International Journal of Infection Control
www.ijic.info ISSN 1996-9783

PRACTICE FORUM

Pseudo-meningitis due to *Pseudomonas aeruginosa* in a paediatric ward of a tertiary care centre: A glimpse on infection control measures

Anuradha Sood[1], Puneet Kumar Gupta[1], Kamlesh Thakur[1], Smriti Chauhan[1], Subhash Chand Jaryal[1], Piyush Gautam[2]

1. Department of Microbiology, Dr. Rajendra Prasad Government Medical College, Kangra at Tanda, Himachal Pradesh, India
2. Department of Paediatrics, Dr. Rajendra Prasad Government Medical College, Kangra at Tanda, Himachal Pradesh, India

doi: 10.3396/IJIC.v12i1.005.16

Abstract

Paediatric bacterial meningitis is a life threatening illness. We report a pseudo-outbreak of *Pseudomonas aeruginosa* meningitis in neonates from the neonatal intensive care unit (NICU) and paediatric ward of our 567 bed tertiary care hospital. The infection control team (ICT) investigated the cause of a sudden significant increase of *Pseudomonas* meningitis in neonates. A retrospective analysis of all the isolates from CSF and environmental sampling from NICU and paediatric ward was done. Direct culture of autoclaved rubber caps of glass vials as well as cetrimide and chlorhexidine solution yielded growth of *P. aeruginosa,* with an antibiogram similar to CSF isolates. Pseudo-infection not only burdens the work of health care providers but also has financial implications; hence every measure should be taken to prevent it.

Keywords: Pseudo outbreak; Meningitis; *Pseudomonas aeruginosa*; Paediatrics

Background

Paediatric bacterial meningitis is a life threatening illness; if left untreated it may lead to dangerous sequelae. *Pseudomonas aeruginosa* is one of the common causes of iatrogenic meningitis and is associated with a high mortality rate.[1] *Staphylococcus epidermidis*, *Serratia marcescens, Proteus* spp. and *Citrobacter* spp. are other predominant organisms responsible for the same.

We report a pseudo-outbreak of *P. aeruginosa* meningitis in neonates from the neonatal intensive care unit (NICU) and paediatric ward of our 567 bed tertiary care hospital and the investigation thereof. In November 2014, the microbiology laboratory reported *P. aeruginosa* in six cerebrospinal fluid (CSF) samples from the NICU and paediatric ward within a period of six days. All isolates had similar colony morphology, biochemical reactions and antibiogram pattern (i.e.

Corresponding author
Puneet Kumar Gupta
Department of Microbiology, Dr. Rajendra Prasad Government Medical College, Kangra at Tanda, Himachal Pradesh, India
Email: drpuneetkumargupta@gmail.com

sensitive to piperacillin, carbenicillin, ticarcillin, ceftazidime; and resistant to cefepime, gentamicin and co-trimoxazole). Since this finding was unusual, an infection control alert was raised regarding the possibility of an outbreak of meningitis. The infection control team (ICT) decided to investigate the cause of the sudden significant increase of *Pseudomonas* meningitis in the neonates. A retrospective analysis of all the isolates obtained from CSF from NICU and paediatric ward was done and a prospective plan for investigation of the so called outbreak was planned.

Methods

This investigation of pseudo-meningitis was conducted by the Department of Microbiology in our 567 bed tertiary care medical college located in a hilly state of Northern India.

Review of cases

Six neonates with suspected late onset septicemia were included in this study. All cases had CSF culture positive for *P. aeruginosa,* resistant to cefepime, co-trimoxazole and gentamicin. The case history of all the patients was reviewed to look for clinical signs and symptoms, and treatment history.

Review of routine CSF sample collection, transportation and processing

The ICT visited the NICU and paediatric ward to review the CSF sample collection and processing methods. The CSF samples were collected by lumbar puncture after positioning the neonate in lateral position; the skin below the L4 lumbar vertebra was prepared with povidone-iodine and allowed to dry for one minute, followed by 70% alcohol. This was followed by draping the area and collecting the sample in autoclaved glass vials. The samples were transported to the microbiology laboratory within two hours and processed in a biosafety cabinet type II as per the standard microbiology protocol.

Environmental Investigation

Environmental samples were taken from the NICU and paediatric ward. These included swabs from CSF vials, autoclaved drums in which the glass vials were stored, autoclaved linen used during the procedure for draping the patient, trolley surface, disinfectants used during the procedure (povidone-iodine solution and 70% alcohol), cetrimide chlorhexidine solution (savlon) used for keeping forceps, and soap swabs. Finger tip culture and swabs from stethoscopes were collected from nurses and doctors of NICU and paediatric ward. The disinfectants were processed by "in use" method.[2] Briefly, in this method one ml of used disinfectant was transferred into 9 ml of nutrient broth in a sterile universal container. Thereafter 0.02 ml of this mixture was placed onto 10 different areas on two nutrient agar plates. One plate was incubated at 37°C for 3 days and other at 25°C for 7 days. Growth in more than five areas in either plate indicated failure of disinfectant.[2] Other samples were processed as per standard microbiology techniques.

Results

Among the six neonates included in the study, four were male and two were female. All of these were suspected cases of late onset septicaemia admitted to the NICU and paediatric ward. All neonates had a peripheral intravenous line in place. There were gram negative bacilli without pus cells in the CSF samples of all the neonates. The CSF of all six patients yielded growth of *P. aeruginosa* and their antibiotic susceptibility pattern was similar. On review of charts, none of the patients showed deterioration of clinical signs and symptoms. All cases were on their way to recovery with the initial empiric treatment (cefotaxime 200 mg/kg/day and amikacin 15mg/kg/day) started for bacterial meningitis as per the hospital protocol.

Description of Pseudo-meningitis

Results of all cultures are summarized in Table I. Direct culture done from autoclaved rubber caps of glass vials yielded growth of *P. aeruginosa* whereas swabs from inner surfaces of glass vials did not yield any growth. The "in use" test of savlon yielded growth of *P. aeruginosa*. The antibiogram of isolates was similar to that obtained from CSF isolates. The results were immediately conveyed to those in charge of the NICU and pediatrics ward, with prompt change of savlon solution for storing forceps and discontinuation of the use of glass vials. Initially, it was presumed that the glass vials were not being autoclaved properly and were the source of contamination. To confirm the source of infection the very next day repeat samples from autoclaved glass vials and from savlon was collected and cultured. Additionally, the biological monitoring

Table I. Results of environmental microbiological surveillance in NICU and Paediatric ward

SNo.	Specimen	Method used	Results
1	Autoclaved vials Swabs from rubber caps of glass vial Swabs from inner surface of glass vial	 Direct culture Direct culture	 *Pseudomonas aeruginosa* Sterile
2	Savlon for dipping chaetal forceps (from NICU & Pedriatic ward)	In Use test	*Pseudomonas aeruginosa*
3	Betadine	In Use test	Sterile
4	Spirit	In Use test	Sterile
5	Gauze pieces (Autoclaved)	Direct culture	Sterile
6	Swab from autoclaved drum (inner side)	Direct culture	Sterile
7	Swab from green sheet	Direct culture	Sterile
8	Swab from trolley surface	Direct culture	Sterile
9	Soap swab	Direct culture	Sterile
10	Swabs from stethoscope (4 in number)	Direct culture	1 grew Coagulase negative staphylococcus; 3 sterile
11	Finger tip cultures from nurses and doctors	Direct culture	No pathogenic organisms; only skin commensals

of the autoclaves was done using strips containing 10^6 spores of *Bacillus stearothermophilus*. The results again were surprising as the functioning of the autoclaves was perfect but savlon still showed growth. The ICT again visited the wards and questioned the savlon dilution method and the source of savlon. It was found that the savlon was being refilled from a larger container that was contaminated, likely due to biofilm formation of *P. aeruginosa* in this larger container. The CSF samples thus collected in these vials were showing growth of *P. aeruginosa*.

Interventions and corrective measures

We immediately stopped the use of savlon from the container and all the glass bottles used for savlon storage were autoclaved and refilled with fresh savlon. The "in use" test was again performed and there was no growth. Passive surveillance from the laboratory for the next few days showed no growth of *P. aeruginosa* in CSF samples from the NICU and paediatric ward. Apart from standard work precautions, recommendations for decontamination such as autoclaving of containers before refilling disinfectant, use of either sterile normal saline or distilled water for dilution of a disinfectant, and changing the disinfectant daily or to follow manufacturer instructions were given.

Discussion

A pseudo-outbreak is an episode of increased disease incidence due to enhanced surveillance or other factors not related to the disease under study,[3] or the recovery of the same organism from cultures of multiple patients who are not infected or colonized with the organism.

Many outbreaks in outpatient clinics and indoor wards from a common source have been associated with the use of intrinsically or extrinsically contaminated fluids or equipment. Intrinsic contamination is quite rare as compared to extrinsic contamination. Approximately 11% of all nosocomial outbreaks are believed to represent pseudo-outbreaks.[4] These may be due to contamination of specimens, laboratory errors, or changes in surveillance techniques.[5] There have been several reports of *Pseudomonas* pseudo-outbreaks and pseudo-infections from across the world. In 1981, the first report of intrinsic contamination of povidone-iodine was from New York, when many cases of

pseudobacteremia were caused by *Pseudomonas cepacia*.[6] In another report, Hallin *et al* reported a pseudo-outbreak of extremely drug resistant *P. aeruginosa* causing urinary tract infection due to contamination of an automated urine analyzer.[7] Similarly, a pseudo-outbreak of *P. aeruginosa* infection occurred in association with use of a damaged bronchoscope in 12 patients in a 1,000-bed urban teaching hospital in Atlanta, Georgia.[8] Finally, an outbreak of four post-surgical *P. aeruginosa* joint infections was attributed to contaminated sterile saline solution that was used to process tissue specimen in these cases.[9]

Pseudo-meningitis in our cases was suspected as all patients were recovering clinically, which is unlikely to occur in *Pseudomonas* meningitis as it is associated with high mortality. Also, all isolates had the same susceptibility pattern. Another supportive finding was that direct gram stain of CSF showed only gram negative bacilli without any inflammatory cells. It was also noted that there had been no change in the local reporting practices or any enhanced surveillance in our cases.

Prompt action taken by the ICT and subsequent microbiological analysis of all possible sources of contamination can be very useful in these situations. Pseudo-infections not only burden the work of health care providers but also have financial implications, so every possible measure should be taken for their control. Control of these types of infection is important to avoid use of unnecessary antibiotics, invasive investigations and hospitalization.

References

1. Huang CR , Lu CH, Chuang YC, *et al*. Adult *Pseudomonas aeruginosa* meningitis: high incidence of underlying medical and/or postneurosurgical conditions and high mortality rate. *Jpn J Infect Dis* 2007; **60:** 397-399.
2. White AB. Sterilization and disinfection. In: Collee JG, Marmion BP, Fraser AG, Simmons A, Eds. *Mackie and McCartney Practical Medical Microbiology*. 14th ed. India: Churchill Livingstone 2014: 813-814.
3. Centers for Disease Control and Prevention. Outbreaks of pseudo-infection with *Cyclospora* and *Cryptosporidium* – Florida and New York City, 1995. MMWR Morb Mort Wkly Rep 1997; **46:** 354-358.
4. Shears P. Pseudo-outbreaks. *Lancet* 1996; **347:** 138. http://dx.doi.org/10.1016/S0140-6736(96)90337-2
5. Dunder D, Meric M, Vahaboglu H, Willke A. pseudo-outbreak of *Serratia marcescens* in a tertiary care hospital. *New Microbiologica* 2009; **32:** 273–276.
6. Berkelman RL, Lewin S, Allen JR, *et al*. Pseudobacteremia attributed to contamination of povidone-iodine with *Pseudomonas cepacia*. Arch Intern Med 1981; **95:** 32-36. http://dx.doi.org/10.7326/0003-4819-95-1-32
7. Hallin M, Deplano A, Roisin S, *et al*. Pseudo-outbreak of extremely drug-resistant *Pseudomonas aeruginosa* urinary tract infections due to contamination of an automated urine analyzer. *J Clin Microbiol* 2012; **50:** 580-582. http://dx.doi.org/10.1128/JCM.06268-11
8. Diaz Granados CA, Jones MY, Kongphet-Tran T, *et al*. Outbreak of *Pseudomonas aeruginosa* infection associated with contamination of a flexible bronchoscope. *Infect Control Hosp Epidemiol* 2009; **30:** 550–555. http://dx.doi.org/10.1086/597235
9. Forman W, Axelrod P, St John K, *et al*. Investigation of a pseudo-outbreak of orthopedic infections caused by *Pseudomonas aeruginosa*. *Infect Control Hosp Epidemiol* 1994; **15:** 652–657. http://dx.doi.org/10.2307/30145276