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Prevalence of *Acinetobacter* Infection in Hospital Environment and their Antimicrobial Sensitivity Pattern in North-East Region of Bangladesh

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***Abstract*— *Acinetobacter species are the most important nosocomial and opportunistic pathogens. In South-Asian countries including Bangladesh, prevalence of Acinetobacter infection in hospital environment and their resistance to antimicrobial agents is significantly high. In this study, the prevalence of Acinetobacter infection from various hospitals and its correlation with patient's age, sex, hospital units, and different season were evaluated. In addition, the sensitivity patterns of Acinetobacter to different 23 antimicrobial agents were also assessed .Comparatively higher infection rate by Acinetobacter species was found in patients with lung infection, urinary tract infection and abscess. Interestingly, significantly higher infection by Acinetobacter was also seen at rainy season in intensive care unit (ICU), and medicine unit. Remarkably, antibiotic colistin was found with highest susceptibility (96.4%) followed by tigecyline (89.6%), iImipenem (57.7%) and meropenem (51.4%). Rest of the 19 antibiotics showed less than 50% susceptibility. Therefore, this hospital based study on Acinetobacter infection suggesting to implement a strict antibiotic management policy of its spread among the patients.*

Keywords*— *Acinetobacter; prevalence; hospital environment; season;susceptibility.

I. INTRODUCTION

Acinetobacter are Gram-negative *Coccobacilli* bacteria and strictly aerobic, catalase positive, non-motile, oxidase negative and lack pigmentation [1]. They are free living saprophytes in soil and water [2-3]. As opportunistic pathogen, *Acinetobacter* have a high incidence among immunocompromised individuals, particularly those who have experienced a prolonged hospital stay [4]. Acinetobacter commonly associated with aquatic environments [5], they have been shown to colonize the skin as well as being isolated in high numbers from the respiratory and urinary tract secretions of infected individuals [6].

They are reported to cause a number of outbreaks of nosocomial infections such as septicemia, pneumonia, wound sepsis, endocarditis, meningitis, urinary tract infections and peritonitis [7], but their predominant role is in ventilator associated pneumonia (VAP), in intensive care units (ICUs) [1], Risk factors for multidrug-resistant *Acinetobacter* colonization and infection include prolonged length of hospital stay, exposure to the intensive care unit (ICU), mechanical ventilation, central venous catheterization, urinary catheterization, prior exposure to antimicrobials, greater severity of illness, surgery, and receipt of invasive procedures [8, 9, 10].

The prevalence of *Acinetobacter* infection is variable depending on the geographical localization and the patient's socio-economic status [11-13], in an international study in ICUs, the *Acinetobacter* infections rate was 19.2% in Asia; 17.1% in Eastern Europe; 14.8% in Africa; 13.8% in Central and South America; 5.6% in Western Europe; 4.4% in Oceania and 3.7% in North America [13]. It is 15% in South African HIV-positive patients [11] and 13% in Canadian burn care units [12]. In our region, no study on *Acinetobacter* prevalence has been performed.

In recent years, *Acinetobacter* have been designated as a "red alert" human pathogen, generating alarm among the medical fraternity, arising largely from its extensive antibiotic resistance spectrum [14]. *Acinetobacter* are opportunistic pathogen known for its intrinsic resistance to antibiotics and greater ability to rapidly acquire resistance genes as mobile genetic elements (plasmids, transposons, integrons cassettes and insertion sequences) [15-17]. Multidrug resistant (MDR) *Acinetobacter* are becoming a global threat with a therapeutic impasse increasingly described in literature [18-20]. Indeed this organism generally has resistance to several antibiotics. According to the literature data, the resistance rate varies from 31.8 to 92.1% to ceftazidime; 8.8 to 89.9% vsimipenem, from 12.2 to 89.9% vs. Piperacillin / Tazobactam, from 28.8 to 91.6% vs. fluoroquinolones and 30 to 90.3% vs. aminoglycosides [11, 21-24] but colistin is often the only effective treatment option whereas some *Acinetobacter* strains develop resistance to colistin [11, 22-25]. Resistance to colistin was estimated to 5.3% in the United States [25]; 2.7% in South Africa [11]; 1.2% in India [24] and 0.9% in Tunisia [23] and 0.5% in Saudi Arabia [22].

In north-east area (Sylhet) of Bangladesh, no study on prevalence of *Acinetobacter* infection and their antibiotic susceptibility have been performed. This study was conducted to determine the frequency of *Acinetobacter* infection in hospitalized patients and observed their antimicrobial susceptibility pattern.

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II. Materials and Methods

Study Population and Sample Collection

The study was carried out in the Department of Biochemistry and Molecular Biology of Shahjalal University of science and Technology, Sylhet, Bangladesh, from August, 2016 to July, 2018. Relevant diagnostic specimens like sputum, tracheal aspirate, urine, pus and wound swab etc. were collected from different units of MAG Osmani Medical College and Hospital, North-east Medical college and Hospital and Nurjahan Hospital Ltd, Sylhet, Bangladesh by standard collection procedures including infection type, season of infection, patient's name, sex and age. Few Technical supports were taken from a well known Diagnostic Centre named Medinova Medical Services Ltd. Sylhet, Bangladesh. About 113 *Acinetobacter* positive samples were collected and observed to complete this study. Specimens were processed by standard microbiological techniques [26].

Bacterial Identification and Sensitivity Pattern Test

Primary culture of *Acinetobacter* was performed on MacConkey agar medium at 37°C for 24 hours [3]. Pure culture and the study of antibiotic susceptibility were performed by the disc diffusion method on Mueller-Hinton agar plates. Gram stains, Indole test, Kigler Iron Agar (KIA), Simon Citrate Agar test, Catalase, Oxidase and Motility tests were also performed to identify *Acinetobacter*.

The antibiotic discs tested were cephradine, amoxicillin, cefuroxime, cefixime, cefotaxime, nalidexic acid, amoxiclav, ceftriaxone, ticarcillin, mecillinum, ciprofloxacin, nitrofurantoin, levofloxacin, ceftazidime, cotrimoxazole, gentamicin, amikacin, doripenem, piperacillin, meropenem, imipenem, tigecylineand colistin.

Graphical Analysis

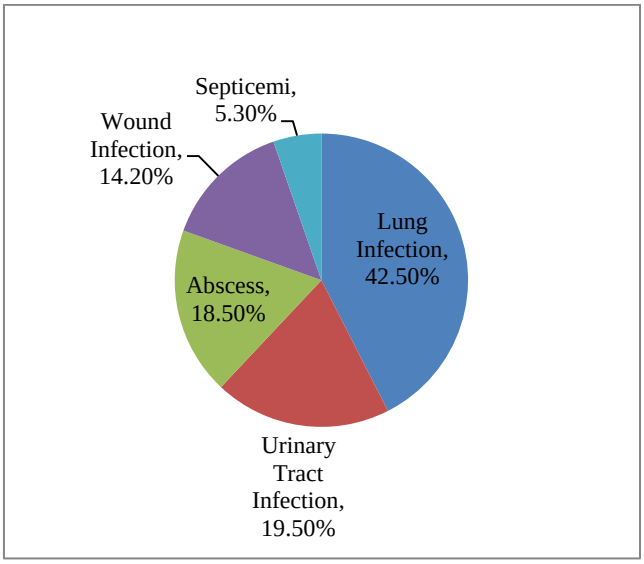
Pie chart and bar diagrams were produced by using data obtained from questionnaire and sensitivity pattern tests. Pie chart was produced for each infection type caused by *Acinetobacter* and bar diagrams were produced for prevalence of *Acinetobacter* at different hospital units at different seasons of the year and also for sensitivity and resistance pattern of *Acinetobacter* to different antimicrobial agents.

III. Results

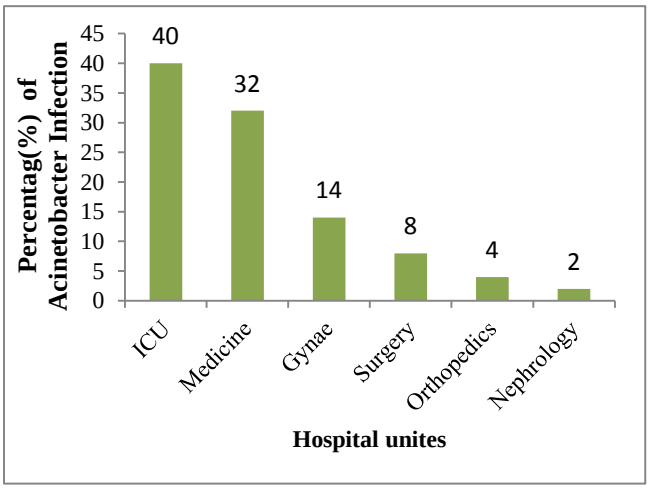
During the study period of August, 2016 to July , 2018, 113 *Acinetobacter* positive sample were collected from different indoor unit (ward) like Intensive Care Unit (ICU), Medicine, Gynae, Surgery, Orthopedics and Nephrology wards of MAG Osmani Medical college and hospital, North-east Medical College and Hospital and Nurjahan Hospital Pvt. Limited, Sylhet (north-east region), Bangladesh.

Sputum, tracheal aspirate, urine, pus, blood and wound swab were collected as specimen and among that 113 *Acinetobacter* positive sample, 65 (57.5%) and 48 (42.5%) were male and female respectively.

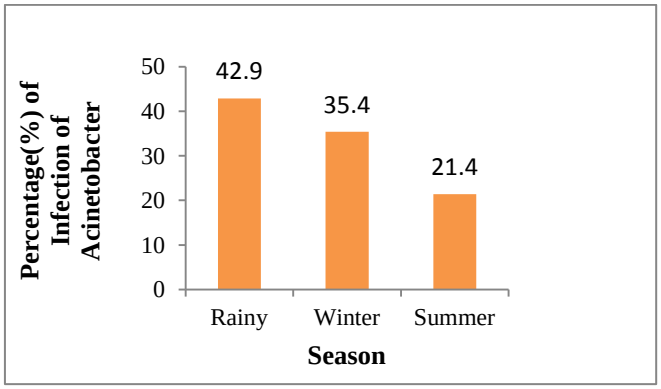
According to this study, among all 113 samples, 48 (42.5%), 22 (19.5%), 21 (18.5%), 16 (14.2%) and 6 (5.3%) were suffered from lung infection, urinary tract infection, abscess, wound infection and septicemia respectively.



Among the collected 113 *Acinetobacter* positive patient's sample, 100 were infected after admitted in hospital. Science the samples were collected from different units of hospitals so a comparative study of prevalence of *Acinetobacter* infection among the hospital units was done. Among that 100 *Acinetobacter* positive sample, 40 (40%) , 32 (32%), 14 (14%), 8(8%), 4 (4%) and 2 (2%) samples were collected from Intensive Care Unit (ICU), Medicine, Gynae, Surgery, Orthopedics and Nephrology units respectively.

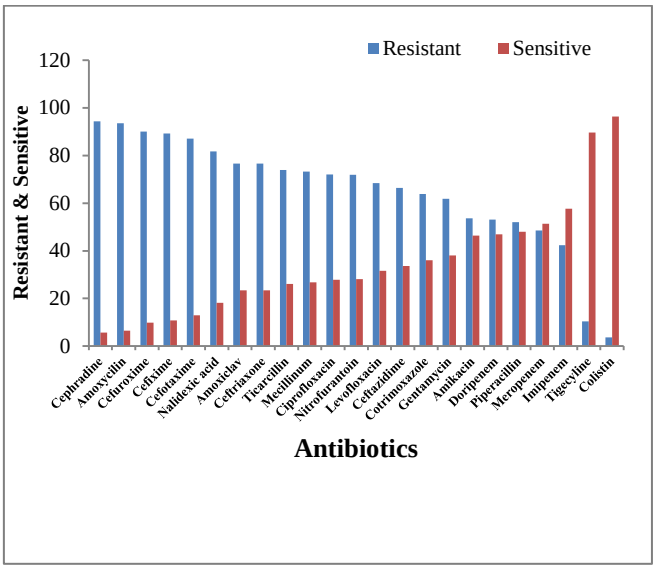


Infection rate of *Acinetobacter* at various seasons of the year was the finding of the study. Prevalence of *Acinetobacter* infection in hospitalized patients at different seasons also a finding of this study. About 42.9%, 35.7% and 21.4% patient were infected at rainy, winter and summer season respectively.



The maximum sensitivity of *Acinetobacter* was seen to Colistin (96.4%), Tigecyline (89.6%), Imipenem (57.7%) followed by Meropenem (51.4%), Piperacillin (48.5%), Doripenem (46.9%), Amikacin (46.4%), and Gentamycin (38.1%).

Resistance also was observed to Cephradine (94.3%), Amoxycillin (93.4%), Cefuroxime (90.1%), Cefixime (89.2%), Cefotaxime (87.1%), Nalidexic acid (81.8%), Amoxiclav (76.6%), Ceftroaxone (76.6%), Ticarcillin (73.9%), Mecillinum (73.3%), Ciprofloxacin (72.1%), Nitrofurantoin (71.9%) and Levofloxacin (68.4%).



IV. Discussion

Out of 113 *Acinetobacter* positive samples, 65 (57.5%) and 48 (42.5%) were male and female respectively. This higher prevalence of male infection may be the male patients visit more frequently to hospitals compared with female. This result also with good agreement with other study, where reported that infections is more common in males (58%) than female (42%) [27].

According to this current study, among all patients, 48 (42.5%), 22 (19.5%), 21 (18.5%), 16 (14.2%) and 6 (5.3%) were suffered from lung infection, urinary tract infection, abscess, wound infection and septicemia respectively, where lung infection and urinary tract infection are almost twice that of other study by Joshi et al [28]. Moreover, *Acinetobacter* infection in ICU-patients during the last decade represents a growing concern among clinicians and researchers and most frequently infections involve in the respiratory tract [24].

Alarmingly 100 patients out of 113 were infected after admitted in hospital and the samples were collected from different units of hospitals for a comparative study of prevalence of *Acinetobacter* among the units and which was 40, 32, 14, 8, 4 and 2 from ICU, Medicine, Gynae, Surgery, Orthopedics and Nephrology units respectively. Infections by *Acinetobacter* were significantly higher in ICU and medicine unit but this result is not same which was observed in other study [24].

It is also important to note that rate of infection by *Acinetobacter* was differ based on seasonal variation in this region and that was 42.9%, 35.7% and 21.4% on rainy, winter and summer respectively.

The maximum sensitivity of *Acinetobacter* was seen to Colistin (96.4%), Tigecyline (89.6%), Imipenem (57.7%), Meropenem (51.4%), Piperacillin (48.5%), Doripenem (46.9%), Amikacin (46.4%), and Gentamicin (38.1%).

On the other hand resistance was also observed to Cephradine (94.3%), Amoxicillin (93.4%), Cefuroxime (90.1%), Cefixime (89.2%), Cefotaxime (87.1%), Nalidexic acid (81.8%), Amoxiclav (76.6%), Ceftriaxone (76.6%), Ticarcillin (73.9%), Mecillinum (73.3%), Ciprofloxacin (72.1%), Nitrofurantoin (71.9%), and Levofloxacin (68.4%).

In summary we have revealed that *Acinetobacter* showed more than 50% sensitivity to only four antimicrobial agents (Colistin, Tigecyline, Imipenem and Meropenem) and less than 50% sensitivity to rest other 19 which indicates that circulating *Acinetobacter* species from this northeastern region of Bangladesh are multidrug resistant bacteria.

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References

[1] Bergogne-Bérézin E, Towner KJ. *Acinetobacter spp*. as nosocomial pathogens: Microbiological, clinical, and epidemiological features. ClinMicrobiol Rev, 9:148–65, 1996.

[2] Riley W. *Acinetobacter* and *Moraxella*. In: Borriello SP, Murray PR, Funke G, editors. Topley and Wilson's Microbiology and Microbial Infections: Bacteriology. 10th ed. Vol. 2. London: Hodder Arnold Publication; pp. 1301–11, 2005. .

[3] Collee JG, Fraser AG, Marmion BP, Simmons A. 14th ed. New York: Churchill-Livingstone. Mackie and McCartney Practical Medical Microbiology, 1999.

[4] Montefour K, Frieden J, Hurst S, Helmich C, Headley D, Martin M, et al. *Acinetobacterbaumannii*: an emerging multidrug-resistant pathogen in critical care. Crit Care Nurse. 28:15–25, quiz 26, 2008.

[5] Turton JF, Kaufmann ME, Gill MJ, Pike R, Scott PT, Fishbain J, et al. Comparison of *Acinetobacterbaumannii* isolates from the United Kingdom and the United States that were associated with repatriated casualties of the Iraq conflict. J ClinMicrobiol. 44:2630–4. doi: 10.1128/JCM.00547-06, 2006.

[6] Sebeny PJ, Riddle MS, Petersen K. *Acinetobacterbaumannii* skin and soft-tissue infection associated with war trauma. Clin Infect Dis47:444–9. doi: 10.1086/590568,2008.

[7] Koneman EW, Allen SD, Jande WM, Schreckenberger PC, Winn WC. Jr . 6th ed. Philadelphia: Lippincott Williams and Wilkins. Koneman'sColour Atlas and Textbook of Diagnostic Microbiology, 2006.

[8] Maragakis L, Perl T. *Acinetobacterbaumannii*: Epidemiology, Antimicrobial Resistance, and Treatment Options. Clin Infect Dis. 46:1254–1263. doi: 10.1086/529198, 2008 .

[9] Playford E, Craig J, Iredell J. Carbapenem-resistant *Acinetobacterbaumannii* in intensive care unit patients: Risk factors for acquisition, infection and their consequences. J Hosp Infect, 65:204–211. doi: 10.1016/j.jhin.2006.11.010, 2007.

[10] Zhou H, Yuan Z, Du Y. Prior use of four invasive procedures increases the risk of *Acinetobacterbaumannii* nosocomial bacteremia among patients in intensive care units: A systematic review and meta-analysis. Int J Infect Dis. 22:2530. doi: 10.1016/j.ijid.2014.01.018, 2014 .

[11] Ntusi NB, Badri M, Khalfey H, Whitelaw A, Oliver S, Piercy J, Raine R, Joubert I, Dheda K. ICU-Associated AcinetobacterbaumanniiColonisation/Infection in a High HIV Prevalence Resource-Poor Setting. PLoS One, 7(12): e52452, 2012.

[12] Simor AE, Lee M, Vearncombe M, Jones-Paul L, Barry C, Gomez M, Fish JS, Cartotto RC, Palmer R, Louie M. An outbreak due to multirésistantAcinetobacterbaumannii in burn unit: Risk factors for acquisition and management. Infect Control HospEpidemiol, 23 (5): 261-267, 2002.

[13] Vincent JL, Rello J, Marshall J, Silva E, Anzueto A, Martin CD, Moreno R, Lipman J, Gomersall C, Sakr Y, Reinhart K. EPIC II Group of Investigators.International Study of the Prevalence and Outcomes of Infection in Intensive Care Units. JAMA, 302(21):2323-2329, 2009.

[14] Cerqueira GM, Peleg AY. Insights into *Acinetobacterbaumannii* pathogenicity. IUBMB Life, 63:1055–60. doi: 10.1002/iub.533. 2011.

[15] García-Garmendia JL, Ortiz-Leyba C, Garnacho-Montero J, Jiménez-Jiménez FJ, Pérez-Paredes C, Barrero-Almodóvar AE, Gili-Miner M. Risk Factors for Acinetobacterbaumannii Nosocomial Bacteremia in Critically Ill Patients:a Cohort Study. Clin Infect Dis, 33(7):939–46, 2001.

[16] Shareek PS, Sureshkumar D, Ramgopalakrishnan, Ramasubramanian V, Ghafur KA, Thirunarayanan MA. Antibiotic Sensitivity Pattern of Blood Isolates of Acinetobacter Species in a Tertiary Care Hospital: A Retrospective Analysis. Am J Infect Dis, 8 (1): 65-69, 2012.

[17] Somily AM, Absar MM, Arshad MZ, Al Aska AI, Shakoor ZA, Fatani AJ, SiddiquiYM,Murray TS. Antimicrobial susceptibility patterns of multidrug resistant Pseudomonas aeruginosa and Acinetobacterbaumannii against carbapenems, colistin, and tigecycline. Saudi Med J, 33 (7): 750-755, 2012.

[18] Mushtaq S, Javeid I, Hassan M.Antibiotic sensitivity pattern of Acinetobacter species isolated from clinical specimens in a tertiary care hospital. Biomedica, 29:23-26, 2013.

[19] Gerald Denys A, Steven M Callister, Michael J Dowzicky. Antimicrobial susceptibility among gram-negative isolates collected in the USA between 2005 and 2011 as part of the Tigecycline Evaluation and Surveillance Trial (TEST). Ann ClinMicrobiolAntimicrob, 12:24, 2013.

[20] Hamouche E, Sarkis DK. Évolution de la sensibilité aux antibiotiques de Escherichia coli,Klebsiellapneumoniae, Pseudomonas aeruginosa et Acinetobacterbaumanniidans un CHU de Beyrouth entre 2005 et 2009.Pathol Biol (Paris), 60:e15-e20, 2012.

[21] Xu J, Sun Z, Li Y, Zhou Q. Surveillance and Correlation of Antibiotic Consumption and Resistance of Acinetobacterbaumannii complex in a Tertiary Care Hospital in Northeast China, 2003–2011. Int J Environ Res Public Health, 10:1462-1473, 2013.

[22] Al-Mously N, Hakawi A. Acinetobacterbaumannii bloodstream infections in a tertiary hospital:Antimicrobial resistance surveillance. Int J Infect Control, 9 (2):1-8, 2013 .

[23] Ben Haj Khalifa A, Khedher M. Profil de sensibilité aux antibiotiques des souchesd'Acinetobacterbaumanniiisoléesdans la région de Mahdia. Med Mal Infect, 40 :126–128, 2010 .

[24] Jaggi N, Sissodia P, Sharma L. Acinetobacterbaumannii isolates in a tertiary care hospital: Antimicrobial resistance and clinical significance. J Microbiol Infect Dis, 2(2), 57-63, 2012 .

[25] Queenan AM, Pillar CM, Deane J, Sahm DF, Lynch AS, Flamm RK, Peterson J, Davies TA. Multidrug resistance among Acinetobacter spp. in the USA and activity profile of key agents: results from Capital Surveillance 2010. DiagnMicrobiol Infect Dis, 73(3):267-70, 2012.

[26] Collee JG, Fraser AG, Marmion BP, Simmons A. 14th ed. New York: Churchill-Livingstone, Mackie and McCartney Practical Medical Microbiology, 1999.

[27] Prashanth K, Badrinath S. Nosocomial infections due to *Acinetobacter* species: Clinical findings, risk and prognostic factors. Indian J Med Microbiol, 24:39–44,2006.

[28] Joshi SG, Litake GM, Satpute MG, Telang NV, Ghole VS, Niphadkar KB. Clinical and demographic features of infection caused by *Acinetobacter* species. Indian J Med Sci. 60:351–60,2006.