We present three cases of epidural abscess, all in patients in whom an epidural catheter had been inserted for postoperative pain management. In all three cases the infecting organism was *Staphylococcus aureus* and two patients had diabetes. The diagnosis was made within 3 days of epidural catheter removal in two cases, but in one the abscess did not present until after the patient had been discharged from hospital. We have retrospectively calculated the incidence of epidural abscess in our hospital over the 5-yr period 1993–98 to be 1 in 800 (0.12%). We emphasize the importance of using techniques that minimize the risk of bacterial contamination during both catheter placement and the management of infusion, and seek to raise awareness of this relatively rare but significant condition.

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Epidural abscess complicating epidural catheter insertion

Epidural abscess is a rare but serious complication of epidural catheter insertion. The incidence of this condition is unclear. The first case of catheter-related epidural abscess was described in 1974 and a further 41 cases were reported up to 1996. We report three case reports from our hospital and discuss the aetiological factors, clinical presentation, management and consequences of this condition.

Case reports

Patient 1

A 75-yr-old woman with carcinoma of the caecum was admitted for a right hemicolectomy. Her medical history was unremarkable. Before induction of anaesthesia a thoracic epidural catheter was sited aseptically. The anaesthetist wore a cap, sterile gloves and a gown; the skin was prepared with 10% iodine and the catheter was dressed with a sterile occlusive dressing. Subcutaneous heparin and i.v. gentamicin and metronidazole were administered in the anaesthetic room. A continuous epidural infusion of bupivacaine and diamorphine was administered for postoperative analgesia. After 3 days the epidural catheter was removed intact.

Over the next day the patient developed a low-grade pyrexia with no obvious cause. This persisted until the fifth day after surgery, when she also spiked a temperature. At this stage she complained of low backache and a headache. There was local tenderness over the epidural site but no neurological deficit or meningism. C-reactive protein (CRP) concentration was 126 mg litre\(^{-1}\) and the white cell count (WCC) was 9.6×10\(^9\) litre\(^{-1}\) with a neutrophil count of 8.2×10\(^9\) litre\(^{-1}\). A possible diagnosis of epidural abscess was considered. Swabs were taken from the epidural site and i.v. flucloxacinilin and cefuroxime were started. The patient’s condition improved over the next few days. *Staphylococcus aureus* sensitive to flucloxacinilin was cultured from the epidural site specimen. Sixteen days after the operation the patient was apyrexial but complained of persistent lower back pain. Magnetic resonance imaging (MRI) showed a focus of enhancement in the posterior epidural space. This pattern is usually associated with granulation tissue and inflamed fat rather than pus. However, the patient had been on i.v. antibiotics for several days. She was referred to the neurosurgeons, who treated the condition conservatively with i.v. flucloxacinilin and fucidin, since there were no signs of cord compression. Forty-four days after surgery she was discharged home on a further 2-week course of oral antibiotics. A follow-up MRI scan showed resolution of the initial findings.

Patient 2

A 55-yr-old man was admitted for an above-knee amputation. He had a medical history of peripheral vascular disease, hypertension, ischaemic heart disease, insulin-dependent diabetes mellitus and a resolved cerebrovascular accident. Anaesthesia was provided by a combined lumbar spinal and epidural technique. This was performed using the aseptic technique described above. A continuous infusion of bupivacaine and diamorphine provided postoperative analgesia for 3 days, after which the epidural catheter was removed intact.

Three days after removal of the catheter, the patient reported discomfort at the epidural insertion site and a severe radicular pain in the distribution of the L2 dermatome. He had a mild pyrexia of 37.2°C and an erythematous tender swelling at the epidural insertion site. Neurological examination revealed loss of sensation to pin prick and light touch in the remaining leg, together with decreased power and an absent right ankle reflex. Blood tests showed a CRP of 118 mg litre\(^{-1}\) and a WCC of 13.9×10\(^9\) litre\(^{-1}\). An MRI scan showed a right posterolateral epidural abscess at L1/2 causing slight thecal displacement. The patient was urgently referred for neurosurgical review and underwent laminectomy and drainage of an epidural abscess. Swabs taken at the time of operation cultured *S. aureus* sensitive to flucloxacinilin, which had been started at the time of operation. He was discharged from hospital 3 months after his first operation.

Patient 3

A 63-yr-old man presented for emergency surgery with a leaking abdominal aortic aneurysm (AAA). He had a history of diet-controlled diabetes and a recent chest infection. He underwent an emergency AAA repair. After induction of anaesthesia he was given augmentin 1.2 g i.v. He received three further doses over the next 24 h as prophylaxis against graft infection. He was initially transferred to the intensive care unit (ITU) where, on the first day after surgery, when his coagulation profile was within normal limits, a thoracic epidural catheter was inserted under aseptic conditions and a continuous infusion of bupivacaine and diamorphine was started.

The patient was transferred to the high-dependency unit on the second day after surgery. On the fourth day the epidural catheter was removed intact and the patient was discharged home 1 week after admission, having made a straightforward recovery.

Three weeks later the patient was re-admitted with a 5–6 day history of infection over the epidural site, which had been treated by his general practitioner with oral flucloxacinilin. He had developed pain over the epidural site 4 days before re-admission, and on the day of re-admission he had developed sudden and progressive weakness in his legs and urinary retention. At this time he had no evidence of superficial infection at the epidural insertion site. He was apyrexial and had a white cell count of 8.2×10\(^9\) litre\(^{-1}\). An urgent epidural myelogram showed an epidural collection causing extradural cord compression at T8. A sample of cerebrospinal fluid sent for culture at that time yielded no bacterial growth. Peripheral blood cultures were also negative. The patient was transferred to a neurosurgical unit.
unit where a T6–8 laminectomy was performed. Culture of abscess material grew methicillin-resistant *S. aureus* (MRSA) and the patient was treated with teicoplanin. The power in his legs returned such that he was able to walk around the ward. Seven days after surgery he suffered a cardiac arrest from which he could not be resuscitated. Postmortem examination established the cause of death to be a pulmonary embolus secondary to a deep vein thrombosis.

Nose, throat and skin swabs taken by the anaesthetist who inserted the epidural catheter did not grow MRSA. However, the strain of MRSA cultured from samples taken from the epidural abscess during laminectomy was also isolated from swabs taken from another patient who had been on the same ward as our patient after discharge from the ITU. This MRSA strain was not cultured from any of the routine swabs taken from patients on the ITU during the patient’s stay. We therefore presume that the infection could have been acquired at some point following transfer to the general ward.

**Discussion**

Epidural abscess is a rare condition, with a reported incidence of 1–2/10 000 of all patients admitted to hospital.\(^7\) The incidence in association with epidural catheter placement *per se* is unclear. The published data quote frequencies ranging from 1 in 506 000 cases, reported in a retrospective review of obstetric patients who underwent epidural anaesthesia for vaginal delivery or Caesarean section,\(^5\) to 3% in patients who had epidural catheters inserted for chronic pain indications.\(^6\) The latter study described two epidural abscesses in only 60 cases of catheter insertion and thus is unlikely to be an accurate statistical analysis of the true occurrence rate. A recent study of epidural catheters inserted over a 1-yr period in Denmark revealed an abscess rate of 1 in 1930 (0.05%).\(^7\) This aimed to include epidural catheters inserted for all indications in all anaesthetic departments in the country.

In our retrospective review of 2401 patients who received epidural postoperative analgesia over a 5-yr period the incidence of epidural abscess was 0.125%. However, this does not include epidural catheters inserted for obstetric indications, which over the same time period amounted to a further 5000 cases, without a single case of epidural abscess. If these cases are included, the incidence falls to 0.04%.

Infection of the epidural space may occur at the time of insertion of the epidural catheter\(^8\) or by subsequent contamination by one of three different ways:\(^9\) through contamination of the skin site and subsequent spread along the catheter track, by haematogenous spread, or by intraluminal contamination via a contaminated syringe\(^10\) or contaminated local anaesthetic solution.\(^14\)

Infection at the time of insertion has been implicated in one published case in which the infecting organism was later isolated from nasal swabs taken from the anaesthetist.\(^8\) There are factors that the anaesthetist can control to reduce the risk of contamination during insertion. These include the use of a strict aseptic technique and the choice of skin dressing used to secure the epidural catheter.

We believe that strict aseptic technique during catheter insertion should include wearing sterile gloves and gown, a theatre cap and a facemask. The skin should be prepared with a suitable bactericidal agent, allowing time to ensure effective antibacterial action. *In vitro* studies have shown that exposing a suspension of MRSA and methicillin-susceptible *S. aureus* to 10% povidone iodine for either 15 or 60 s will result in a 55.2% and 96.7% reduction in mean colony count, respectively.\(^12\) Furthermore, no organism was cultured after the same suspension was exposed to 0.5% chlorhexidine in 80% ethanol for 15 s.

In all three patients described above, 10% povidone iodine was used for skin preparation. However, there was no record of how long it was allowed to dry. At this time it was not policy to use chlorhexidine routinely. Infection during insertion is unlikely to have occurred in patient 3, since swabs taken from the anaesthetist did not grow MRSA. The same strain of MRSA cultured from the abscess fluid was, however, also cultured from a patient who was on the same ward as patient 3 after discharge from the ITU. At this stage the epidural catheter had been in situ for 24 h.

Skin colonization by bacteria at the site of the epidural catheter puncture may occur at the time of placement or later. One study has shown that even when aseptic techniques are used, the epidural and spinal needles can become contaminated with a variety of organisms which may introduce pathogens into the epidural space and lead to clinical infection.\(^13\) The type of dressing used to secure the catheter may influence infection as a result of skin contamination. The use of a porous dressing might be less likely to encourage bacterial culture by reducing the potential for fluid accumulation, but might increase the possibility of secondary pathogen colonization by the passage of bacteria through the dressing. This could have occurred in patient 3.

Contamination of the epidural infusate is a further possible mechanism of infection. In all three patients a continuous infusion of bupivacaine and diamorphine was established after insertion of the epidural catheter. A closed delivery system and bacterial filter were used, in line with published recommendations.\(^14\) The infusate was delivered through a 60-ml syringe prepared by the anaesthetist. We have now changed to using 250-ml bags of 0.15% bupivacaine with diamorphine prepared in the pharmacy under sterile conditions. This may reduce the likelihood of contamination during preparation and during syringe changes.\(^15\) A recently published analysis of factors associated with epidural infection reported an increased risk of infection when the epidural infusate is administered via a 60-ml syringe driver rather than an infusion bag.\(^16\) It is interesting to note that mixtures of bupivacaine and diamorphine in concentrations used clinically have bactericidal activity against commonly encountered skin organisms.\(^17\)
Attention to asepsis is important throughout the period the catheter is in situ as infection can occur whilst the patient is on the ward. The most common organism cultured from epidural abscesses is S. aureus, which we found in all three of our patients. Epidural abscess due to MRSA, as in patient 3, has been previously described in only one case in the literature. Other organisms less commonly implicated are gram-negative bacilli, anaerobic bacteria and mycobacteria. MRSA is a growing problem in hospitals. Each hospital should have policies in place regarding admission to wards known to have MRSA-colonized or -infected patients. Whether these wards are closed to admission of patients, particularly those more susceptible to infection, depends on a number of factors, such as the strain of MRSA, number of cases and availability of alternative facilities.

Infection of the epidural space is more likely to occur in certain patient groups. Patients 2 and 3 both had diabetes mellitus. Association of epidural infection with diabetes mellitus has been shown to be strong, one study showing that 13% of patients presenting with epidural abscesses without prior spinal injections also had diabetes mellitus. With epidural anaesthesia, identifiable risk factors other than diabetes mellitus are chronic renal failure, cancer, steroid administration, herpes zoster and rheumatoid arthritis.

Patients 1 and 2 both received intraoperative antibiotics; however, whilst providing good surgical prophylaxis, these antibiotics are unlikely to have good bactericidal action against S. aureus. Antibiotics are not given to cover epidural catheter insertion and there is no evidence to support their introduction. Given the low incidence of epidural abscess, it would be very difficult to show a positive effect of prophylactic antibiotics.

The common presenting symptoms of epidural abscess are backache (72%), radicular pain (47%), weakness of an extremity (35%), sensory deficit (23%), bladder or bowel dysfunction (30%), and paralysis (21%). Presentation may, however, be variable and pyrexia is not always present. All three of our patients had backache but only two had a fever at the time of diagnosis. The third patient had been treated for a period with oral antibiotics before hospital admission, which may have masked the fever. If the symptoms do suggest a diagnosis of epidural abscess, then an MRI scan is the investigation of choice and eliminates the need for dural puncture.

The successful management of epidural abscess relies on an early diagnosis and surgical decompression and debridement, followed by antibiotics. A non-surgical approach to management has been described. Patients 2 and 3 were managed surgically and patient 1 conservatively. In patient 2, diagnosis was prompt after the onset of symptoms. In patient 1, a definitive diagnosis was delayed until MRI scans were performed, although the patient was treated with i.v. antibiotics at an early stage for a presumptive abscess. An earlier MRI scan and referral to the neurosurgical centre would have been appropriate. Patient 3’s diagnosis was delayed until the onset of a profound neurological deficit. This was despite the presence of local infection over the epidural site and the onset of lower back pain. The onset of symptoms and signs occurred in the primary setting and it is thus important to raise awareness amongst general practitioners of the possibility of such problems, especially as epidural anaesthesia is becoming increasingly popular, and postoperative discharge from hospital to the care of the general practitioner is occurring earlier.

Whilst the benefits of epidural catheters in the management of postoperative pain have been widely documented, the accompanying risks must not be forgotten. Apart from epidural abscess formation, other complications with serious consequences, such as epidural haematoma and nerve damage, may also occur. These complications are also rare. Epidural abscesses occur at a cost both to the patient and the hospital. A patient with an epidural abscess will have a prolonged stay in hospital, may undergo a spinal decompression and may be left with a permanent neurological deficit. The recovery rate from epidural abscess is poor. One survey of patients who received surgical intervention for epidural abscess revealed that of the seven patients who were paralysed before surgery, five died and two were paralysed permanently. Of the eleven patients who had only some neurological deficit, only three made a full recovery.

Hospital costs are also considerable. The patient may stay in hospital for several weeks, requiring full nursing care. Patient 1 stayed in hospital for 6 weeks and patient 3 for 3 months. Diagnosis requires MRI scanning, which may not be readily available. Treatment may also involve transfer to a neurosurgical centre and the cost of a spinal decompression.

Since the occurrence of these three cases we have reviewed our practice and have re-emphasized that the following guidelines are adhered to. Epidurals should be inserted in a clean area (anaesthetic room or theatre). The anaesthetist should observe a strict aseptic technique, washing their hands with chlorhexidine for 2 min and wearing a theatre cap, facemask, sterile gloves and gown. The skin should be prepared with 0.5% chlorhexidine in 80% ethanol and this should be left for 2 min before attempting epidural insertion. A sterile drape is placed around the insertion site. After catheter insertion, a semipermeable occlusive dressing (Opsite 3000) is applied. The dressing is inspected daily by the acute pain sister and is only changed if the catheter is to remain in place for longer than 3 days or if there is any blood staining. Infusates are prepared in 250-ml bags under sterile conditions in the pharmacy. We thus aim to minimize the chances of contamination by processes under the control of the clinician and acute pain team. In addition, we have raised the profile of epidural abscess as a complication of epidural analgesia amongst both hospital staff and general practitioners in order to ensure early diagnosis and appropriate investigation and treatment.
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