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ORIGINAL ARTICLE

Bacterial contamination of saline used for epidural procedures in an obstetric setting: a randomised comparison of two drawing-up techniques

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ABSTRACT

Background: There is little evidence to inform practice regarding the optimum aseptic technique of drawing up saline for epidural insertion. Our regional practice is to draw up saline from a non-sterile packaged plastic ampoule, therefore introducing the risk of bacterial contamination. Usually, the anaesthetist draws up saline directly from the vial held by an assistant using a needle (needle technique). Alternatively, the saline vial is emptied onto a sterile tray by an assistant and then drawn up by the anaesthetist (tray technique). We hypothesised that the latter will lead to an increase in the number of contaminated saline samples as they are exposed to the environment.

Methods: In labour rooms and before epidural catheter insertion, 110 samples of saline 20 mL were randomly drawn up using our hospital's recommended epidural aseptic precautions, using either the needle or the tray technique. Equal amounts of saline were inoculated into aerobic and anaerobic blood culture bottles.

Results: Eleven percent of samples in the needle arm and 24% of samples in the tray arm grew commensal micro-organisms including coagulase-negative Staphylococcus, Micrococcus luteus and Streptococcus viridans. A two-sided Fisher's exact test for categorical unpaired data showed no statistical difference between the two arms of the trial (P=0.13).

Conclusion: The difference in the saline contamination rate between the two techniques did not reach statistical significance. As bacterial contamination occurred with both techniques, we recommend using sterile saline pre-packaged in the epidural tray or individually wrapped sterile glass saline ampoules.

Keywords: Anaesthesia; Epidural; Saline; Bacterial contamination

Introduction

Infectious complications associated with central neuraxial blockade (CNB) have potentially devastating consequences including paralysis, meningitis and death.[1] The incidence of epidural abscess after CNB depends on risk factors present in local clinical practice and in the patient population.[2] It is difficult to quantify, but has been reported to vary from 1:1000 to 1:100 000 in the general population.[3] The obstetric population appears to be resistant to the infective complications of CNB, and in the Royal College of Anaesthetists Third National Audit Project (NAP3), the risk of all causes of permanent harm following obstetric CNB, judged pessimistically, was 1 in 80 000.[4] The incidence of epidural abscess in the Serious Complication Repository (SCORE) project developed by the Society for Obstetric Anesthesia and Perinatology (SOAP) was 1 in 62 866.[5]

Staphylococcus aureus infection causes 57–93% of epidural abscesses. This is followed in frequency by streptococci (18%) and a variety of Gram-negative bacilli (13%).[3] Migration of skin bacteria through needle puncture sites is considered to be a major source of epidural colonisation.[6] Micro-organisms can also reach the epidural space through contaminated syringes, catheter hubs, local anaesthetic drugs, breaches in aseptic technique and by local or haematogenous spread.[1–3]

Dural puncture appears necessary to allow entry of the less pathogenic streptococci into the subarachnoid space.[7] Meningitis develops rarely when spinals are used for elective caesarean delivery, which may suggest that labour itself could be a risk factor for meningitis due

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to associated vaginal trauma and bacteraemia.[7] In several cases of meningitis in obstetrics, causative organisms have been isolated from the bloodstream and the patient's vagina.[2] Commensals in the upper airway can cause nosocomial meningitis, particularly when a mask is not worn by the anaesthetist.[1–3,8–10]

Failure of aseptic technique was identified by the NAP3 report as a risk factor for the development of epidural abscess.[4] The Association of Anaesthetists of Great Britain and Ireland describes the optimum aseptic technique of performing CNB in guidelines for infection control in anaesthesia,[11] and also published a safety guideline regarding the method of choice for skin antisepsis.[12] The American Society of Regional Anesthesia and Pain Medicine (ASRA) consensus statement acknowledged the importance of performing a strict aseptic regional anaesthetic procedure.[1] However, the ASRA recognised that many recommendations have been extrapolated from the medical and surgical literature and that there are significant variations in practice across the world. For example, a national survey of prevention of infection in obstetric CNB in the UK in 2009 showed 99% of anaesthetists used gown, gloves and sterile drape, 91% used a surgical mask but only 87% used surgical caps.[13] In the same survey, 90% of anaesthetists insisted procedural assistants wear a surgical cap and mask. However, the survey did not look at the method of drawing up sterile saline for epidural insertion.

In the Wessex region of the UK, saline used for epidural insertion comes from a non-sterile packaged plastic ampoule and is drawn up using one of two methods. Usually, the assistant opens and holds the ampoule whilst the anaesthetist aspirates its contents with a drawing-up needle, filter needle or straw (needle technique). Alternatively, the assistant empties the saline vial onto the epidural pack sterile tray and the anaesthetist draws it up directly into the loss of resistance syringe (tray technique). Both techniques carry a potential risk of bacterial contamination of the sterile saline; the tray technique also exposes more of the saline to the atmosphere. We hypothesised that the tray technique would lead to an increase in the number of saline samples contaminated by bacteria compared with the needle technique.

Methods

The study was carried out in labour rooms at Poole Maternity Unit, a maternity hospital with approximately 5000 deliveries per year. Labour rooms were chosen to conduct the study in a typical clinical setting where epidural insertion takes place and the risk of environmental contamination is potentially greater than in a surgical theatre.

Between September 2013 and April 2014, 110 women in active labour on the delivery suite were recruited. Since the study was intended to replicate performance of the epidural procedure in the labour room environment, the only exclusion criterion was the lack of patient consent for the study. The investigating team used the delivery room in which a woman was in labour. The local Research Ethics Committee deemed approval unnecessary, as the study did not directly involve patients other than by using the rooms in which they were labouring.

When convenient for both mother and attending midwife, we asked for the labouring woman's permission to draw up the saline in her room, trying to minimise any disruption to her care. If the parturient had already requested an epidural for labour analgesia, this was performed with minimal delay by the labour ward anaesthetist as a completely separate procedure using a new epidural pack and saline samples.

After donning of cap and surgical mask, hand washing with surgical scrub and the use of sterile gown and gloves, the study investigator drew up the saline with the help of an assistant, who was usually the attending midwife or the labour ward anaesthetist. Local practice was for the assistant not to wear a hat, surgical mask or non-sterile gloves. The assistant was asked to open the plastic saline ampoules employing their usual technique. The tray or needle technique was used according to the randomisation sequence described below.

The needle technique involved drawing up 20 mL of saline with a sterile 21-gauge hypodermic needle from the plastic ampoules opened by the assistant. The tray technique required the assistant to empty two 10 mL plastic ampoules of saline onto a sterile tray placed on a sterile drape on the epidural trolley. The investigator then drew up saline from the tray with a sterile 20 mL syringe.

For both techniques, the assistant removed the plastic caps from blood culture bottles, disinfected the exposed rubber stoppers with a 2% chlorhexidine in 70% isopropyl alcohol wipe and allowed them to dry. The study investigator inoculated 10 mL of saline each into aerobic and anaerobic blood culture bottles (Becton-Dickinson BACTEC culture bottles containing soybean-casein digest broth) using a new sterile 21-gauge hypodermic needle. This volume has optimum sensitivity to detect blood stream infections for these culture bottles. The samples were sent for bacteriology analysis; results were not checked until all samples had been processed.

Bacterial cultures were incubated for six days using an automated, continuously monitored system. The positive bottles were sub-cultured onto a variety of agar plates to establish bacterial type and Gram-stained. The intention was to establish if there was any growth in the saline solutions; quantitative aspects, such as degree of contamination, were not sought since it was considered that any contamination of a solution being introduced into the epidural space may be clinically significant.

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