Introduction - Incidence

Spinal epidural abscess (SEA) was first described in the medical literature in 1761 and represents a severe infection of the epidural space requiring emergent neurosurgical intervention to avoid permanent neurologic deficits [1]. Epidural abscess is a rare condition, with a reported incidence of $1 \pm 2 / 10,000$ of all patients admitted to hospital [2]. It is generally thought to be a "very rare, severe complication" of central nerve blocks.

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 [3], to 3% in patients who had epidural catheters inserted for chronic pain indications [4]. 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. In a comprehensive meta-analysis [1] of SEA published in the international literature between 1954 and 1997, only 42 (5% of 854 cases of SEA) were associated with epidural anaesthesia. This information must be seen in relation to the quite common use of this form of regional anaesthesia.

It must be noted though that a recent study of epidural catheters inserted over a 1–year period in Denmark revealed an abscess rate of 1 in 1930 (0.05%) [5]. This included epidural catheters inserted for all indications in all anaesthetic departments in the country. The disparity with the previously published results cannot be explained easily, even though the mean period of epidural catheterization was 11 days, prophylactic antibiotics were not used and the concomitant use of thromboprophylaxis may have led to epidural haematomas, subsequently infected [6]. This incidence is much higher than previously reported and underlines the need for vigilance and the early consideration of epidural abscess as part of a differential diagnosis.

In a series of 17,372 epidural catheter treatments (surgical and cancer patients combined) by Wang et al [5], immunocompromise was identified as a predisposing factor, being associated in eight of a total of nine occurrences of abscess. Risk also appears to increase with length of catheterization. Compare the risk of 0/9.232 or 1/505,000 for short-term use in obstetric patients versus 15/350 when the catheter is used in cancer patients for up to 457 days. In Wang et al's series of 9 patients (7/9 surgical) with epidural abscess after epidural catheterization, the average catheterization period was 11.2 days, although in three patients catheterization lasted only 3 days, and only in three patients (one cancer, 2 surgical) longer than 1 week.
**Clinical Features**

The typical features of spinal epidural abscess are recognizable clinically—notably fever, spinal pain and tenderness, and radiating root pain followed by limb weakness. Although pain is considered to be the most consistent symptom that occurs in virtually all patients at some time during their illness [7], it appears in Reihsaus's et al. review of 871 cases that many patients do not present in the typical way; According to this meta-analysis only 66 of patients had fever, 71% had back pain, and 17% had local tenderness.

Spinal pain and fever are usually the only symptoms present before a precipitous neurological deterioration occurs. Most patients have major neurological signs before surgery. When septicemia dominates the clinical picture, the neurological symptoms may go unnoticed. This may also be the case in patients confined to bed. In patients with chronic illness or infection, constitutional symptoms of fever, weight loss, and systemic illness may predominate over the neurological syndrome and lead to late diagnosis and treatment. A typical presentation specifically in immune–compromised patients has been reported previously [7], and it is possible that the normal painful inflammatory response does not occur in these patients [8].

These cases suggest that back pain, fever, and local infection at the catheter insertion site should raise suspicion of an epidural abscess, even in the absence of neurological deficits [9]. Since delay in the diagnosis can lead to permanent neurological damage, MRI scanning is indicated at this point. One should not wait for the development of neurological deficits.

In Reihsaus's meta-analysis of 871 patients, 20 showed signs of spinal irritation including radicular complaints. Weakness of the voluntary musculature, as well as urinary or fecal incontinence were seen in 26% and 24% of the cases included in this meta-analysis, respectively. The incidence of sensory deficits is reported to be between 23% and 43.4%.

Delayed onset is not unusual, and delays up to 32 days have been reported, with an average delay of 5.4 ± 3.4 days quoted [5, 14]. It can take up to 60 days after epidural catheterization before clinical signs of epidural abscess develop [11]. Therefore, it is important to observe a patient who only had local signs of infection at the site of catheter insertion, without neurological symptoms or systemic signs, until 2 months postoperatively.

**Pathogenic Factors**

Mechanical compression is the most important pathogenic factor for the neurological symptoms seen in SEA [12], however, this opinion is not shared by other authors in older publications [7, 13], who favor the notion of vascular damage due to SEA with secondary hypoxia being the main pathogenic factor for SEA. According to Hlavin et al [14], the combination of spinal cord compression and vascular damage with resultant hypoxia represents the pathogenic basis of SEA.
Causative Microorganisms

Staphylococcus was described as the principle etiologic agent in SEA [15] and this has remained true up to the present day. Staphylococcus aureus was present in 551 (73%) of 753 patients from the international literature where the causative agent of SEA was identified. Skin abscesses and furuncles represent common risk factors for SEA and are mainly due to Staphylococcus.

Among gram-negative bacteria, 21 (3%) of the 753 patients from the literature with bacterial SEA had infections due to Escherichia coli and 14 (2%) had infections due to Pseudomonas aeruginosa. Staphylococci were the most common etiologic agents in 31 patients with epidural anesthesia or analgesia for whom an infectious agent was identified, being found in 26 of them [16].

Diagnosis

Radiological investigations have been the mainstay of diagnosis for patients with SEA. However, the dictum of Schlossberg and Shulman from 1977 [17] on the central aspect of the diagnosis of SEA still remains valid: "The most important step in diagnosing spinal epidural abscess is consideration of the entity."

Before the era of computed tomography (CT) and magnetic resonance imaging (MRI), the only imaging modalities of use in diagnosis were conventional radiographs and myelography, and these are the only investigations mentioned in the literature up to 1980 as diagnostic methods for patients with SEA [1]. Myelography was considered the method of choice for the diagnosis of SEA for long. It reveals evidence of SEA reliably because there is contrast medium blockage above or below the abscess [18].

The introduction of CT into routine clinical use, at the beginning of the 1980s, replaced myelography, as the diagnostic method of first choice for patients with SEA [19]. In contrast to myelography, CT is noninvasive. However, delineation of the spinal cord from the epidural space can be difficult with CT [20]. Of nine patients with SEA, the diagnosis by CT could not be made in six; repeat CT could only demonstrate SEA in one of these six patients [21]. Therefore, the authors judged the value of CT in the diagnosis of SEA to be limited. On the other hand, it may enable early diagnosis, which is not usually possible with conventional radiographs or sonography. In addition, CT is advantageous for planning the operative procedure and performing percutaneous needle biopsies of the epidural space or of bony structures involved in osteomyelitis in order to isolate the causative microorganism.

In contrast to CT, MRI is able to form multiplanar tomographic images with high contrast among soft-tissue structures and without bone artifacts. Hlavin et al [14], report a sensitivity of 91% in MRI for the definitive diagnosis of SEA. This is comparable with the 92% sensitivity with myelo-CT, which these authors evaluated in parallel. Beyond that, MRI allows spinal tumors, hematomas, transverse myelitis, spinal cord infarction, or intervertebral disk prolapse to be differentiated from SEA. Recently, gadolinium is used as a contrast medium for MRI [22]. The use of gadolinium in MRI allows better delineation of SEA from contiguous structures. In summary, MRI, especially in
combination with gadolinium, now represents the method of first choice for the diagnosis of SEA. It has made other diagnostic procedures essentially superfluous.

**Treatment**

Surgical intervention is still the treatment of choice for the majority of SEA. It is usually performed with dorsal access as a laminectomy or removal of the spinous process and vertebral arch (lamina) including the posterior longitudinal ligament in order to drain the abscess [1]. The surgical intervention is generally performed with pre- and postoperative administration of antibiotics.

Conservative treatment with antibiotics is an alternative for selected groups of patients if the causative microorganism is known, and the neurological status and laboratory values are monitored. MRI enables diagnosis of SEA before deficits occur. Decompressive surgery is recommended in cases with progressive deficits, when the deficits have lasted for less than 36 h and when the microorganism is not known [23].

Empirical antimicrobial treatment of spinal epidural abscess should start early, be delivered intravenously in high doses, and be continued well into the postoperative period [24]. Initial treatment should be broad spectrum and include a combination of drugs with bactericidal activity against staphylococci, anaerobes, and gram negative bacteria.

The antibiotics used for purely conservative or combined conservative and surgical treatment should fulfill the criteria of Leys et al [25]: (1) efficacy against Staphylococcus aureus, the most common cause of SEA, (2) low toxicity to enable treatment over several weeks, and (3) the ability to penetrate bony tissues, as also is necessary in treating spondylodiscitis. Parenteral treatment should be continued for at least 4 weeks and may be prolonged for 8 weeks or longer if vertebral osteomyelitis is suspected [18]. When no pathogen is isolated, broad "best guess" bactericidal over is safest and best.

The prognosis is dependent on the clinical and neurological condition of the patient at presentation [7] and any delay in the diagnosis or instigation of appropriate antimicrobial treatment. Patients who present with overt sepsis do poorly. All such patients in one series died. Patients who are plegic preoperatively also do poorly, although this is time dependent [26]. In the series of Danner and Hartman [27], patients with preoperative neurological defects present for less than 36 hours showed some improvement, whereas nine of 11 patients with deficits present for more than 36 hours before surgery did not. In the review by Maslen et al, patients paralyzed preoperatively for greater than 12 hours did not recover neurological function and those paralyzed for greater than 36 hours often died.

Prevention [9], of course, is much to be preferred with this complication. Probably the incidence of epidural abscess formation can be reduced by meticulous care during catheter placement. 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 [28]. Semi permeable transparent material is recommended for covering the site, which protects the catheter
from contamination and allows the insertion site to be evaluated visibly. Because an epidural catheter for postoperative analgesia usually stays in situ for less than 4 days, the material that is used to protect the catheter does not need to be changed in that period unless it is dislodged.

The epidural site must be checked according to a protocol, and the results recorded. If any signs of infection are observed, the catheter must be removed and the tip sent for culture [29]. The patient stays under observation until a clear explanation for the clinical features of infection. Communication between the multi-disciplinary teams in review and follow-up of these patients should be improved. Guidelines for insertion and management of epidural catheters are needed. Additionally, there should be a low threshold for MRI scanning in patients where there is any suspicion of serious epidural complications. This will enable prompt diagnosis and treatment with reduced likelihood of permanent neurological sequelae.

Conclusions

Epidural abscess remains a rare but feared complication of regional anaesthesia. Prevention is most important. Since outcome depends greatly on time to diagnosis [30], the development of back pain, local and systemic signs of infection should prompt visualization of the epidural space by MRI even in the absence of neurologic signs.

References


