Original Article

Incidence of Nasal Carriage of Staphylococcus Aureus in Haemodialysis Patient

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Abstract:
Background: *End stage renal failure (ESRF) patients maintained on regular haemodialysis (HD) have a high risk for serious Staphylococcus aureus infection. It is a major cause of morbidity in haemodialysis patient. Chronic dialysis patients are more prone to Staphylococcal infection because of their decreased immunity and increased skin colonization by Staph. aureus. One of the important source of Staph. aureus is the anterior nares other than vascular access site. Elimination of Staphylococcal nasal carriage results in significant lowering of infection rate.* ***Objective:*** *To find out the incidence of nasal carriage of Staph. aureus in haemodialysis patient and Staphylococcal bacteraemic haemodialysis patient and the sensitivity pattern.* ***Design:*** *This was a cross sectional study.* ***Setting:*** *Department of Nephrology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Shahbag, Dhaka, from June 2010 to Sept 2011.* ***Methods:*** *A total of 104 patients underwent haemodialysis by central venous catheter during the study period who fulfill the inclusion criteria were selected. Inclusion criteria was patients admitted for haemodialysis and exclusion criteria were patients having clinical focus of infection, I/V cannula in situ with features of suspected phlebitis.* ***Results:*** *Out of 104 study patients, majority were male (57.7%). Out of 104 patients 20 (19.2%) patients had bacteraemia and out of 20 patients 8 (40%) patients had Staphylococcal bacteraemia and out of 8 patients 5 (62.8%) patients had positive nasal swab culture. Staph. aureus was 100% sensitive to Amoxicillin plus Clavulanic acid, Methicillin and Vancomycin.* ***Conclusion:*** *Haemodialysis is an important method of treatment of ESRF patients. One of the major problem is bloodstream infection. The commonest causative organism of infection is Staph. Aureus and antibiotics which are sensitive to common organisms are Amoxicillin plus Clavulanic acid, Methicillin and Vancomycin.*

Key words: Nasal carriage, Staphylococcus aureus, Bacteraemia, Haemodialysis

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Introduction:
Haemodialysis is required in end stage renal failure (ESRF) patients. Haemodialysis patients are particularly predisposed to infection. Infection remains one of the most frequent causes of morbidity, mortality and hospitalization among long term haemodialysis (HD) patients[1]. The United States Renal Data Service (USRDS) database review revealed that 15-17% of hospitalizations among patients on long term HD were related to infectious complications of vascular access[2].

Staph. aureus is one of the most important pathogens worldwide and has emerged as a prominent organism infecting critically ill persons[3-6]. The impact of *Staph. aureus* on human health has dramatically increased as a result of its remarkable ability to became resistant to antimicrobial[7-10]. Although asymptomatic nasal colonization with *Staph. aureus* is common, it appears to be an important factor in the development of most infections due to this organism[4,11,12].

Due to an increasing number of infections caused by *methicillin resistant Staph. aureus* (MRSA) strains, therapy has become problematic. Therefore, prevention of Staphylococcal infections has become more important. Carriage of *Staph. aureus* appears to play a key role in the epidemiology and pathogenesis of infection. *Staph. aureus* colonize at the anterior nares in over 42% of HD patient, which play a major role in body expansion of this germ and consequently the HD patients infection risk[2,13].

Bacteria harboring in the nose passes to the hands and, from the hands, to the skin[14-16]. From the skin, it may cause infection by any foreign substance such as a graft or a dialysis catheter. Boelaert et al. showed that 84% of nasal *Staph. aureus* patients

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carried this bacteria on their hands. Even more, molecular typing revealed that strains from nares, skin and infectious sites are identical in 91% of cases[13,17].

In healthy subjects, over time, three patterns of carriage can be distinguished: about 20% of people are persistent carriers, 60% are intermittent carriers, and approximately 20% almost never carry *Staph. aureus*. Several factors increase the risk for bacteraemia in haemodialysis patients such as immunosuppressive therapy, hypoalbuminemia and diabetic state, site of catheter insertion and duration of catheter dependence, repeated puncture of skin (e.g. haemodialysis or continuous ambulatory peritoneal dialysis, intravenous drug addicts)[18].

Most episodes of bacteraemia are associated with vascular access and specially with central venous catheter. The risk of infection from central venous catheter is estimated to be 10 times higher compared to arteriovenous fistula infection. Elimination of carriage has been found to reduce the infection rates in surgical patients and those on haemodialysis. Elimination of carriage appears to be an attractive preventive strategy.

Materials and Methods:
This study was carried out in the department of Nephrology, Bangabandhu Sheikh Mujib Medical University, Shahbag, Dhaka, from June 2010 to September 2011 on the patients admitted in department of Nephrology of BSMMU having indication of haemodialysis with vascular access. Patients with fever and patients who are already on antibiotic for other reason were excluded. From all the participants history has been taken, physical examination has been done and necessary investigations were carried out.

Patient's estimated glomerular filtration rate (eGFR) has been calculated by using Cockcroft and Gault (CG) equations. Initially from all, nasal swab was collected aseptically. Patients were followed for appearance of fever with chills. As soon as fever was appeared blood sample and nasal swab were collected aseptically and sent for microbiological study. 5 ml blood was inoculated in Trypticase Soya broth and was incubated at 37°C. The culture bottle was observed for development of any turbidity on every alternate day. Subculture was done on blood agar, chocolate agar and MacConkey's agar medium. The organisms were identified by using Triple Sugar Iron agar (TSI), Motility Indole Urea agar (MIU) and Citrate medium. Nasal swab were cultured in blood agar and MacConkey's agar media. Subsequently Coagulase test was done to confirm *Staph. aureus*. Any focus of infection was clinically sought. In presence of any focus of infection, patient was excluded from the study. Culture was done in the department of Microbiology, Bangabandhu Sheikh Mujib Medical University, Shahbag, Dhaka.

Results:
Out of 104 patients majority of the study patients were male (57.7%) and male to female ratio was 1.36:1.

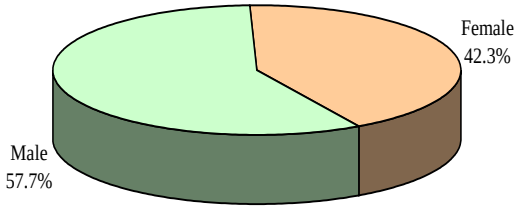

Figure-1: Gender distribution of the patients (n=104)

Out of 104 patients 41 (39.4%) patients were carrier of *Staph. aureus*, 20 (19.2%) patients had bacteraemia, 8 patients had Staphylococcal bacteraemia and out of 8 patients 5 (62.5%) patients had positive nasal swab culture. *Staph. aureus* was 100% sensitive to Amoxicillin + Clavulanic acid, Methicillin and Vancomycin.

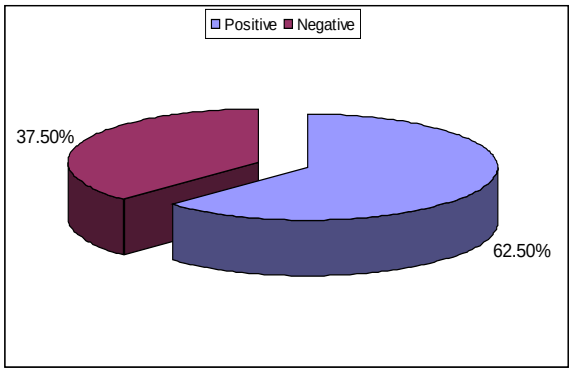

Figure-2: Distribution of patients in relation to bacteraemia (*Staph. aureus*) and positivity of nasal swab culture (n=8)

Table-I shows 41 (39.4%) patients were carrier of *Staph. aureus*. Table-II shows 20 (19.2%) patients had bacteraemia and 84 (80.8%) patients did not have bacteraemia. Table-III shows *Staph. aureus* was found in 8 (40%) and other organisms were found in 12 (60%) patients.

Table-I: Incidence of nasal carriage of *Staph. aureus* in study subject (n=104)

Parameters	Positive No. (%)	Negative No. (%)
Nasal carriage of *Staph. aureus*	41 (39.4)	63 (60.6)

Table-II: Bacteraemia in study subjects (n=104)

Parameters	Positive No. (%)	Negative No. (%)
Bacteraemia	20 (19.2)	84 (80.8)

Table-III: Distribution of Staph. aureus among bacteraemic patients (n=20)

Organism	No.	%
Staphylococcus aureus	8	40
Others	12	60

Table-IV: Distribution of the study patients according to sensitivity (n=8)

Antibiotic	Staph. aureus Number (%)
Amoxicillin + Clavulanic acid	8 (100.0)
Cloxacillin	3 (37.5)
Imipenem	7 (87.5)
Linezolid	6 (75.0)
Methicillin	8 (100.0)
Vancomycin	8 (100.0)

Discussion:

This study was carried out to find out the frequency of nasal carriage of *Staph. aureus* in haemodialysis patient and sensitivity pattern of the organism. Majority of the study patients were male (57.7%) and male female ratio was 1.36:1. The most common cause of CKD was Glomerulonephritis (63.46%), Diabetic nephropathy was the second common cause (31.73%). Other study showed that in our country Glomerulonephritis is the most common cause of CKD[19].

An overall incidence of nasal carriage of 39.4% was observed in this study. It was observed 38.5%, 35.43%, 35%, 53% in elsewhere[20-22]. However, in previous reports, it was relatively lower, between 11.25% and 31.4% [23-25] and the rate was higher between 44% and 84% in other studies[26-29]. One explanation for this variability may be that factors in the host, such as nutritional status, race, age, sex, hormonal factors, anatomical alterations, bactericidal activity of nasal secretions, epithelial cell receptors and/or local immunity associated with IgA predispose some patients to be *Staph. aureus* nasal carriage. Other reasons may be related to bacteria and/or environment[30,31]. Out of 104 patients 20 (19.2%) patients had bacteraemia. In one study bacteraemia was occurred in (17.14%) of cases[32] and in another study it was occurred in 11% of cases[33]. Staphylococcal bacteraemia was observed in 8 (40%) and in another study *Staph. aureus* was found in 32.4% of cases[34].

Out of the 8 patients of Staphylococcal bacteraemia 5 (62.8%) patients had positive nasal swab culture having similarity with another study where it was reported that *Staph. aureus* isolated from haemodialysis patients with blood stream infections were clonally identical to those obtained from their nasal specimen in 82.2% of cases, suggesting that the organism in blood stream originates from the patients own nasal flora.

These staphylococcal infections present a serious clinical problem in the routine management of the haemodialyzed patients. That is why, a greater understanding of *Staph. aureus* colonization prevalence and microbiology is essential to guide efforts in reducing antibiotic resistant strains spread. Furthermore, the nasal application of an antistaphylococcal drug temporarily decolonizes the nose and other parts of the body sites, which prevents infection. *Staph. aureus* was 100% sensitive to Amoxicillin + Clavulanic acid, Methicillin and Vancomycin. Imipenem was sensitive to 87% of cases. In one study, it was also found that *Staph. aureus* was sensitive to Vancomycin in 100% cases[18]. In another study, it was found that Ciprofloxacin was sensitive to the most of the gram positive and gram negative organisms[34].

Limitation of the study:

This study was conducted at a single centre with small sample size and short duration. So, it may not be the representative of other centers. Clonal identification of bacteria is not available in our country.

Conclusion:

Haemodialysis is an important method of treatment of ESRF patients. One of the major problem is bloodstream infection. The commonest causative organism of infection is *Staph. aureus*. One of the important source of Staphylococcus is the anterior nares. It can be reduced by proper antiseptic measure during needling and appropriate nursing care. Antibiotics which are sensitive to common organisms is Amoxicillin + Clavulanic acid, Methicillin and Vancomycin.

References:

1. Vanholder R, Van Biesen W. Incidence of infectious morbidity and mortality in dialysis patients. Blood Purif. 2002; 20 (5): 477-80.

2. Collins AJ, Foley RN, Gilbertson DT, Chen SC. United States Renal Data System public health

surveillance of chronic kidney disease and end-stage renal disease. Kidney Int Suppl (2011). 2015; 5 (1): 2-7.

3. Lowy FD. Staphylococcus aureus infections. N Engl J Med. 1998; 339 (8): 520-32.

4. Laupland KB, Church DL, Mucenski M, Sutherland LR, Davies HD. Population-based study of the epidemiology of and the risk factors for invasive Staphylococcus aureus infections. J Infect Dis. 2003; 187 (9): 1452-9.

5. Richards MJ, Edwards JR, Culver DH, Gaynes RP. Nosocomial infections in medical intensive care units in the United States. National Nosocomial Surveillance System. Crit Care Med. 1999; 27 (5): 887-92.

6. Laupland KB, Zygun DA, Davies HD, Church DL, Louie TJ, Doig CJ. Population-based assessment of intensive care unit-acquired bloodstream infections in adults: Incidence, risk factors, and associated mortality rate. Crit Care Med. 2002; 30 (11): 2462-7.

7. Sieradzki K, Roberts RB, Haber SW, Tomasz A. The development of vancomycin resistance in a patient with methicillin-resistant Staphylococcus aureus infection. N Engl J Med. 1999; 340 (7): 517-23.

8. Smith TL, Pearson ML, Wilcox KR, Cruz C, Lancaster MV, Robinson-Dunn B, et al. Emergence of vancomycin resistance in Staphylococcus aureus. Glycopeptide-Intermediate Staphylococcus aureus Working Group. N Engl J Med. 1999; 340 (7): 493-501.

9. Centers for Disease Control and Prevention (CDC). Vancomycin-resistant Staphylococcus aureus--Pennsylvania, 2002. MMWR Morb Mortal Wkly Rep. 2002; 51 (40): 902.

10. Centers for Disease Control and Prevention (CDC). Staphylococcus aureus resistant to vancomycin--United States, 2002. MMWR Morb Mortal Wkly Rep. 2002; 51 (26): 565-7.

11. von Eiff C, Becker K, Machka K, Stammer H, Peters G. Nasal carriage as a source of Staphyloccus aureus bacteraemia. Study Group. N Engl J Med. 2001; 344 (1): 11-6.

12. Kluytmans J, van Belkum A, Verbrugh H. Nasal carriage of Staphylococcus aureus: epidemiology, underlying mechanisms, and associated risks. Clin Microbiol Rev. 1997; 10 (3): 505-20.

13. Vandecasteele SJ, Boelaert JR, De Vriese AS. Staphylococcus aureus infections in haemodialysis: what a nephrologist should know. Clin J Am Soc Nephrol. 2009; 4 (8): 1388-400.

14. Doebbeling BN. Nasal and hand carriage of Staphylococcus aureus in healthcare workers. J Chemother. 1994; 6 (Suppl 2): 11-7.

15. Boelaert JR, Van Landuyt HW, Gordts BZ, De Baere YA, Messer SA, Herwaldt LA. Nasal and cutaneous carriage of Staphylococcus aureus in hemodialysis patients: the effect of nasal mupirocin. Infect Control Hosp Epidemiol. 1996; 17 (12): 809-11.

16. Goldblum SE, Ulrich JA, Goldman RS, Reed WP. Nasal and cutaneous flora among hemodialysis patients and personnel: quantitative and qualitative characterization and patterns of Staphylococcal carriage. Am J Kidney Dis. 1982; 2 (2): 281-6.

17. Ena J, Boelaert JR, Boyken LD, Van Landuyt HW, Godard CA, Herwaldt LA. Epidemiology of Staphyloccus aureus infections in patients on hemodialysis. Infect Control Hosp Epidemiol. 1994; 15 (2): 78-81.

18. Marr KA, Sexton DJ, Conlon PJ, Corey GR, Schwab SJ, Kirkland KB. Catheter-related bacteremia and outcome of attempted catheter salvage in patients undergoing hemodialysis. Ann Intern Med. 1997; 127 (4): 275-80.

19. Rashid HU, Khanam A. Slowing of progression in chronic renal failure. Bangladesh Renal J. 1999; 18 (1): 1-4.

20. Saxena AK, Panhotra BR, Chopra R. Advancing age and the risk of nasal carriage of Staphylococcus aureus among patients on long-term hospital-based hemodialysis. Ann Saudi Med. 2004; 25 (5): 337-42.

21. Diawara I, Bekhti K, Elhabchi D, Saile R, Elmdaghri N, Timinouni M, et al. Staphylococcus aureus nasal carriage in hemodialysis centers of Fez, Morocco. Iranian J Microbiol. 2014; 6 (3): 175-83.

22. Trivedi HS, Pang MM, Campbell A, Saab P. Slowing the progression of chronic renal failure: economic benefits and patients' perspectives. Am J Kidney Dis. 2002; 39 (4): 721-9.

23. Ternois I, Geffroy S, Brunn Y, Lemeland JF, Etienne I, Fleurette J, et al. Evaluation of the

carriage of Staphylococcus aureus in patients and the personnel of a haemodialysis centre for the prevention of infections. Pathologie Biologie. 1993; 41 (4): 428-33.

24. Kozioł-Montewka M, Szczepanik A, Baranowicz I, Jóźwiak L, Ksiazek A, Kaczor D. The investigation of Staphylococcus aureus and coagulase-negative staphylococci nasal carriage among patients undergoing haemodialysis. Microbiol Res. 2006; 161 (4): 281-7.

25. Montagnac R, Eloy C, Schillinger F, Croix JC, Milcent T. Repeated studies of the prevalence of Staphylococcus aureus in the nasal cavity in haemodialysed patients. La Presse Med. 1995; 24 (23): 1075-7.

26. Souly K, Ait el kadi M, Lahmadi K, Biougnach H, Boughaidi A, Zouhdi M, et al. Epidemiology and prevention of Staphylococcus aureus nasal carriage in haemodialyzed patients. Med Mal Infect. 2011; 41 (9): 469-74.

27. Yu VL, Goetz A, Wagener M, Smith PB, Rihs JD, Hanchett J, et al. Staphylococcus aureus nasal carriage and infection in patients on haemodialysis. Efficacy of antibiotic prophylaxis. N Engl J Med. 1986; 315 (2): 91-6.

28. Kaplowitz LG, Comstock JA, Landwehr DM, Dalton HP, Mayhall CG. Prospective study of microbial colonization of the nose and skin and infection of the vascular access site in hemodialysis patients. J Clin Microbiol. 1988; 26 (7): 1257-62.

29. Peña C, Fernández-Sabe N, Domínguez MA, Pujol M, Martinez-Castelao A, Ayats J, et al. Staphylococcus aureus nasal carriage in patients on haemodialysis: role of cutaneous colonization. J Hosp Infect. 2004; 58 (1): 20-7.

30. Peacock SJ, Mandal S, Bowler IC. Preventing Staphylococcus aureus infection in the renal unit. QJM. 2002; 95 (6): 405-10.

31. Weidenmaier C, Kokai-Kun JF, Kristian SA, Chanturiya T, Kalbacher H, Gross M, et al. Role of teichoic acids in Staphylococcus aureus nasal colonization, a major risk factor in nosocomial infections. Nat Med. 2004; 10 (3): 243-5.

32. Nagarik AP, Soni S, Barnela S, Gondane S, Kishan AG, et al. Bacteremia following temporary hemodialysis catheter insertion: A prospective study. Indian Journal of Nephrology. 2007; 17 (3): 107-8.

33. Oliver MJ, Callery SM, Thorpe KE, Schwab SJ, Churchill DN. Risk of bacteremia from temporary hemodialysis catheters by site of insertion and duration of use: a prospective study. Kidney Int. 2000; 58 (6): 2543-5.

34. Rahman H, Iqbal M, Ali TMM, Chowdhury AA. Study of haemodialysis through femoral catheter-usefulness and complications. Bangladesh Renal J. 1996; 15 (2): 57-62.

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