intensive care units.

Among Endotracheal secretions, the *Acinetobacter baumanii* was the most common isolate (42%), followed by *Pseudomonas aeruginosa* (30%). These findings are similar to study done by Benachinmardi[10] *et al.*, where the most common isolate among ET secretions was *Acinetobacter baumanii* (41%). Also, in a study conducted by maniyan[7] *et al.*, *Acinetobacter baumanii* accounted for 80% of ET secretion isolates and *Pseudomonas aeruginosa* accounted for 20%. On the contrary, this study differs from a study conducted by Sudha Krishnan[17] *et al.*, where the isolation rate of *Acinetobacter baumanii* is 36.7% and *Pseudomonas aeruginosa* is 53.9%.

Among the sputum samples, most number of isolates are *Pseudomonas aeruginosa* (63.1%) followed by *Acinetobacter baumanii* (31.5%). These findings correlate with Benachinmardi[10] *et al.*, Khante[13] *et al.*, Kaur[18] *et al.*, where *Pseudomonas aeruginosa* and *Acinetobacter baumanii* were 43% and 78% respectively. In a study conducted by Malini[2] *et al.*, *Pseudomonas aeruginosa* and *Acinetobacter baumanii* accounted for 23% and 16.3% of the sputum isolates, respectively.

In the study, the antibiotic senstivity of *Acinetobacter baumanii* to colistin is 100% and to tigecycline is 92.5%. Similarly, in a study by Nazir[19] *et al.*, sensitivity of *Acinetobacter baumanii* to colistin is 100% to tigecycline (84%). However, the findings of Baruah[20] *et al.*, showed variation from present study to colistin suspectibility (12.5%).

In the study *Acinetobacter baumanii* showed maximum resistance to Piperacillin Tazobactum (97.5%), Amikacin (97.5%)and Aztreonam (97.5%). Study done by Memish[21] *et al.,* showed maximum resistance to Aztreonam (95.5%) and Amikacin(76.9%) and study done by Kaur[18] *et al.,* showed maximum resistance to Amikacin (90%)and Piperacillin tazobactum (87%). Whereas, in a Study done by Jithendranath[22] *et al.,* Maniyan[7] *et al.,* there was least resistance to Piperacillin tazobactum (15% and 27% respectively). A study done by Prasanna[23] *et al.,* there was least resistance to piperacillin tazobactum (4.3%) and Amikacin (2.6%).

In the study, *Pseudomonas aeruginosa* showed 100% sensitive to Colistin (100%) and Gentamycin (73.6%) which is similar to studies done by Parajuli[24] *et al.,* Khante[13] *et al.,* Prasanna[23] *et al.,* Kaur[18] *et al.,* where *Pseudomonas aeruginosa* is sensitive to colistin (100%), (100%), (95.3%), (100%) and gentamycin were (62.5%), (52%), (94.7%), (55%) respectively.

Pseudomonas aeruginosa is intrinsically resistant to Minocycline, Tigecycline and Cotrimoxazole as per CLSI 2018 guidelines.

In the study, *Pseudomonas aeruginosa* is maximum resistant to levofloxacin (44.7%). It is similar to study done by Khante[13] *et al.,* where levofloxacin (44.87%). In the study, *Pseudomonas aeruginosa* is maximum resistant to ticarcillin+clavunilic acid (44.7%) and it is similar to study conducted by Juyal[25] *et al.,* where ticarcillin+ clavunilic acid is (30%). In the present study *Pseudomonas aeruginosa* are resistant to several antibiotics because of low permeability of the outer membrane, constitutive expression of various efflux pumps, and production of antibiotic inactivating enzymes.

Elizabethkingae meningoseptica has also been reported to cause infections in patients receiving hemodialysis and healthcare-associated bacteriuria primarily in elderly patients with diabetes.

Elizabethkingae meningoseptica is maximum sensitive to vancomycin (100%) and Minocycline (100%). It is comparable to study done by Tak[26] *et al.,* Sinha[27] *et al.,* showing isolate is sensitive to Vancomycin. Fraser[28] *et al.,* showed that the isolate is maximum sensitive to minocycline but resistant to vancomycin which is contraindicating from the present study.

References

1. Winn W Jr, Allen S, Janda W, Koneman E, Procop G, Schreckenberger P, *et al.,* editors. Non fermenting gram negative bacilli. In: Koneman's colour atlas and textbook of diagnostic microbiology.6th ed.USA: Lippincott Williams and Wilkins company;2006.p.305-91.
2. Malini A, Deepa E K, Gokul B N, Prasad S R. Non fermenting gram negative bacilli infections in a Teritiary care hospital in Kolar, Karnataka. J Lab physicians 2009;1(2):62-6.
3. Rajendra D, Ramana B V, Chaudhary A. Spectrum of Non fermenting Gram-Negative Bacilli Infection (excluding *pseudomonas*)in a Tertiary care Hospital. Int J Biol Med Res 2012;3(3):1902-1904.
4. Hill E B, Henry D A, Speert D P. *Pseudomonas*. In: Murray PR, Baron EJ, Jorgensen JH, Landry ML, Pfaller MA, editors. Manual of Clinical Microbiology,vol.1,9th ed. Washington, D.C: American Society for Microbiology; 2007.p.734-48.
5. Vijaya D, Kamala, Bavani S, Veena M. Prevalance of Non fermentors in Clinical Specimens. Indian J Med Sci 2000;54:87-91.
6. Sajjad *et al.,* Frequency and

Susceptability pattern of Non fermenter Gram negative Bacilli In a Tertiary Care Hospital. Biomedica 2017;33(3):174-178.
7. Maniyan G, Vedachalam D, Chinnuswamy N, *et al.,* Characterization and antimicrobial susceptibility pattern of Non fermenting gram negative bacilli from various clinical samples in a tertiary care hospital. Indian J Microbiol Res 2016;3(4):387-391.
8. Ridhima W, Yash S, Upadhayay R P, Bala K. Nosocomial infection by Non fermenting Gram negative bacilli in a tertiary care hospital. Inter J Pharmacy Pharmaceutical Sci.2016;8(3):274-77.
9. Kalidas RIT, Falguni NAG, Hirak J R, Maity P K. Prevalance and susceptibility profiles of Non fermentative Gram negative bacilli infection in a tertiary care hospital of Eastern India. Ind J Clin Prac.2013;24(5):451-55.
10. Benachinmardi K K, Padmavathy M, Malini J, Naveeneth B V. Prevalance of Non fermenting Gram Negative Bacilli and their in vitro susceptibility pattern at a Teritiary care hospital in Birjung, Nepal. Int. J. Curr. Microbiol. App. Sci 2015;4(7):301-307.
11. Bruno D, Nishino M K,Priore W N, Remus P R, Do Carmo A A, Stafanello V B, *et al.,* Prevalance of Gram negative non fermentors patients in porto Alegre-RS. Jornal of Brasileiro de Patalogia e Medicinia Laboratorial. 2011;47:529-34.
12. Bhuvaneshwari G, *et al.,* Multiple Antibiotic resistance indexing of Non fermenting gram negative bacilli.Asian J Pharm Clin Res 2017;10(6):78-80.
13. Khante S, Mate P, Raut S, Khadse R, Chavan S, *et al.,* Prevalance of Non fermenters and their antibiogram at tertiary care hospital.Indian journal of Applied research 2019;9(7):76-77.
14. Samantha P, Gautam V, Thapar R, Ray P. Emerging resistance of non fermenting gram negative bacilli in a teritiary care centre. Indian J Pathol Microbiol 2011;54:666-7.
15. Eltahawy A T, Khalaf R M. Antibiotic resistance among gram negative non fermentative bacteria at a teaching hospital in Saudi Arabia.J Chemother 2001;13:260-4.
16. Wang H, Chen M J. China Nosocomial pathogens resistance surveillance study group. Changes of antimicrobial resistance among non fermenting Gram negative bacilli isolated from intensive care units from1994 to 2001 in china. Zhonghua Yi Xue Za Zhi 2003;83:385-90.
17. Sudha Krishna *et al.,* Prevalence of Non fermenting Gram Negative Bacilli and their Antibiotic Sensitivity Pattern at a Tertiary care Hospital in Tamilnadu, India. Int J Curr Microbiol App sci 2018;7(2):2751-2758.
18. Kaur A,Gill A K,Singh S, *et al.,* Prevalance and antibiogram of Non fermenting gram negative bacilli isolates obtained from various clinical samples in a tertiary care hospital, Bathinda, Punjab, India. International journal of research in medical sciences 2018;6(4):1228-1234.
19. Nazir A, Peerzada B Y, Sana I, *et al.,* Spectrum of Non fermenting gram negative bacilli isolated from patients with blood stream infections in a tertiary care hospital in north India. Int J Res Med Sci 2019;7(5):1762-1766.
20. Baruah F K, Hussian A N, Kausalya N, Grover R K. Antibiotic resistance profile of non fermenting gram negative bacilli isolated from the blood cultures of cancer patients.J Global Infect Dis 2015;7:46-7.
21. Memish Z A, Shibl A M, Kambal A M, Ohaly Y A, Ishaq A, Livermore D M. Antimicrobial resistance among nonfermenting gram negative bacteria in Saudi Arabia. J Antimicrobi chemother 2012;67:1701-5.
22. Jithendranath A, Radhika R, Bhargavi L,

Bhai G, Bhai R, *et al.*, Current trend of Non fermenting gram negative bacilli in a tertiary care hospital in Trivandrum. J Pure Appl Microbiol 2016;10(1):425-429.
23. Prasanna S, Dharanidevi S, Das K N, Raj S. Prevalance, Phenotypic Characterization and Antibiotic Susceptibility of Non-fermentative gram negative bacilli isolates at a tertiary care centre.Int J Curr Microbiol App sci 2016;5(11):442-454.
24. Parajuli P N, Acharya P S, Mishra K S, Parajuli K, Rijal P B, Pokhrel M B. High burden of antimicrobial resistance among gram negative bacteria causing health care infections in a critical care unit of Nepal. Antimicrobial resistance and infection control 2017;6(67):1-9.
25. Juyal D, Prakash R, Shankarnarayan S A, Sharma M, Negi V, *et al.*, Prevalance of Non fermenting gram negative bacilli and their *in vitro* susceptibility pattern in a Teritiary care hospital of uttarakhand: A study from foot hills of Himalayas. Saudi journal of health Sci 2013;2:108-12.
26. Tak V, Mathur P, Varghese P, Mishra M C. Elizabethkingia meningoseptica:An emerging pathogen causing meningitis in a hospitalized adult trauma patient. Indian J Med Microbiol 2013;31:293-5.
27. Shinha T, Ahuja R. Bacteremia due to Elizabethkingia meningoseptica.ID cases.2015;2:13-15.
28. Fraser S L, Jorgensen J H. Reappraisal of the antimicrobial susceptibilities of Chryseobacterium and Flavobacterium species and methods for reliable susceptibility testing. Antimicrob Agents Chemother.1997;41(12):2738-2741.
29. Clinical and laboratory standards institute(CLSI). Performance standards for antimicrobial susceptibility testing.28th edition. CLSI supplement.M100.Wayne,IN.2018.

How to cite this article:

Anirudh, Anil Bilolikar and Sukrutha Gopal Reddy. 2021. Emerging Non Fermentative Gram Negative Bacteria and their Antibiogram from Various Clinical Samples Collected from Patient Admitted to Medical Intensive Care Units. *Int.J.Curr.Microbiol.App.Sci.* 10(07): 514-524.
doi: https://doi.org/10.20546/ijcmas.2021.1007.056