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Education/new procedure

Infectious complications of regional anaesthesia and analgesia

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INTRODUCTION

Regional anaesthetic techniques provide excellent anaesthesia and analgesia for many surgical procedures. Regional anaesthesia is gained increased popularity all over the world. Regional anaesthesia is associated with many benefits compared to general anaesthesia, including reduced morbidity and mortality, superior postoperative analgesia and reduced costs *(1)*. However, neurological injury after regional anaesthesia can be distressing to the patients and their families. Most complications of regional anaesthesia are relatively minor, easily managed and temporary but in rare cases serious and permanent damage can occur. Neurologic complications associated with central neuraxial block (CNB) can be attributed to incorrect placement of a needle or catheter causing direct neural tissue damage, toxic and infectious agents, and spinal cord compromise resulting from ischemia or mass effect *(2)*.

Infectious complications

Infectious complications may occur with any regional anaesthetic technique. However those associated with the neuraxial anaesthesia and analgesia may result in devastating morbidity and mortality, including abscess formation, necrotizing fasciitis, meningitis, arachnoiditis, paralysis and death. The risks of serious central or peripheral nervous system infection are low, and with strict adherence to sterility during the block performance there is little probability of infection being introduced. However, recent epidemiologic studies suggest the enormous discrepancy of infectious complications associated with neuraxial techniques. The rate of spinal-epidural abscess or meningitis occurence has been reported to be 1:10 000 to 1:40 000 *(3, 4, 5)*. Aromaa *et al*. reported lower infectious complication rate of 1.1:100 000 blocks *(6)*. On the contrary Wang *et al*. estimated that the incidence of epidural abscess after epidural analgesia was 1:1930 and the risk of permanent neurologic deficit was 1:4343 catheters *(7)*. This discrepancy can be explained by different data collection techniques, differences in postoperative monitoring and reporting and in aseptic technique and antibiotic administration,varying definitions of infection and colonization. The frequency of infection associated with peripheral neural catheters remains undefined. Capdevila *et al*. showed that 29% of peripheral nerve catheters may become colonized with 3% resulting in localized inflammation *(8)*.

Routes of infection

The etiology of infectious complications is often unclear. Potential routes might be contaminated syringes, catheter hubs, local anaesthetics or breaches in aseptic technique. Dural puncture has long been considered a risk factor in the pathogenesis of meningitis. The suggested mechanisms include introduction of blood into the intrathecal space during needle placement and disruption of the protection provided by the blood-brain barrier.

Skin bacteria gain epidural space through the catheter insertion site. This is supported by Saguraki *et al*. who traced the source of an epidural abscess to Staphylococcus aureus strains fom the patient's skin flora *(9)*.

Kindler *et al*. revealed that 83% of 35 epidural catheter related infections, were caused by various Staphylococcus species, typical for bacterial flora of the skin *(10)*. The most frequently detected microorganism on the skin surface is S. epidermidis (65–69% of skin flora), while S. aureus (1–2% of skin flora) is the most prevalent microorganism in epidural infections. This suggests that S. aureus may be more resistant to disinfectants than other microorganisms *(11)*. Important components of aseptic technique are summarized in Table 1. *(12)*. However, most epidural abscesses are not related to the placement of indwelling catheters but are believed to be related to infections of the skin, soft tissue, spine or haematogenous spread to the epidural space.

TABLE 1

Important components of aseptic technique.

Major
Removal of watches, jewelry
Hand washing with antiseptic solutions
Surgical masks, caps, sterile gowns and gloves
Skin desinfection, alcohol, chlorhexidine
Sterile draping
Minor
Bacterial filters
Prevention of catheter, hub and site violations

Risk factors

Possible risk factors include underlying sepsis, diabetes, depressed immune status, steroid therapy, localized infection and chronic catheter maintenance *(13)*. Patients with altered immune status because of neoplasm, immunosuppression after solid organ transplantation and chronic infection with human immunodeficiency virus or herpes simplex virus are often not considered candidates for neuraxial blocks. These patients are susceptible to infection with opportunistic pathogens. Anaesthesiologists have long considered sepsis to be a relative contraindication to the administration of spinal or epidural anaesthesia. However, if there is a clear benefit to be gained from epidural anaesthesia or analgesia, a septic condition is not an absolute contraindication *(14)*. Postulated mechanisms for haematogenous infection of the central nervous system caused by subarachnoid or epidural puncture might be an accidental vessel puncture. Antibiotic chemoprophylaxis should be given before the puncture and the patients must be closely followed for the development of epidural abscess. Because of the possibly increased risk of infectious complications, informed consent should be obtained from the patient *(15)*. The decision to perform a regional anaesthetic technique must be made on an individual basis considering the benefits of regional anaesthesia and the risk of central nervous system infection which may occur in any bacteremic patient. Available data suggest that patients with evidence of systemic infection may safely undergo spinal anaesthesia, provided appropriate antibiotic therapy. Meningitis and epidural abscess are both complications of neuraxial blocks, the risk factors and causative organisms are disparate. Staphylococcus is the organism most commonly associated epidural abscess and often this infections occured in patients with impaired immunity. Meningitis follows dural puncture is typically caused by alpha-hemolytic streptococci, with the source of the organism the nasopharynx of the anaesthesiologist *(16)*.

To date, there are published three serious infectious complications of peripheral block. Two of the three occurred in immunocompromised patients *(17)*. A case of fatal necrotizing fasciitis after single-injection axillary block in woman with a history of diabetes mellitus has been published *(18)*.

Symptoms, signs and diagnosis

The most frequent signals of an impending epidural infectious complication are local tenderness and infectious signs at the skin catheter entry site and new backache. Subsequently, increasing leg weakness, loss of sensation and sphincter control in the presence of backache

TABLE 2

Signs and symptoms of the epidural abscess and meningitis.

	Epidural abscess	Meningitis
Altered mental status and seizures	–	+
Fever	+,–	+
Headache	–,+	+
Stiff neck	–,+	+
Photophobia	–	+
Back pain	+,–	+,–
Paraplegia /paraparesis	+	–
Sensory involvement	+	–
Nausea and vomiting	–	+
Incontinence of urin and feces	+	–

TABLE 3

Differential diagnosis of epidural haematoma, epidural abscess and anterior spinal artery syndrome.

	Epidural abscess	Epidural haematoma	Syndrome art. spinalis anterior
Age of patient	Any age	> 50 yr	Elderly
History	Infection	Anticoagulants	Arteriosclerosis
Onset	1–3 days	Sudden	Sudden
Gener. symptoms	Fever, malaise	Back pain	None
Paralysis	Flaccid	Flaccid	Flaccid
MRI/CT	Epid. compression	Epid. compression	Normal
Cerebrospinal fluid	↑ Cell count	Normal	Normal
Sensory involvement	Paresthesias	Variable	Minor
Blood data	↑ leukocytosis	Abnorm coagulation	Normal

are ominous signs (Table 2). Epidural abscess formation usually occurs days to weeks after neural block associated with fever and leukocytosis (Table 3) *(13)*. However, it is important to know that an epidural abscess may present with paraplegia and no backache or pyrexial symptoms.

Computer tomography can help in verifying the diagnosis, however CT-scans have given false negative findings in up to 50% of cases *(19)*. The most sensitive diagnostic procedure is MRI with or without gadolinium contrast enhancement.

Treatment of infectious complications

Abscess formation after epidural or spinal anaesthesia can be superficial, requiring limited surgical drainage and intravenous antibiotics, or occur deep in the epidural space with associated cord compression. The latter is fortunately a rare complication, but it requires aggressive, early surgical decompression to achieve a satisfactory outcome *(13)*.

Antibiotics alone cured some patients who had minimal or no neurological symptoms.

Case report

We have published case report about acute bacterial transverse myelitis, secondary to an epidural catheter. A 49-year-old man who underwent left pneumonectomy because of the lung carcinoma received general and epidural (Th6-7) anaesthesia. The operative procedure, anaesthesia and early postoperative course were uneventful. Through an epidural catheter mixture of morphine, bupivacaine and clonidine was administered for two days postoperatively. On the fifth postoperative day patient developed progressive paresis in the lower extremities. There was a loss of sensation below seventh thoracic dermatoma. Elevated inflammatory parameters along with the results of cerebrospinal fluid analysis and magnetic resonance imaging were suggestive of acute transverse bacterial myelitis of the spinal cord. Despite prompt antibiotic therapy, anti-oedema treatment and rehabilitation, the neurological deficit failed to resolve *(20)*.

Outcome

After surgical management 45% of the patients who recovered good or complete spinal cord functions received antibiotic therapy earlier than those who did not recover full spinal cord functions *(10)*. Epidural abscesses are treated too late because of careless postoperative surveillance by medical and nursing staff, who are unfocussed upon the early symptoms and signs of evolving spinal cord dysfunction and imminent neurological catastrophes *(21)*.

Recommendations

Because of the catastrophic consequences to the patient, as well to the anaesthesiolgist of such complications, recommendations are important to provide quality patient care.

Implications of aseptic techniques

Thorough handwashing and remove of jewelry reduce the risk of cross-contamination.

Alcohol-based chlorhexidine antiseptic solutions will provide high degree of antimicrobial activity.

Sterile surgical gloves and gowns should be used.

The use of surgical masks significantly reduce the contamination from microorganisms grown in the upper airway of clinicians.

Regional anaesthesia in the febrile or infected patient

Serious central neuraxial infections such as arachnoiditis, meningitis and abscess after spinal or epidural anaesthesia are rare.

The decision to perform regional anaesthesia must be made considering patient's preoperative status, the benefits of regional anaesthesia and the risk of central nervous system infections.

Epidural catheters should be removed in the presence of local erythema.

A delay in diagnosis and treatment of CNS infections may significantly worsen neurologic outcome.

Regional anaesthesia in the immunecompromised patient

The attenuated inflammatory response within the immunocompromised patient may diminish the clinical signs and symptoms of infections.

The risk of epidural abscess increases with the duration of epidural catheterization.

Viremia, fever and meningitis in the presence of HSV--type 2 infection suggest a conservative approach.

Neuraxial and peripheral techniques can be performed safely in HIV-infected patients *(12, 13, 17)*.

CONCLUSION

Infectious complications may occur with any regional anaesthetic technique but serious central or peripheral nervous system infections are low. Aseptic technique is critical to minimize the risk of extrinsic contamination Patients with a bacteraemia or septicaemia may benefit from regional anaesthesia but each patient requires careful preoperative evaluation and appropriate antibiotic therapy should be instituted before the block. Emphasis on close surveillance and monitoring for early signs and symptoms of infections, as well as high preparedness for early treatment with surgical decompression and antibiotics, and recommendations will ensure that infectious complications remain rare occurrences.

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