

child with meningitis and *Salmonella* from stool specimens of children present in a neonatal ward during an outbreak of salmonellosis, belonged to a single epidemic strain. The present report illustrates that the diagnosis of *Salmonella* meningitis should be considered in neonates with Gram-negative rods in the CSF.

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References

1. Cohen JI, Artlett JA, Orey GR. Extra-intestinal manifestations of Salmonella infections. *Medicine* 1987; **66**: 349–388.
2. Rabinowitz SG, MacLeod NR. Salmonella meningitis. *Am J Dis Child* 1972; **123**: 259–262.
3. Aarts HJM, Lith van LAJT, Keijer J. High-resolution genotyping of Salmonella strains by ALFP-fingerprinting. *Letters in Applied Microbiology* 1998; **26**: 131–135.
4. Vos P, Hogers R, Bleeker M *et al.* AFLP: a new technique for DNA fingerprinting. *Nucleic Acids Res* 1995; **23**: 4407–4414.
5. Chorba TL, Meriwether RA, Jenkins BR, Gunn RA, MacCormack JN. Control of a non-foodborne outbreak of salmonellosis: day care in isolation. *Am J Public Health* 1987; **77**: 979–981.

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Maintenance of peripheral and central intravenous infusion devices by 0.9% sodium chloride with or without heparin as a potential source of catheter microbial contamination

Sir,

The use of 0.9% sodium chloride injection with or without heparin sodium for maintaining peripheral and central venous indwelling intermittent-infusion devices is frequently recommended.^{1,2} Microbial contamination of the flush solution during prepara-

tion and manual filling of the empty disposable syringes may result in sepsis particularly in immuno-compromized patients. The objective of this study was to determine the prevalence of any microbial contamination of manually filled disposable syringes containing heparinized or normal saline solution in oncology, surgery, intensive care and internal medicine wards at the University Hospital of Grenoble – La Tronche (France).

There was no change to the standard operating procedures for preparing the flush syringes before or during the study period. The disposable equipment used to fill the syringes and the 0.9% sodium chloride and heparin solution supplied, were the same as used in routine practice. Filled syringes were collected by the Hospital Pharmacy staff for examination just after preparation by the nurse on the ward. No information about the day of the syringe collection in the various wards or the purpose of the study was made before or during the study period. In addition to the syringes collected from the wards, 10 filled syringes were deliberately contaminated with *Staphylococcus aureus* (10 CFU/mL) as a positive control at the Hospital Pharmacy. A further 10 pre-filled syringes were steam sterilized at 121°C for 30 min and acted as negative controls. The control syringes were randomly included amongst the collected samples. The syringe contents were sampled for the presence of micro-organisms using standard microbiological methods previously described.³

One hundred and sixty eight syringes were collected from 19 different wards of which 14 were contaminated. Micrococci were detected in 11 syringes with colony forming units/mL ranging from 2 to 10. Two syringes were contaminated with *Corynebacterium* species and coagulase negative staphylococci and one further syringe contained *Candida albicans*. In order to identify the risk factors for microbial contamination the results were analysed according to the surgical or medical activities of the wards, the step by step procedure followed by the nurse to fill the syringe, the type of catheter intended to be maintained, and the level of professional experience of the nurse. The only significant risk factor was the filling of the syringe which involved direct contact of the syringes with the ungloved hands of hospital personnel. Interestingly, flush syringes prepared to maintain implantable ports were not contaminated. This may have been because nurses routinely wear surgical gloves during this filling procedure.

We conclude that flush syringe preparation in wards can result in contamination of intravenous infusion delivery systems. The source of the micro-organisms appears to be from hand contact with the filling equipment in the uncontrolled ward environment. Several previous reports have also commented on the potential for microbial contamination when glass ampoules are used, as a result of ampoule opening.^{4,5} A possible solution to this potential problem of both microbial and glass contamination of manually prepared flush syringes is the use of pre-filled disposable syringes which are sterilized and supplied either by hospital pharmacies or a Medical Device Manufacturer.

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References

1. ASHP. Therapeutic position statement on the institutional use of 0.9% sodium chloride injection to maintain patency of peripheral indwelling intermittent infusion devices. *Am J Hosp Pharm* 1994; **51**: 1572–1574.
2. Nelson TJ, Graves SM. 0.9% sodium chloride injection with and without heparin for maintaining peripheral indwelling intermittent-infusion devices in infants. *Am J Health-Syst Pharm* 1998; **55**: 570–573.
3. European Pharmacopia. Addendum 1999 – Sterility, 27–31.
4. Taylor M, Bourke J, Anderson M, Davey R, Kelly AM, Byron G. Titrated intravenous opioids from the same syringe: an infection risk. *J Accid Emerg Med* 1997; **14**: 33–35.
5. Kempen PM, Treiber HS. Contamination of drugs in ampoules: container as culprit! (abstract). *Anesth Analg* 1990; **70**: S197.