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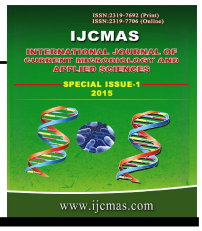

Case Study

Intravenous Cannula Site Infection Presenting as Endocarditis – A Preventable Complication

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A B S T R A C T

Nosocomial infections pose a global safety concern for hospitalized individuals as well as health care providers. About 10 to 30% of patients acquire nosocomial infection according to Hospital Infection Society, India. Common hospital-acquired infections are respiratory, urinary tract, surgical wound infections and infections associated with intravascular catheters. We discuss here a case of a 35-year-old woman who had an intravenous cannula inserted at her right wrist at the time of her laparoscopic cholecystectomy. She developed fever along with redness and tenderness at the catheter insertion site on 4th postoperative day. Further investigations revealed cannula site infection by methicillin-sensitive Staphylococcus aureus (MSSA) which later spread to cause endocarditis, due to poor treatment adherence. The main purpose of this case report is to highlight the importance of emerging serious threat of nosocomial catheter related infections, that they can complicate even a simple routine procedure like peripheral intravascular catheter insertion leading to increased morbidity, mortality and financial burden. Also we emphasize on the simple preventive measures which can effectively control and drastically reduce the burden of catheter related blood stream infection (CRBSI) complications in the health care facilities and improve the quality of health care.

Introduction

Nosocomial infections are defined as those occurring within 48 hours of hospital admission, 3 days of discharge or 30 days of an operation. Approximately 1 in 10 patients admitted to a hospital fall victimized (Revelas, 2012). Intravenous (IV) catheters are routinely used in modern clinical practice, most commonly in the hospital setting and also for 'home' intravenous therapy, for patients receiving total parenteral nutrition or cancer chemotherapy. Despite indisputable benefit, these cannulas have proved to be a double edged sword with many patients developing severe cannula related infections ranging from local site infection, catheter-related bloodstream

infections (CRBSI), septic thrombophlebitis, endocarditis, to other metastatic infections (e.g., lung abscess, brain abscess, osteomyelitis, and endophthalmitis). Nosocomial infective endocarditis (NIE) is rather an infrequent hospital-acquired infection representing 0.1% of nosocomial infections (Haddad et al., 2004). In India, the rates of IV cannula related infections remain high with an incidence of about 8.75 per 1,000 catheter days, and are now the leading cause of all bloodstream infections (Parameswaran et al., 2011). Peripheral catheter related sepsis is on an increased trend causing many clinical and prognostic connotations on patients. Therefore a dire need for continuous training on standard infection control strategies to prevent intravascular catheters infections including peripheral catheters arises to overcome the current scenario.

Case presentation

A 35-year-old woman had an intravenous catheter inserted at her right wrist at the time of her laparoscopic cholecystectomy. The procedure got complicated and was converted to laparotomy. On the fourth postoperative day, she developed fever. On examination she had redness and tenderness at the catheter site. Catheter was removed. Investigations revealed leukocytosis of 15.6.0x 10^9/L, blood cultures from catheter tip grew methicillin-sensitive *Staphylococcus aureus* (MSSA). The patient was started on intravenous cloxacillin and discharged on day 2 of treatment with advice to continue the same for full course at her centre of convenience. But the patient failed to do so and presented to hospital seven days later with fever. On examination she had a new early diastolic murmur suggesting aortic regurgitation. Investigations showed leukocytosis, CRP of 260 mg/dl, raised ESR of 80mm/hr, blood cultures again grew MSSA and transthoracic echocardiogram revealed aortic valve vegetation. She was treated with a four-week course of intravenous cefazolin for endocarditis and had an uneventful recovery.

Discussion

Catheter related bloodstream infection (CRBSI) is defined as the presence of bacteremia originating from an intravenous catheter. It emerges as the commonest cause of septicemia in developing countries like India. Incidence of CRBSI reported differs from country to country and even hospital to hospitals. An attribute mortality rate of 12% to 25% occurs due to associated serious complications (Maki et al., 2006). However the relative risk for CRBSI is up to 64 times greater with central venous catheters CVCs than with peripheral venous catheters (Gahlot et al., 2014). Other independent risk factors for cannula related infections include the use of triple lumen (versus single lumen) catheters, infusion of total parenteral nutrition, frequency of catheter manipulation, certain catheter insertion sites (jugular and femoral sites in particular), and patient related factors, such as underlying disease and severity of illness (Horvath and Collignon, 2003).

Pathogenesis: Several modes of colonisation with pathogens have been proposed like colonization of the catheter tip and cutaneous tract with skin flora; endoluminal colonization of the catheter caused by contamination; hematogenous seeding of the catheter from another infected site; and contamination of the lumen of the catheter with infusate. Another issue is biofilm formation which plays an important role in causing bacteremia resistant to antibiotic therapy and cure is usually only possible by removing the catheter (Crump and Collignon, 2000). The point of change

of colonization to invasive infection is unclear, and a faint relation to the number of organisms present on the catheter and time dependency with infection being rare within the first 48 hours of catheter placement exists.

Microbiology: The predominant pathogens causing CRBSI are skin-associated micro-organisms usually bacteria and yeasts, with *S. aureus* 40% (infection risk being highest in patients with neutrophil defects or venous thrombophlebitis), *Pseudomonas aeruginosa* 16%, *Candida sp*., 16%, coagulase negative *Staphylococci* 8%, *E. coli* 8%, *Klebsiella pneumoniae* 8%, and *Acinetobacter baumanii* 4% (Parameswaran et al., 2011).

Nosocomial infective endocarditis (NIE)

It is defined as acute IE occurring 48 to 72 hours or more post-admission to hospital and/or endocarditis directly relating to a hospital-based procedure performed during a previous hospital stay within eight weeks of admission. The most commonly isolated pathogens in NIE are staphylococci, both *S. aureus* and coagulase-negative *Staphylococci*. Cases of catheter-related NIE (CR-NIE) have been associated with all kinds of intravascular devices; 9.1–48% of episodes of CR-NIE were associated with central venous catheters, 6–22.7% with peripheral venous catheters, 2–9% with central arterial catheters (pulmonary artery catheters) and a substantially lower incidence with peripheral arterial catheters and hemodialysis catheters (Haddad et al., 2004).

Diagnosis of catheter related blood stream infection:

Clinical diagnosis:

The diagnosis of CRBSI should be clinically suspected, if the patient with IV catheter have at least one of the following clinical signs or symptoms only after excluding the alternative sources of infection: fever (>38ºC), hypotension (systolic pressure ≤90 mm Hg), or oliguria (<20 cm^3/hr) and signs of inflammation at cannula site like erythema, swelling, tenderness, and purulent drainage around the catheter exit commonly seen associated with the peripheral catheters. Infective endocarditis should be suspected in those patients with onset of new cardiac murmur, repeatedly positive blood cultures, and other features of the modified Duke criteria. Other metastatic complications should arouse suspicion incase of inadequate response to treatment.

Laboratory diagnosis:

The definitive diagnosis of CRBSI warrants atleast one positive blood culture from a peripheral vein and clear-cut evidence implicating no other apparent source for the BSI, except the catheter. This criterion can be fulfilled by any of the following methods:

- A positive catheter tip culture by roll plate technique, showing semi-quantitative (>15 colonies) or quantitative culture (>10^3 organisms) along with isolation of the same organism (antibiogram and species) from the catheter segment and peripheral blood culture. Unfortunately, this method only has a positive predictive value of 16–31% because most catheter tip cultures are negative (Maki et al., 1977).

- Simultaneous quantitative paired blood cultures with a >5:1 ratio growth of catheter blood versus peripheral blood, or a differential time to positivity, whereby a nonquantitative blood culture

drawn from the catheter with greater density of pathogens becomes positive at least 2 hr earlier than the peripheral blood culture (using the Bactec system). This new technique for the diagnosis of CRBSI without removing the catheter has been reported to have a sensitivity and specificity of greater than 90% and a positive predictive value of approximately 80% (Horvath and Collignon, 2003).

Treatment and Prevention

Once diagnosed, the first and foremost step to be taken is catheter removal. While awaiting blood culture results, empiric therapy for catheter site infections should be given in the form of vancomycin, or flucloxacillin in combination with an aminoglycoside (Mermel et al., 2009). The regimen may be modified once the pathogen is identified and drug sensitivity established by disk diffusion method done on Muller Hinton agar. Removal of the line itself has been suggested to be sufficient to resolve the infection, if low virulence organisms such as *coagulase-negative staphylococci* are isolated, but usually the patient is also treated with one week of intravenous antibiotics. The other basic prevention guidelines are elucidated in Table 1.

If *Staphylococcus aureus* is isolated, patient should be treated with antibiotics (e.g. flucloxacillin if sensitive) for a minimum of 14 days after catheter removal (4–6 weeks therapy if fever persists or there is a suspected distant focus of infection). In our case the patient had poor antibiotic therapy compliance as she did not complete the full course of antibiotics leading to residual infection which flared up the complication ending up with endocarditis.

Infective endocarditis (IE) is a serious complication, occurring in up to 25 % of cases of *Staphylococcus* associated bacteremia (Incani et al., 2013). If the patient remains febrile after removal of the device, three sets of blood cultures should be obtained.

Endocarditis or septic thrombophlebitis should be suspected if blood cultures remain positive for more than 48 hours after the device has been removed (Horvath and Collignon, 2003). As per the Infectious Disease Society of America (IDSA) guidelines, Trans Esophageal Echocardiography (TEE) should be done for patients with CRBSI who have any of the following: a prosthetic heart valve, pacemaker, or implantable defibrillator; persistent bacteremia or fungemia and/or fever 13 days after initiation of appropriate antibiotic therapy and catheter removal; and any case of *S. aureus* CRBSI in which duration of therapy less than 4–6 weeks is being considered.

Unless the clinical condition of the patient dictates otherwise, TEE should be performed at least 1 week after the onset of bacteremia or fungemia to prevent false negative results. A repeat TEE can be considered for patients with a high index of suspicion for infective endocarditis in whom the initial TEE had negative findings along with follow-up blood cultures (Mermel et al., 2009). NIE has 29% higher mortality rate compared to the acquired endocarditis cases (Martín-Dávila et al., 2005). Hence much emphasis is made in this article to improve the early diagnosis and prevent NIE.

Table.1 Prevention guidelines of intravascular catheter related infections

• Do not insert an intravascular catheter unless required. • Meticulous hand hygiene by health care workers. • Effective cutaneous aseptic precautions. • Proper attention to aseptic techniques for central venous catheters (gowns, gloves, drapes) • Strictly disinfect access sites before use. • Daily inspection of the insertion site. • Cover site with sterile dressings. • Immediately change the soiled/ moistened catheter dressings. • Routinely replace the peripheral catheters (every 72 hrs). • Remove catheter when no longer clinically necessary. • Prompt investigations to aid in early diagnosis of catheter site infections whenever required. • Appropriate, adequate dose and complete antibiotic course should be prescribed. • Proper follow up of patients confirming compliance to antibiotic course to prevent unnecessary lethal complications due to persistent bacteremia. • Appropriate investigations for suspected complications (endocarditis etc.,) whenever necessary. • If central catheter used, prefer low risk prone infection sites like subclavian vein rather than jugular and femoral vein sites.

Conclusion

- Intravascular catheter related blood stream infections are emerging as a huge devastating health hazard associated with innumerable complications, but in most cases are eminently preventable.
- While diagnosis and treatment of such cases is imperative, even more important are adequate measures to prevent them altogether to reach a status of "zero morbidity and mortality" from this infection.
- Implementation of simple preventive measures like minimal use and early removal of invasive devices, prudent antimicrobial use, timely hand washing, aseptic techniques, short hospital stays, adequate staffing and an active infection control program are essential.
- Even though central venous catheter site infections are more commonly responsible for nosocomial induced endocarditis, peripheral iv catheter site infections should not be overlooked and suspicion for the same is necessary for proper prevention and management.
- Trans-oesophageal echocardiography is mandatory in all cases of *Staphylococcus* associated bacteremia, unless contraindicated to improve the detection of endocarditis, as nosocomial induced endocarditis carry a much worse prognosis than acquired endocraditis.

References

Crump, J.A., Collignon, P.J. 2000. Intravascular catheter-associated infections. *Eur. J. Clin. Microbiol. Infect. Dis.*, 19: 1–8.

Gahlot, R., Nigam, C., Kumar, V., Yadav, G., Anupurba, S. 2014. Catheter related bloodstream infections. *Int. J. Crit. Illn. Inj. Sci.*, 4: 16–27.

Haddad, S.H., Arabi, Y.M., Memish, Z.A., Al-Shimemeri, A.A. 2004. Nosocomial infective endocarditis in critically ill patients: a report of three cases and review of the literature. *Int. J. Infect. Dis.*, 8(4): 210–6.

Horvath, R., Collignon, P. 2003. Controlling intravascular catheter infections. *Aust. Prescr.*, 26: 41–43.

Incani, A., Hair, C., Purnell, P., O'Brien, D.P., Cheng, A.C., Appelbe, A., Athan, E. 2013. *Staphylococcus aureus* bacteraemia: evaluation of the role of transoesophageal echocardiography in identifying clinically unsuspected endocarditis. *Eur. J. Clin. Microbiol. Infect. Dis.*, 32(8): 1003–1008.

Maki, D.G., Kluger, D.M., Crnich, C.J. 2006. The risk of bloodstream infection in adults with different intravascular devices: a systematic review of 200 published prospective studies. *Mayo Clin. Proc.*, 81: 115971.

Maki, D.G., Weise, C.E., Sarafin, H.W. 1977. A semiquantitative culture method for identifying intravenous-catheter-related infection. *N. Engl. J. Med.*, 296: 1305–1309.

Martín-Dávila, P., Fortún, J., Navas, E., Cobo, J., Jiménez-Mena, M., Moya, J.L., et al. 2005. Nosocomial endocarditis in a tertiary hospital : An increasing trend in native valve cases. *Chest*, 128(2): 772–779.

Mermel, L.A., Allon, M., Bouza, E., Craven, D.E., Flynn, P., O'Grady, N.P. et al. 2009. Clinical practice guidelines for the diagnosis and management of intravascular catheter-related infection: 2009 update by the infectious diseases society of America. *Clin. Infect. Dis.*, 49: 1–45.

Parameswaran, R., Sherchan, J.B., Varma, M., Mukhopadhyay, C., Vidyasagar, S. 2011. Intravascular catheter-related infections in an Indian tertiary care hospital. *J. Infect. Dev. Ctries.*, 5(6): 452–458.

Revelas, A. 2012. Healthcare - associated infections: A public health problem. *Niger Med J.*, 53(2): 59–64.