Practice Advisory for the Prevention, Diagnosis and Management of Infectious Complications Associated with Neuraxial Techniques: An Updated Report

##### American Society of Anesthesiologists

**Bibliography by Section**

***I. Identification of patients at increased risk of infectious complications***

**Reviewing medical records (patient condition).**

*Observational studies, case reports, or non-pertinent comparison groups*

1. Beaudoin MG, Klein L: Epidural abscess following multiple spinal anaesthetics. Anaesth Intensive Care 1984; 12:163-164
2. Bengtsson M, Nettelblad H, Sjoberg F: Extradural catheter-related infections in patients with infected cutaneous wounds. Br J Anaesth 1997; 79:668-670
3. Bomberg H, Kubulus C, List F, Albert N, Schmitt K, Gruber S, Kessler P, Steinfeldt T, Standl T, Gottschalk A, Wirtz SP, Burgard G, Geiger P, Spies CD, Volk T: Diabetes: a risk factor for catheter-associated infections. Reg Anesth Pain Med 2015; 40:16-21
4. Brookman CA, Rutledge ML: Epidural abscess: case report and literature review. Reg Anesth Pain Med 2000; 25:428-431
5. Bulow PM, Biering-Soeensen F: Paraplegia, a severe complication to epidural analgesia. Acta Anaesthesiol Scand 1999; 43:233-235
6. Chevalier X, Lavabre C, Claudepierre P, Larget-Piet B: Iatrogenically induced vertebral osteomyelitis due to Pseudomonas aeruginosa. Clin Exp Rheumatoloty 1996; 14:191-194
7. Dawson P, Rosenfeld JV, Murphy MA, Hellyar AG: Epidural abscess associated with postoperative epidural analgesia. Anaesth Intens Care 1991; 19:569-572
8. Eisen DP, MacGinley R, Christensson B, Larsson L, Woods ML: Candida tropicalis vertebral osteomyelitis complicating epidural catheterisation with disease paralleled by elevated D-arabinitol/L-arabinitol ratios. Eur J Clin Microbiol Infect Dis 2000; 19:61-63
9. Erdine S, Aldemir T: Long-term results of peridural morphine in 225 patients. Pain 1991; 45:155-159
10. Gosavi C, Bland D, Poddar R, Horst C: Epidural abscess complicating insertion of epidural catheters. Br J Anaesth 2004; 92:294
11. Gritsenko K, Marcello D, Liguori GA, Jules-Elysee K, Memtsoudis SG: Meningitis or epidural abscesses after neuraxial block for removal of infected hip or knee prostheses. Br J Anaesth 2012; 108:485-490
12. Heller AR, Ragaller M, Koch T: Epidural abscess after epidural catheter for pain release during pancreatitis. Acta Anaesthesiol Scand 2000; 44:1024-1027
13. Hill JS, Hughes EW, Robertson PA: A Staphylococcus aureus paraspinal abscess associated with epidural analgesia in labour. Anaesthesia 2001; 56:873-878
14. Iseki M, Okuno S, Tanabe Y, Mitsuhata H, Miyazaki T: Methicillin-resistant Staphylococcus aureus sepsis resulting from infection in paravertebral muscle after continuous epidural infusion for pain control in a patient with herpes zoster. Anesth Analg 1998; 87:116-118
15. Jakobsen KB, Chrsitensen M-K, Carlsson PS: Extradural anaesthesia for repeated surgical treatment in the presence of infection. Br J Anaesth 1995; 75:536-540
16. Knight JW, Cordingley JJ, Palazzo MG: Epidural abscess following epidural steroid and local anaesthetic injection. Anaesth 1997; 52:576-578
17. Kvalsvik O, Borchgrevink PC, Gisvold SE: Epidural abscess following continuous epidural analgesia in two traumatized patients. Acta Anaesthesiol Scand 1998; 42:732-735
18. Lin YC, Greco C: Epidural abscess following epidural analgesia in pediatric patients. Paediatr Anaesth 2005; 15:767-770
19. Mahendru V, Bacon DR, Lema MJ: Multiple epidural abscesses and spinal anesthesia in a diabetic patient. Reg Anesth 1994; 19:66-68
20. McDonogh AJ, Cranney BS: Delayed presentation of an epidural abscess. Anaesth Intensive Care 1984; 12:364-365
21. Moen V, Dahlgren N, Irestedt L: Severe neurological complications after central neuraxial blockades in Sweden 1990-1999. Anesthesiology 2004; 101:950-959
22. Nordström O, Sandin R: Delayed presentation of an extradural abscess in a patient with alcohol abuse. Br J Anaesth 1993; 70:368-369
23. Pegues DA, Carr, DB, Hopkins C: Infectious complications associated with temporary epidural catheters. Clin Infect Dis 1994; 19:970-972
24. Phillips JM, Stedeford JC, Hartsilver E, Roberts C: Epidural abscess complicating insertion of epidural catheters. Br J Anaesth 2002; 89:778-782
25. Rygnestad T, Borchgrevink PC, Eide E: Postoperative epidural infusion of morphine and bupivacaine is safe on surgical wards. Organisation of the treatment, effects and side-effects in 2000 consecutive patients. Acta Anaesth Scand 1997; 41:868-876
26. Sakuragi T, Yasunaka K, Hirata K, Hori K, Dan K: The source of epidural infection following epidural analgesia identified by pulsed-field gel electrophoresis. Anesthesiology 1998; 89:1254-1256
27. Sarubbi FA, Vasquez JE: Spinal epidural abscess associated with the use of temporary epidural catheters: Report of two cases and review. Clin Infect Dis 1997; 25:1155-1158
28. Shioya N, Ishibe Y, Kan S, Masuda T, Matsumoto N, Takahashi G, Makabe H, Yamada Y, Endo S: Sternoclavicular joint septic arthritis following paraspinal muscle abscess and septic lumbar spondylodiscitis with epidural abscess in a patient with diabetes: a case report. BMC Emerg Med 2012;12:7
29. Sillevis Smitt P, Tsafka A, Teng-van de Zande F, van der Holt R, Elswijk-de Vries I, Elfrink E, van den Bent MJ, Vecht CJ: Outcome and complications of epidural analgesia in patients with chronic cancer pain. Cancer 1998; 83:2015-2022
30. Sillevis Smitt P, Tsafka A, van den Bent M, de Bruin H, Hendriks W, Vecht C, Teng-van de Zande F: Spinal epidural abscess complicating chronic epidural analgesia in 11 cancer patients: clinical findings and magnetic resonance imaging. J Neurol 1999; 246:815-820
31. Smith KM, Deddish RB, Ogata ES: Meningitis associated with serial lumbar punctures and post-hemorrhagic hydrocephalus. J Pediatr 1986; 109:1057-1060
32. van Dongen RTM, Crul BJP, De Bock M: Long-term intrathecal infusion of morphine and morphine/bupivacaine mixtures in the treatment of cancer pain: a retrospective analysis of 51 cases. Pain 1993; 55:119-123
33. Yap KB, Finlay IG: Epidural infection associated with epidural catheterization in a cancer patient with back pain: case report. Palliat Med 1994; 8:251-253
34. Zakaria M, Butt MU: Epidural abscess and meningitis, a complication of spinal anesthesia in a bacteraemic patient. J Pak Med Assoc 2009; 59:565-567

**Physical examination.**

No entries

**Preprocedure laboratory evaluation.**

No entries

***II. Prevention of infectious complications***

**Selection of neuraxial techniques.**

***Epidural versus spinal techniques.***

*Nonrandomized comparative studies*

1. Raedler C, Lass-Florl C, Puhringer F. Kolbitsch Ch, Lingnau W, Benzer A: Bacterial contamination of needles used for spinal and epidural anaesthesia. Br J Anaesth 1999; 83:657-661

*Observational studies or non-pertinent comparison groups*

1. Abramovici A, Szychowski JM, Biggio JR, Sakawi Y, Andrews WW, Tita AT: Epidural use and clinical chorioamnionitis among women who delivered vaginally. Am J Perinat 2014; 31:1009-1014
2. Douglas M, Shields SG: Maternal fever after epidural analgesia. J Fam Pract 1997; 44:529-530
3. Greenberg BM, Williams MA: Infectious complications of temporary spinal catheter insertion for diagnosis of adult hydrocephalus and idiopathic intracranial hypertension. Neurosurgery 2008; 62:431-435
4. Green LK, Paech MJ: Obstetric epidural catheter-related infections at a major teaching hospital: a retrospective case series. Int J Obst Anesth 2010; 19:38-43
5. Hayek SM, Paige B, Girgis G, Kapural L, Fattouh M, Xu M, Stanton-Hicks M, Mekhail NA: Tunneled epidural catheter infections in noncancer pain: increased risk in patients with neuropathic pain/complex regional pain syndrome. Clin J Pain 2006; 22:82-89
6. Horlocker TT, McGregor DG, Matsushige DK, Schroeder DR, Besse JA,: A retrospective review of 4767 consecutive spinal anesthetics: central nervous system complications. Anesth Analg 1997; 84:578-584

***Continuous infusion epidural versus single injection epidural techniques.***

*Observational studies or non-pertinent comparison groups*

1. Seth N, Macqueen S, Howard RF: Clinical signs of infection during continuous postoperative epidural analgesia in children: the value of catheter tip culture. Paediatr Anaesth 2004; 14:996-1000

***Lumbar epidural versus thoracic epidural techniques.***

*Nonrandomized comparative studies*

1. Dawson SJ, Small H, Logan MN, Geringer S: Case control study of epidural catheter infections in a district general hospital. Commun Dis Public Health 2000; 3:300-302

***Lumbar versus caudal techniques.***

*Nonrandomized comparative studies*

1. Abouleish E, Orig T, Amortegui AJ: Bacteriologic comparison between epidural and caudal techniques. Anesthesiology 1980; 53:511-514
2. Kost-Byerly S, Tobin JR, Greenberg RS, Billett C, Zahurak M, Yaster M: Bacterial colonization and infection rate of continuous epidural catheters in children. Anesth Analg 1998; 86:712-716
3. McNeely J, Trentadue N, Rusy LM, Farber NE: Culture of bacteria from lumbar and caudal epidural catheters used for postoperative analgesia in children. Reg Anesth 1997; 22:428-431

**Prophylactic antibiotic therapy (vs no antibiotic therapy) in the known or suspected bacteremic or immunocompromised patient.**

*Observational studies, case reports, or non-pertinent comparison groups*

1. Beaudoin MG, Klein L: Epidural abscess following multiple spinal anaesthetics. Anaesth Intensive Care 1984; 12:163-164
2. Berman RS, Eiselem JH: Bacteremia, spinal anesthesia and development of meningitis. Anesthesiology 1978; 48:376-377
3. Videira RI, Ruiz-Neto PP,, Brandao-Neto M: Post spinal meningitis and sepsis. Acta Anaesthesiol Scand 2002; 46:639-646

**Physician aseptic techniques during neuraxial procedures (e.g., hand washing, sterile gowns, gloves, and drapes, wearing of caps and masks).**

*Randomized controlled trials*

1. Siddiqui NT, Davies S, McGeer A, Carvalho JCA, Friedman Z: The effect of gowning on labor epidural catheter colonization rate. A randomized controlled trial. Reg Anesth Pain Med 2014; 39:520-524

*Observational studies, case reports, or non-pertinent comparison groups*

1. Abaza KT, Bogod DG: Cerebrospinal fluid-cutaneous fistula and pseudomonas meningitis complicating thoracic epidural analgesia. Br J Anaesth 2004; 92:429-431
2. Bajwa ZH, Ho C, Grush A, Kleefield J, Warfield CA: Discitis associated with pregnancy and spinal anesthesia. Anesth Analg 2002; 94:415-416
3. Barnwell R, Ball V: Iatrogenic bacterial meningitis: an unmasked threat. CJEM 2012; 14:259-262
4. Bevacqua BK, Slucky AV, Cleary WF: Is postoperative intrathecal catheter use associated with central nervous system infection? Anesthesiology 1994; 80:1234-1240
5. Blackmore TK, Morley HR, Gordon DL: Streptococcus mitis-induced bacteremia and miningitis after spinal anesthesia. Anesthesiology 1993; 78:592-594
6. Bouhemad B, Dounas M, Mercier FJ, Benhamou D: Bacterial meningitis following combined spinal-epidural analgesia for labour. Anaesthesia 1998; 53:292-295
7. Brookman CA, Rutledge ML: Epidural abscess: case report and literature review. Reg Anesth Pain Med 2000; 25:428-431
8. Cascio M, Heath G: Meningitis following a combined spinal-epidural technique in a labouring term parturient. Can J Anaesth 1996; 43:399-402
9. Chiang HL, Chia YY, Chen YS, Hung CC, Liu K, Lo Y: Epidural abscess in an obstetric patient with patient-controlled epidural analgesia--a case report. Int J Obstet Anesth 2005; 14:242-245
10. Cohen S, Hunter CW, Sakr A, Hijazi RH: Meningitis following intrathecal catheter placement after accidental dural puncture. Int J Obstet Anesth 2006; 15:172
11. Collis RE, Harries SE: A subdural abscess and infected blood patch complicating regional analgesia for labour. Int J Obstet Anesth 2005; 14:246-251
12. Couzigou C, Vuong TK, Botheral AH, Aggoune M, Astagneau P: Iatogenic streptococcus salivarius meningitis after spinal anesthesia: need for strict application of standard precautions. J Hosp Infect 2003; 53:313-314
13. Emmanuel ER: Post-sacral extradural catheter abscess in a child. Br J Anaesth 1994; 73:548-549
14. Hernández-Palazón J, Puertas-García JP, Martínez-Lage JF, Tortosa JA: Lumbar spondylodiscitis caused by Propionibacterium acnes after epidural obstetric analgesia. Anesth Analg 2003; 96:1486-1488
15. Hill JS, Hughes EW, Robertson PA: A Staphylococcus aureus paraspinal abscess associated with epidural analgesia in labour. Anaesthesia 2001; 56:873-878
16. Huang YY, Zuo Z, Yuan HB, Tsou MY, Chen MT, Tsai SK: A paraspinal abscess following spinal anaesthesia for caesarean section and patient-controlled epidural analgesia for postoperative pain. Int J Obstet Anesth 2005; 14:252-255
17. Ingelmo PM, Marino G, Fumagalli R: Sepsis after epidural catheterization in a child with chronic regional pain syndrome type I. Paediatr Anaesth 2005; 15:623-624
18. Jeffreys A, Horton R, Evans B: Epidural abscesses. Br J Anaesth 2006; 97:115-116
19. Laurila JJ, Kostamovaara PA, Alahuhta S: Streptococcus salivarius meningitis after spinal anesthesia. Anesthesiology 1998; 89:1579-1580
20. McDonogh AJ, Cranney BS: Delayed presentation of an epidural abscess. Anaesth Intensive Care 1984; 12:364-365
21. Meunier JF, Norwood P, Dartayet B, Dubousset AM, Ecoffey C: Skin abscess with lumbar epidural catheterization in infants: is it dangerous? Report of two cases. Anesth Analg 1997; 84:1248-1249
22. Newton JA, Lesnik IK, Kennedt CA: Streptococcus salivarius meningitis following spinal anesthesia. Clin Infect Dis 1994; 18:840-841
23. Nordström O, Sandin R: Delayed presentation of an extradural abscess in a patient with alcohol abuse. Br J Anaesth 1993; 70:368-369
24. Phillips JM, Stedeford JC, Hartsilver E, Roberts C: Epidural abscess complicating insertion of epidural catheters. Br J Anaesth 2002; 89:778-782
25. Pinder AJ, Dresner M: Meningococcal meningitis after combined spinal-epidural analgesia. Int J Obstet Anesth 2003; 12:183-187
26. Ready LB, Helfer D: Bacterial meningitis in parturients after epidural anesthesia. Anesthesiology 1989; 71:988-990
27. Sandkovsky U, Mihu MR, Adeyeye A, De Forest PM, Nosanchuk JD: Iatrogenic meningitis in an obstetric patient after combined spinal-epidural analgesia: case report and review of the literature. South Med J 2009; 102:287-290
28. Schroeder TH, Krueger WA, Neeser E, Hahn U, Unertl K: Spinal epidural abscess--a rare complication after epidural analgesia for labour and delivery. Br J Anaesth 2004; 92:896-898
29. Schroter J, Wa DD, Hoffmann V, Bach A, Motsch J: Epidural abscess after combined spinal-epidural block. Can J Anaesth 1997; 44:300-344
30. Sellors J, Cyna A, Simmons S: Aseptic precautions for inserting and epidural catheter. Anaesthesia 2002; 57:593-605
31. Shewmaker PL, Gertz RE, Jr., Kim CY, de Fijter S, DiOrio M, Moore MR, Beall BW: Streptococcus salivarius meningitis case strain traced to oral flora of anesthesiologist. J Clin Microbiol 2010; 48:2589-2591
32. Siddiqui NT, Anandakrishnan S, McGeer A, Guerina L, Carvalho J, Friedman Z: Hand washing technique for epidurals-effect on reduction of contamination risk. Can J Anesthesia 2012; 59:54
33. Stallard N, Barry P: Another complication of the combined extradural-subarachnoid technique. Br J Anaesth 1995; 75:370-371
34. Suy F, Verhoeven PO, Lucht F, Garattard F, Carricajo A, Pozzetto B, Berthelot P: Nosocomial meningitis due to Streptoccus salivarius linked to the oral flora of an anesthesiologist. Inf Cont Hospit Epidem 2013; 34:331-332
35. Villevielle T, Vincent-Rouquette I, Petitjeans F, Koulmann P, Legulluche Y, Rousseau JM, Diraison Y, Brinquin: Strepoccus miitis-induced meningitis after spinal anesthesia. Anesth Analg 2000; 90:500-501
36. Yap KB, Finlay IG: Epidural infection associated with epidural catheterization in a cancer patient with back pain: case report. Palliat Med 1994; 8:251-253
37. Yuan HB, Zuo Z, Yu KW, Lin WM, Lee HC, Chan KH: Bacterial colonization of epidural catheters used for short-term postoperative analgesia: microbiological examination and risk factor analysis. Anesthesiology 2008; 108:130-137

**Selection of antiseptic solution.**

***Chlorhexidine (Hibiclens) vs povidone iodine (Betadine).***

*Randomized controlled trials*

1. Kasuda H, Fukuda H, Togashi H, Hotta K, Hirai Y, Hayashi M: Skin disinfection before epidural catheterization: comparative study of providone-iodine versus chlorhexidine ethanol. Dermatology 2002; 204:42-46
2. Kinirons B, Mimoz O, Lafendi L, Naas T, Meunier J-F, Nordmann P: Chlorhexidine versus povidone iodine in preventing colonization of continuous epidural catheters in children: a randomized, controlled trial. Anesthesiology 2001; 94:239-244
3. Krobbuaban B, Diregpoke S, Prasan S, Thanomsat M, Kumkeaw S: Alcohol-based chlorhexidine vs. povidone iodine in reducing skin colonization prior to regional anesthesia procedures. J Med Assoc Thai 2011; 94:807-812
4. Nahm FS, Ahn W, Lee CJ, Ham BM: Chlorhexidine versus povidone iodine in bacterial contamination rate of needles used for spinal anesthesia. Korean J Anesthesiol 2004; 47:S1-S4
5. Yentur A, Topcu I, Isik R, Degerli K, Surucuoglu S: Underestimated role of alcohol at skin disinfection: lipid dissolving property when used in association with conventional antiseptic agents. Turkish J Med Sci 2010; 40:593-598

*Observational studies, case reports, or non-pertinent comparison groups*

1. Abaza KT, Bogod DG: Cerebrospinal fluid-cutaneous fistula and pseudomonas meningitis complicating thoracic epidural analgesia. Br J Anaesth 2004; 92:429-431
2. Bajwa ZH, Ho C, Grush A, Kleefield J, Warfield CA: Discitis associated with pregnancy and spinal anesthesia. Anesth Analg 2002; 94:415-416
3. Barreto RS: Bacteriological culture of indwelling epidural catheters. Anesthesiology 1962; 23:643-646
4. Bevacqua BK, Slucky AV, Cleary WF: Is postoperative intrathecal catheter use associated with central nervous system infection? Anesthesiology 1994; 80:1234-1240
5. Blackmore TK, Morley HR, Gordon DL: Streptococcus mitis-induced bacteremia and miningitis after spinal anesthesia. Anesthesiology 1993; 78:592-594
6. Brookman CA, Rutledge ML: Epidural abscess: case report and literature review. Reg Anesth Pain Med 2000; 25:428-431
7. Chiang HL, Chia YY, Chen YS, Hung CC, Liu K, Lo Y: Epidural abscess in an obstetric patient with patient-controlled epidural analgesia--a case report. Int J Obstet Anesth 2005; 14:242-245
8. Collis RE, Harries SE: A subdural abscess and infected blood patch complicating regional analgesia for labour. Int J Obstet Anesth 2005; 14:246-251
9. Crawford JS: Pathology in the extradural space. Br J Anaesth 1975; 47:412-415
10. Debreceni G, Meggyesi R, Mestyán G: Efficacy of spray disinfection with a 2-propanol and benzalkonium chloride containing solution before epidural catheter insertion--a prospective, randomized, clinical trial. Br J Anaesth 2007; 98:131-135
11. Dhillon AR, Russell IF: Epidural abscess in association with obstetric analgesia. Int J Obstet Anesth 1997; 6:118-121
12. Emmanuel ER: Post-sacral extradural catheter abscess in a child. Br J Anaesth 1994; 73:548-549
13. Evans PR, Misra U: Poor outcome following epidural abscess complicating epidural analgesia for labour. Eur J Obstet Gynecol Reprod Biol 2003; 109:102-105
14. Ferguson CC: Infection and the epidural space: a case report. AANA J 1992; 60:393-396
15. Hernández-Palazón J, Puertas-García JP, Martínez-Lage JF, Tortosa JA: Lumbar spondylodiscitis caused by Propionibacterium acnes after epidural obstetric analgesia. Anesth Analg 2003; 96:1486-1488
16. Hill JS, Hughes EW, Robertson PA: A Staphylococcus aureus paraspinal abscess associated with epidural analgesia in labour. Anaesthesia 2001; 56:873-878
17. Huang YY, Zuo Z, Yuan HB, Tsou MY, Chen MT, Tsai SK: A paraspinal abscess following spinal anaesthesia for caesarean section and patient-controlled epidural analgesia for postoperative pain. Int J Obstet Anesth 2005; 14:252-255
18. Ingelmo PM, Marino G, Fumagalli R: Sepsis after epidural catheterization in a child with chronic regional pain syndrome type I. Paediatr Anaesth 2005; 15:623-624
19. Jeffreys A, Horton R, Evans B: Epidural abscesses. Br J Anaesth 2006; 97:115-116
20. Knight JW, Cordingley JJ, Palazzo MG: Epidural abscess following epidural steroid and local anaesthetic injection. Anaesth 1997; 52:576-578
21. Kocamanoglu IS, Sener EB, Tur A, Ustin E, Sahinoglu H: Streptococcal meningitis after spinal anesthesia: report of a case. Can J Anesth 2003; 50:314-315
22. Kudavidanage BP, Gunasekara TDCP, Fernando SSN, Meedin DFD, Abayadeera A: Comparison of three skin disinfectant solutions used for skin preparation prior to spinal and epidural anaesthetic procedures in parturients at De Soyza Maternity Hospital and Castle Street Hospital for Women. Sri Lankan J Anaesthesiol 2009; 17:5-10
23. Laurila JJ, Kostamovaara PA, Alahuhta S: Streptococcus salivarius meningitis after spinal anesthesia. Anesthesiology 1998; 89:1579-1580
24. Lee JJ, Parry H: Bacterial meningitis following spinal anaesthesia for Caesarean section. Br J Anaesth 1991; 66:383-386
25. Mann TJ, Orlikowski CE, Gurrin LC, Keil AD: The effect of the biopatch, a chlorhexidine impregnated dressing, on bacterial colonization of epidural catheter exit sites. Anaesth Intensive Care 2001; 29:600-603
26. Meunier JF, Norwood P, Dartayet B, Dubousset AM, Ecoffey C: Skin abscess with lumbar epidural catheterization in infants: is it dangerous? Report of two cases. Anesth Analg 1997; 84:1248-1249
27. Newton JA, Lesnik IK, Kennedt CA: Streptococcus salivarius meningitis following spinal anesthesia. Clin Infect Dis 1994; 18:840-841
28. Nickels JH, Poulos JG, Chaouki K: Risks of infection from short-term epidural catheter use. Reg Anesth 1989; 14:88-89
29. Phillips JM, Stedeford JC, Hartsilver E, Roberts C: Epidural abscess complicating insertion of epidural catheters. Br J Anaesth 2002; 89:778-782
30. Ready LB, Helfer D: Bacterial meningitis in parturients after epidural anesthesia. Anesthesiology 1989; 71:988-990
31. Roberts SP, Petts HV: Meningitis after obstetric spinal anaesthesia. Anaesthesia 1990; 45:376-377
32. Robins K, Wilson R, Watkins EJ, Columb MO, Lyons G: Chlorhexidine spray versus single use sachets for skin preparation before regional nerve blockade for elective caesarean section: an effectiveness, time and cost study. Int J Obstet Anesth 2005; 14:189-192
33. Saady A: Epidural abcess complicating thoracic epidural analgesia. Anesthesiology 1976; 44:244-246
34. Sakuragi T, Yasunaka K, Hirata K, Hori K, Dan K: The source of epidural infection following epidural analgesia identified by pulsed-field gel electrophoresis. Anesthesiology 1998; 89:1254-1256
35. Schroeder TH, Krueger WA, Neeser E, Hahn U, Unertl K: Spinal epidural abscess--a rare complication after epidural analgesia for labour and delivery. Br J Anaesth 2004; 92:896-898
36. Shapiro JM, Bond EL, Garman JK: Use of a chlorhexidine dressing to reduce microbial colonization of epidural catheters. Anesthesiology 1990; 73:625-631
37. Schroter J, Wa DD, Hoffmann V, Bach A, Motsch J: Epidural abscess after combined spinal-epidural block. Can J Anaesth 1997; 44:300-344
38. Sowter MC, Burgess NA, Woodsford PV, Lewis MH: Delayed presentation of an extradural abscess complicating thoracic extradural analgesia. Br J Anaesth 1992; 68:103-105
39. Stallard N, Barry P: Another complication of the combined extradural-subarachnoid technique. Br J Anaesth 1995; 75:370-371
40. Sviggum HP, Jacob AK, Arendt KW, Mauermann ML, Horlocker TT, Hebl JR: Neurologic complications after chlorhexidine antisepsis for spinal anesthesia. Reg Anesth Pain Med 2012; 37:139-144
41. Yap KB, Finlay IG: Epidural infection associated with epidural catheterization in a cancer patient with back pain: case report. Palliat Med 1994; 8:251-253
42. Yentur EA, Luleci N, Topcu I, Degerli K, Surucuoglu S: Is skin disinfection with 10% povidone iodine sufficient to prevent epidural needle and catheter contamination? Reg Anesth Pain Med 2003; 28:389-393
43. Yuan HB, Zuo Z, Yu KW, Lin WM, Lee HC, Chan KH: Bacterial colonization of epidural catheters used for short-term postoperative analgesia: microbiological examination and risk factor analysis. Anesthesiology 2008; 108:130-137

***Aseptic preparation with vs without alcohol.***

No entries

**Individual packets vs multiple use bottles of antiseptic.**

*Observational studies, case reports, or non-pertinent comparison groups*

1. Birnbach DJ, Stein DJ, Murray O, Thys DM, Sordillo EM: Povidone iodine and skin disinfection before initiation of epidural anesthesia. Anesthesiology 1998; 88:668-672
2. Hernández-Palazón J, Puertas-García JP, Martínez-Lage JF, Tortosa JA: Lumbar spondylodiscitis caused by Propionibacterium acnes after epidural obstetric analgesia. Anesth Analg 2003; 96:1486-1488

**Sterile occlusive dressings.**

*Observational studies, case reports, or non-pertinent comparison groups*

1. Dhillon AR, Russell IF: Epidural abscess in association with obstetric analgesia. Int J Obstet Anesth 1997; 6:118-121
2. Huang YY, Zuo Z, Yuan HB, Tsou MY, Chen MT, Tsai SK: A paraspinal abscess following spinal anaesthesia for caesarean section and patient-controlled epidural analgesia for postoperative pain. Int J Obstet Anesth 2005; 14:252-255
3. Phillips JM, Stedeford JC, Hartsilver E, Roberts C: Epidural abscess complicating insertion of epidural catheters. Br J Anaesth 2002; 89:778-782
4. Seth N, Macqueen S, Howard RF: Clinical signs of infection during continuous postoperative epidural analgesia in children: the value of catheter tip culture. Paediatr Anaesth 2004; 14:996-1000
5. Simons R, Dinner L, Lappin S: Skin abscess obscured by epidural catheter fixation. Anaesthesia 2007; 62:418
6. Trojanowski A, Janicki P: Bacterial contamination of epidural catheters used for perioperative analgesia. Internet J Anesthesiol 2008; 20: http://print.ispub.com/api/0/ispub-article/3469

**Use of a bacterial filter during continuous epidural infusion.**

*Nonrandomized comparative studies*

1. Abouleish E, Amortegui AJ, Taylor FH: Are bacterial filters needed in continuous epidural analgesia for obstetrics? Anesthesiology 1977; 46:351-354

*Observational studies, case reports, or non-pertinent comparison groups*

1. Abaza KT, Bogod DG: Cerebrospinal fluid-cutaneous fistula and pseudomonas meningitis complicating thoracic epidural analgesia. Br J Anaesth 2004; 92:429-431
2. Bevacqua BK, Slucky AV, Cleary WF: Is postoperative intrathecal catheter use associated with central nervous system infection? Anesthesiology 1994; 80:1234-1240
3. Borum SE, McLeskey CH, Williamson JB, Harris FS, Knight AB: Epidural abscess after obstetric epidural analgesia. Anesthesiology 1995; 82:1523-1526
4. Brookman CA, Rutledge ML: Epidural abscess: case report and literature review. Reg Anesth Pain Med 2000; 25:428-431
5. Collis RE, Harries SE: A subdural abscess and infected blood patch complicating regional analgesia for labour. Int J Obstet Anesth 2005; 14:246-251
6. Crawford JS: Pathology in the extradural space. Br J Anaesth 1975; 47:412-415
7. Dawson P, Rosenfeld JV, Murphy MA, Hellyar AG: Epidural abscess associated with postoperative epidural analgesia. Anaesth Intens Care 1991; 19:569-572
8. Dhillon AR, Russell IF: Epidural abscess in association with obstetric analgesia. Int J Obstet Anesth 1997; 6:118-121
9. Emmanuel ER: Post-sacral extradural catheter abscess in a child. Br J Anaesth 1994; 73:548-549
10. Evans PR, Misra U: Poor outcome following epidural abscess complicating epidural analgesia for labour. Eur J Obstet Gynecol Reprod Biol 2003; 109:102-105
11. Ferguson CC: Infection and the epidural space: a case report. AANA J 1992; 60:393-396
12. Fine PG, Hare BD, Zahniser JC: Epidural abscess following epidural catheterization in a chronic pain patient: a diagnostic dilemma. Anesthesiology 1988; 69:422-424
13. James FM, George RH, Raiem H, White GJ: Bacteriologic aspects of epidural analgesia. Anesth Analg 1976; 55:187-190
14. Kindler C, Seeberger M, Siegemund M, Schneider M: Extradural abscess complicating lumbar extradural anaesthesia and analgesia in an obstetric patient. Acta Anaesthesiol Scand 1996; 40:858-861
15. McDonogh AJ, Cranney BS: Delayed presentation of an epidural abscess. Anaesth Intensive Care 1984; 12:364-365
16. Meunier JF, Norwood P, Dartayet B, Dubousset AM, Ecoffey C: Skin abscess with lumbar epidural catheterization in infants: is it dangerous? Report of two cases. Anesth Analg 1997; 84:1248-1249
17. Tay SM, Lee R: Case report: catheter-related epidural abscess. Ann Acad Med Singapore 2001; 30:62-65
18. Saady A: Epidural abcess complicating thoracic epidural analgesia. Anesthesiology 1976; 44:244-246
19. Sakuragi T, Yasunaka K, Hirata K, Hori K, Dan K: The source of epidural infection following epidural analgesia identified by pulsed-field gel electrophoresis. Anesthesiology 1998; 89:1254-1256
20. Schroter J, Wa DD, Hoffmann V, Bach A, Motsch J: Epidural abscess after combined spinal-epidural block. Can J Anaesth 1997; 44:300-344
21. Seth N, Macqueen S, Howard RF: Clinical signs of infection during continuous postoperative epidural analgesia in children: the value of catheter tip culture. Paediatr Anaesth 2004; 14:996-1000
22. Sowter MC, Burgess NA, Woodsford PV, Lewis MH: Delayed presentation of an extradural abscess complicating thoracic extradural analgesia. Br J Anaesth 1992; 68:103-105
23. Strong WE: Epidural abscess associated with epidural catheterisation: a rare event? Report of two cases with markedly delayed presentation. Anesthesiology 1991; 74:943-946
24. Yap KB, Finlay IG: Epidural infection associated with epidural catheterization in a cancer patient with back pain: case report. Palliat Med 1994; 8:251-253

**Limiting disconnection and reconnection of neuraxial delivery systems.**

No entries

**Remove an accidentally disconnected catheter.**

No entries

**Limiting the duration of catheterization: long duration of catheterization (trend data or > 5 days duration of catheterization).**

*Observational studies, case reports, or non-pertinent comparison groups*

1. Abaza KT, Bogod DG: Cerebrospinal fluid-cutaneous fistula and pseudomonas meningitis complicating thoracic epidural analgesia. Br J Anaesth 2004; 92:429-431
2. Allen S, Kalsi A, Shankar S, Jones N: Rate of bacterial colonisation and infective complications of epidurals in situ for prolonged duration in patients undergoing laparotomy for pseudomyxoma peritonei. Anaesthesia 2014; 69(suppl 4):43
3. Anía BJ: Staphylococcus aureus meningitis after short-term epidural analgesia. Clin Infect Dis 1994; 18:844-845
4. Bengtsson M, Nettelblad H, Sjoberg F: Extradural catheter-related infections in patients with infected cutaneous wounds. Br J Anaesth 1997; 79:668-670
5. Bollensen E, Menck S, Buzanoski J, Prange HW: Iatrogenic epidural spinal abscess. Clin Invest 1993; 71:780-786
6. Bulow PM, Biering-Soeensen F: Paraplegia, a severe complication to epidural analgesia. Acta Anaesthesiol Scand 1999; 43:233-235
7. de Jong, Kansen PJ: A comparison of epidural catheters with or without subcutaneous injections ports for treatment of cancer pain. Anesth Analg 1994; 78:94-100
8. De Leon-Casasola OA, Parker B, Lema M, Harrison P, Massey J: Postoperative epidural bupivacaine-morphine therapy: Experience with 4227 surgical cancer patients. Anesthesiology 1994; 81:368-375
9. Eisen DP, MacGinley R, Christensson B, Larsson L, Woods ML: Candida tropicalis vertebral osteomyelitis complicating epidural catheterisation with disease paralleled by elevated D-arabinitol/L-arabinitol ratios. Eur J Clin Microbiol Infect Dis 2000; 19:61-63
10. Erdine S, Aldemir T: Long-term results of peridural morphine in 225 patients. Pain 1991; 45:155-159
11. Gosavi C, Bland D, Poddar R, Horst C: Epidural abscess complicating insertion of epidural catheters. Br J Anaesth 2004; 92:294
12. Hernandez JM, Coyle FP, Wright CD, Ballantyne JC: Epidural abscess after epidural anesthesia and continuous epidural analgesia in a patient with gastric lymphoma. J Clin Anesth 2003; 15:48-51
13. Holt HM, Andersen SS, Andersen O, Gahrn-Hansen B, Siboni K: Infections following epidural catheterization. J Hosp Infect 1995; 30:253-260
14. Hori K, Kano T, Fukushige T, Sano T: Successful treatment of epidural abscess with a percutaneously introduced 4-French catheter for drainage. Anesth Analg 1997; 84:1384-1386
15. Ingelmo PM, Marino G, Fumagalli R: Sepsis after epidural catheterization in a child with chronic regional pain syndrome type I. Paediatr Anaesth 2005; 15:623-624
16. Kvalsvik O, Borchgrevink PC, Gisvold SE: Epidural abscess following continuous epidural analgesia in two traumatized patients. Acta Anaesthesiol Scand 1998; 42:732-735
17. Larsson BA, Lundeberg S, Olsson GL: Epidural abscess in a one-year-old boy after continuous epidural analgesia. Anesth Analg 1997; 84:1245-1247
18. Mann TJ, Orlikowski CE, Gurrin LC, Keil AD: The effect of the biopatch, a chlorhexidine impregnated dressing, on bacterial colonization of epidural catheter exit sites. Anaesth Intensive Care 2001; 29:600-603
19. Mishra S, Bhatnagar S, Srikanti M, Gupta D: Clinical implication of routine bacterial culture from epidural catheter tips in postoperative cancer patients: a prospective study. Anaesthesia 2006; 61:878-882
20. Nordberg G, Mark H: Epidural abscess after epidural analgesia treated successfully with antibiotics. Acta Anaesthesiol Scand 1998; 42:727-731
21. Nordström O, Sandin R: Delayed presentation of an extradural abscess in a patient with alcohol abuse. Br J Anaesth 1993; 70:368-369
22. Shintani S, Tanaka H, Irifune A, Mitoh Y, Udono H, Kaneda A, Shiigai T: Iatrogenic acute spinal epidural abscess with septic meningitis: MR findings. Clin Neurol Neurosurg 1992; 94:253-255
23. Sillevis Smitt P, Tsafka A, Teng-van de Zande F, van der Holt R, Elswijk-de Vries I, Elfrink E, van den Bent MJ, Vecht CJ: Outcome and complications of epidural analgesia in patients with chronic cancer pain. Cancer 1998; 83:2015-2022
24. Sollmann WP, Gaab MR, Panning B: Lumbar epidural hematoma and spinal abscess following peridural anesthesia. Reg Anaesth 1987; 10:121-124
25. Sowter MC, Burgess NA, Woodsford PV, Lewis MH: Delayed presentation of an extradural abscess complicating thoracic extradural analgesia. Br J Anaesth 1992; 68:103-105
26. Srivastava U CP, Saxena S, Kumar A, Kannaujia A, Singh Rana SP, Issar H: Bacterial colonization and infection of epidural catheters: a prospective study of incidence and risk factors in surgical patients. Indian J Anaesth 2007; 51:496–500
27. Tham EJ, Stoodley MA, Macintyre PE, Jones NR: Back pain following postoperative epidural analgesia: an indicator of possible spinal infection. Anaesth Intensive Care 1997; 25:297-301
28. Wang LP, Hauerberg J, Schmidt JF: Incidence of spinal epidural abscess after epidural analgesia: a national 1-year survey. Anesthesiology 1999; 91:1928-936

***III. Diagnosis of infectious complications***

**Patient monitoring.**

***Periodically checking for signs/symptoms of infection (erythema, tenderness, fever).***

*Observational studies, case reports, or non-pertinent comparison groups*

1. Abaza KT, Bogod DG: Cerebrospinal fluid-cutaneous fistula and pseudomonas meningitis complicating thoracic epidural analgesia. Br J Anaesth 2004; 92:429-431
2. Aldrete JA, Williams SK: Infections from extended epidural catheterization in ambulatory patients. Reg Anesth Pain Med 1998; 23:491-495
3. Anía BJ: Staphylococcus aureus meningitis after short-term epidural analgesia. Clin Infect Dis 1994; 18:844-845
4. Aram L, Krane EJ, Kozloski LJ, Yaster M: Tunneled epidural catheters for prolonged analgesia in pediatric patients. Anesth Analg 2001; 92:1432-1438
5. Athmaja TR, Sanders GM: An unusual presentation of epidural Acinetobacter infection. Reg Anesth Pain Med 2005; 30:577-579
6. Baer ET: Post-dural puncture bacterial meningitis. Anesthesiology 2006; 105:381-393
7. Bajwa ZH, Ho C, Grush A, Kleefield J, Warfield CA: Discitis associated with pregnancy and spinal anesthesia. Anesth Analg 2002; 94:415-416
8. Beaudoin MG, Klein L: Epidural abscess following multiple spinal anaesthetics. Anaesth Intensive Care 1984; 12:163-164
9. Bengtsson M, Nettelblad H, Sjoberg F: Extradural catheter-related infections in patients with infected cutaneous wounds. Br J Anaesth 1997; 79:668-670
10. Berga S, Trierweiler MW: Bacterial meningitis following epidural anesthesia for vaginal delivery: A case report. Obstet Gynecol 1989; 74:437-439
11. Berman RS, Eiselem JH: Bacteremia, spinal anesthesia and development of meningitis. Anesthesiology 1978; 48:376-377
12. Bertol V, Ara JR, Oliveros A, Gros B: Neurologic complications of lumbar epidural analgesia: spinal and paraspinal abscess. Neurology 1997; 48:1732-1733
13. Blackmore TK, Morley HR, Gordon DL: Streptococcus mitis-induced bacteremia and miningitis after spinal anesthesia. Anesthesiology 1993; 78:592-594
14. Bollensen E, Menck S, Buzanoski J, Prange HW: Iatrogenic epidural spinal abscess. Clin Invest 1993; 71:780-786
15. Borum SE, McLeskey CH, Williamson JB, Harris FS, Knight AB: Epidural abscess after obstetric epidural analgesia. Anesthesiology 1995; 82:1523-1526
16. Bouhemad B, Dounas M, Mercier FJ, Benhamou D: Bacterial meningitis following combined spinal-epidural analgesia for labour. Anaesthesia 1998; 53:292-295
17. Bromage PR: Spinal extradural abscess: pursuit of vigilance. Br J Anaesth 1993; 70:471-473
18. Brookman CA, Rutledge ML: Epidural abscess: case report and literature review. Reg Anesth Pain Med 2000; 25:428-431
19. Brooks K, Pasero C, Hubbard L, Coghlan RH: The risk of infection associated with epidural analgesia. Infect Control Hosp Epidemiol 1995; 16:725-728
20. Bulow PM, Biering-Soeensen F: Paraplegia, a severe complication to epidural analgesia. Acta Anaesthesiol Scand 1999; 43:233-235
21. Bussink M, Gramke H, van Kleef M, Marcus M: Bacterial meningitis ten days after spinal anesthesia. Reg Anesth Pain Med 2005; 30:210-211
22. Cascio M, Heath G: Meningitis following a combined spinal-epidural technique in a labouring term parturient. Can J Anaesth 1996; 43:399-402
23. Cesari M, Onder G, Torre S, Landi F, Carbonin P, Gambassi G: A "painful" epidural analgesia. J Am Geriatr Soc 2004; 52:329-330
24. Chan ST, Leung S: Spinal epidural abscess following steroid injection for sciatica. Spine 1989; 14:106-108
25. Chevalier X, Lavabre C, Claudepierre P, Larget-Piet B: Iatrogenically induced vertebral osteomyelitis due to Pseudomonas aeruginosa. Clin Exp Rheumatoloty 1996; 14:191-194
26. Chiang HL, Chia YY, Chen YS, Hung CC, Liu K, Lo Y: Epidural abscess in an obstetric patient with patient-controlled epidural analgesia--a case report. Int J Obstet Anesth 2005; 14:242-245
27. Choy JC: Mortality from peripartum meningitis. Anaesth Intensive Care 2000; 28:328-330
28. Christie IW, McCabe S: Major complications of epidural analgesia after surgery: results of a six-year survey. Anaesthesia 2007; 62:335-341
29. Coapes CM, Roysam GS: Vertebral osteomyelitis secondary to epidural catheter use: a case report. Spine 2001; 26:1492-1494
30. Cohen S, Hunter CW, Sakr A, Hijazi RH: Meningitis following intrathecal catheter placement after accidental dural puncture. Int J Obstet Anesth 2006; 15:172
31. Collier CB, Gatt SP: Epidural abscess in an obstetric patient. Anaesth Intensive Care 1999; 27:662-666
32. Collis RE, Harries SE: A subdural abscess and infected blood patch complicating regional analgesia for labour. Int J Obstet Anesth 2005; 14:246-251
33. Cooper AB, Sharpe MD: Bacterial meningitis and cauda equina syndrome after epidural steroid injections. Can J Anaesth 1996; 43:471-474
34. Couzigou C, Vuong TK, Botheral AH, Aggoune M, Astagneau P: Iatogenic streptococcus salivarius meningitis after spinal anesthesia: need for strict application of standard precautions. J Hosp Infect 2003; 53:313-314
35. Crawford JS: Pathology in the extradural space. Br J Anaesth 1975; 47:412-415
36. Cummings KC 3rd, Dolak JA: Case report: epidural abscess in a parturient with pruritic urticarial papules and plaques of pregnancy (PUPPP). Can J Anaesth 2006; 53:1010-1014
37. Darchy B, Forceville X, Bavoux E, Soriot F, Domart Y: Clinical and bacteriologic survey of epidural analgesia in patients in the intensive care unit. Anesthesiology 1996; 85:988-998
38. Darouiche RO, Hamill RJ, Greenberg SB, Weathers SW, Musher DM: Bacterial spinal epidural abscess. Review of 43 cases and literature survey. Medicine 1992; 71:369-385
39. Davis L, Hargreaves C, Robinson PN: Postpartum meningitis. Anaesthesia 1993; 48:788-789
40. Dawson P, Rosenfeld JV, Murphy MA, Hellyar AG: Epidural abscess associated with postoperative epidural analgesia. Anaesth Intens Care 1991; 19:569-572
41. Dhillon AR, Russell IF: Epidural abscess in association with obstetric analgesia. Int J Obstet Anesth 1997; 6:118-121
42. Dougherty JH Jr, Fraser RA: Complications following intraspinal injections of steroids: report of two cases. J Neurosurg 1978; 48:1023-1025
43. Dysart RH, Balakrishnan V: Conservative management of extradural abscess complicating spinal extradural anaesthesia for caesarean section. Br J Anaesth 1997; 78:591-593
44. Edelstein S, Edoute Y: Bacterial sacroiliitis probably induced by lumbar epidural analgesia. Infect Dis Obstet Gynecol 2003; 11:105-108
45. Eisen DP, MacGinley R, Christensson B, Larsson L, Woods ML: Candida tropicalis vertebral osteomyelitis complicating epidural catheterisation with disease paralleled by elevated D-arabinitol/L-arabinitol ratios. Eur J Clin Microbiol Infect Dis 2000; 19:61-63
46. Emmanuel ER: Post-sacral extradural catheter abscess in a child. Br J Anaesth 1994; 73:548-549
47. Ericsson M, Algers G, Schliamser SE: Spinal epidural abscess in adults. Review and report of iatrogenic cases. Scand J Infect Dis 1990 22:249-257
48. Evans PR, Misra U: Poor outcome following epidural abscess complicating epidural analgesia for labour. Eur J Obstet Gynecol Reprod Biol 2003; 109:102-105
49. Ferguson CC: Infection and the epidural space: a case report. AANA J 1992; 60:393-396
50. Ferguson JF, Kirsch WM: Epidural empyema following thoracic extradural block. J Neurosurg 1974; 41:762-764
51. Fine PG, Hare BD, Zahniser JC: Epidural abscess following epidural catheterization in a chronic pain patient: a diagnostic dilemma. Anesthesiology 1988; 69:422-424
52. Gosavi C, Bland D, Poddar R, Horst C: Epidural abscess complicating insertion of epidural catheters. Br J Anaesth 2004; 92:294
53. Goucke CR, Graziotti P: Extradural abscess following local anaesthetic and steriod injection for chronic low back pain. Br J Anaesth 1990; 65:427-429
54. Harding SA, Collis RE, Morgan BM: Meningitis after combined spinal-extradural anaesthesia in obstetrics. Br J Anaesth 1994; 73:545-547
55. Hearn M: Epidural abscess complicating insertion of epidural catheters. Br J Anaesth 2003; 90:706-707
56. Heller AR, Ragaller M, Koch T: Epidural abscess after epidural catheter for pain release during pancreatitis. Acta Anaesthesiol Scand 2000; 44:1024-1027
57. Hernandez JM, Coyle FP, Wright CD, Ballantyne JC: Epidural abscess after epidural anesthesia and continuous epidural analgesia in a patient with gastric lymphoma. J Clin Anesth 2003; 15:48-51
58. Hernández-Palazón J, Puertas-García JP, Martínez-Lage JF, Tortosa JA: Lumbar spondylodiscitis caused by Propionibacterium acnes after epidural obstetric analgesia. Anesth Analg 2003; 96:1486-1488
59. Hill JS, Hughes EW, Robertson PA: A Staphylococcus aureus paraspinal abscess associated with epidural analgesia in labour. Anaesthesia 2001; 56:873-878
60. Hooten WM, Kinney MO, Huntoon MA: Epidural abscess and meningitis after epidural corticosteroid injection. Mayo Clin Proc 2004; 79:682-686
61. Huang RC. Shapiro GS, Lim M, Sandhu HS, Lutz GE, Herzog RJ: Cervical epidural abscess after epidural steroid injection. Spine 2004; 29:E7-E9
62. Huang YY, Zuo Z, Yuan HB, Tsou MY, Chen MT, Tsai SK: A paraspinal abscess following spinal anaesthesia for caesarean section and patient-controlled epidural analgesia for postoperative pain. Int J Obstet Anesth 2005; 14:252-255
63. Hunt JR, Rogor BM, Collins JR: The potential for contamination of continuous epidural catheters. Anesth Analg 1977; 56:222-225
64. Idigoras P, Valiente A, Iglesias I, Trieu-Cuot P, Poyart C: Meningitis due to streptococcus salivarius. J Clin Microbiol 2001; 39:3017
65. Ingelmo PM, Marino G, Fumagalli R: Sepsis after epidural catheterization in a child with chronic regional pain syndrome type I. Paediatr Anaesth 2005; 15:623-624
66. Iseki M, Okuno S, Tanabe Y, Mitsuhata H, Miyazaki T: Methicillin-resistant Staphylococcus aureus sepsis resulting from infection in paravertebral muscle after continuous epidural infusion for pain control in a patient with herpes zoster. Anesth Analg 1998; 87:116-118
67. Jakobsen KB, Chrsitensen M-K, Carlsson PS: Extradural anaesthesia for repeated surgical treatment in the presence of infection. Br J Anaesth 1995; 75:536-540
68. Jeffreys A, Horton R, Evans B: Epidural abscesses. Br J Anaesth 2006; 97:115-116
69. Kindler C, Seeberger M, Siegemund M, Schneider M: Extradural abscess complicating lumbar extradural anaesthesia and analgesia in an obstetric patient. Acta Anaesthesiol Scand 1996; 40:858-861
70. Knight JW, Cordingley JJ, Palazzo MG: Epidural abscess following epidural steroid and local anaesthetic injection. Anaesth 1997; 52:576-578
71. Kocamanoglu IS, Sener EB, Tur A, Ustin E, Sahinoglu H: Streptococcal meningitis after spinal anesthesia: report of a case. Can J Anesth 2003; 50:314-315
72. Koka VK, Potti A: Spinal epidural abscess after corticosteroid injections. South Med J 2002; 95:772-774
73. Kruger M, Harries K, Dumont S: Osteomyelitis following epidural analgesia in an immunocompromised patient. Anaesthesia 1998; 53:314-315
74. Kvalsvik O, Borchgrevink PC, Gisvold SE: Epidural abscess following continuous epidural analgesia in two traumatized patients. Acta Anaesthesiol Scand 1998; 42:732-735
75. Larsson BA, Lundeberg S, Olsson GL: Epidural abscess in a one-year-old boy after continuous epidural analgesia. Anesth Analg 1997; 84:1245-1247
76. Laurila JJ, Kostamovaara PA, Alahuhta S: Streptococcus salivarius meningitis after spinal anesthesia. Anesthesiology 1998; 89:1579-1580
77. Lee JJ, Parry H: Bacterial meningitis following spinal anaesthesia for Caesarean section. Br J Anaesth 1991; 66:383-386
78. Lehman RA, Jr., Lenke LG: Extensive epidural abscess treated with a thoracic laminoplasty. Spine J 2011; 11:798-799
79. Lin YC, Greco C: Epidural abscess following epidural analgesia in pediatric patients. Paediatr Anaesth 2005; 15:767-770
80. Lindner A, Warmuth-Metz M, Becker G, Toyka VV: Iatrogenic spinal epidural abscesses: early diagnosis essential for good outcome. Eur J Med Res 1997; 2:201-205
81. Liu S, Pope A: Spinal meningitis masquerading as postdural puncture headache. Anesthesiology 1996; 85:1493-1494
82. Lurie S, Feinstein M, Hiefetz C, Manet Y: Iatrogenic bacterial meningitis after spinal anesthesia for pain relief during labor. J Clin Anesth 1999; 11:438-439
83. Mahendru V, Bacon DR, Lema MJ: Multiple epidural abscesses and spinal anesthesia in a diabetic patient. Reg Anesth 1994; 19:66-68
84. Mamourian AC, Dickman CA, Drayer BP, Sonntag VKH: Spinal epidural abscess: three cases following spinal epidural injection demonstrated with magnetic resonance imaging. Anesthesiology 1993; 78:204-207
85. McDonogh AJ, Cranney BS: Delayed presentation of an epidural abscess. Anaesth Intensive Care 1984; 12:364-365
86. Meunier JF, Norwood P, Dartayet B, Dubousset AM, Ecoffey C: Skin abscess with lumbar epidural catheterization in infants: is it dangerous? Report of two cases. Anesth Analg 1997; 84:1248-1249
87. Newton JA, Lesnik IK, Kennedt CA: Streptococcus salivarius meningitis following spinal anesthesia. Clin Infect Dis 1994; 18:840-841
88. Ngan Kee WD, Jones MR, Thomas P, Worth RJ: Extradural abscess complicating extradural anaesthesia for caesarean section. Br J Anaesth 1992; 69:647-652
89. Nordberg G, Mark H: Epidural abscess after epidural analgesia treated successfully with antibiotics. Acta Anaesthesiol Scand 1998; 42:727-731
90. Nordström O, Sandin R: Delayed presentation of an extradural abscess in a patient with alcohol abuse. Br J Anaesth 1993; 70:368-369
91. North JB, Brophy BP: Epidural abscess; a hazard of spinal epidural anaesthesia. Aust NZ J Surg 1979; 49:484-485
92. Pegues DA, Carr, DB, Hopkins C: Infectious complications associated with temporary epidural catheters. Clin Infect Dis 1994; 19:970-972
93. Phillips JM, Stedeford JC, Hartsilver E, Roberts C: Epidural abscess complicating insertion of epidural catheters. Br J Anaesth 2002; 89:778-782
94. Pinder AJ, Dresner M: Meningococcal meningitis after combined spinal-epidural analgesia. Int J Obstet Anesth 2003; 12:183-187
95. Raj V, Foy J: Paraspinal abscess associated with epidural in labour. Anaesth Intensive Care 1998; 26:424-426
96. Rathmell JP, Garahan MB, Alsofrom GF: Epidural abscess following epidural analgesia. Reg Anesth Pain Med 2000; 25:79-82
97. Ready LB, Helfer D: Bacterial meningitis in parturients after epidural anesthesia. Anesthesiology 1989; 71:988-990
98. Roberts SP, Petts HV: Meningitis after obstetric spinal anaesthesia. Anaesthesia 1990; 45:376-377
99. Royakkers AANM, Willigers H, Van Der Ven AJ, Wilmink J, Durieux M, Van Kleef M: Catheter-related epidural abscesses. Don't wait for neurological deficits. Acta Anaesth Scand 2002; 46:611-615
100. Rubin L, Sprecher H, Kabaha A, Weber G, Teitler N, Rishpon S: Meningitis following spinal anesthesia: 6 cases in 5 years. Infect Control Hosp Epidemiol 2007; 28:1187-1190
101. Saady A: Epidural abcess complicating thoracic epidural analgesia. Anesthesiology 1976; 44:244-246
102. Sakuragi T, Yasunaka K, Hirata K, Hori K, Dan K: The source of epidural infection following epidural analgesia identified by pulsed-field gel electrophoresis. Anesthesiology 1998; 89:1254-1256
103. Sandkovsky U, Mihu MR, Adeyeye A, De Forest PM, Nosanchuk JD: Iatrogenic meningitis in an obstetric patient after combined spinal-epidural analgesia: case report and review of the literature. South Med J 2009; 102:287-290
104. Sarubbi FA, Vasquez JE: Spinal epidural abscess associated with the use of temporary epidural catheters: Report of two cases and review. Clin Infect Dis 1997; 25:1155-1158
105. Schneeberger PM, Janssen M, Voss A: Alpha-hemolytic streptococci: A major pathogen of iatrogenic meningitis following lumbar puncture. Case reports and a review of the literature. Infection 1996; 24:29-33
106. Schroter J, Wa DD, Hoffmann V, Bach A, Motsch J: Epidural abscess after combined spinal-epidural block. Can J Anaesth 1997; 44:300-344
107. Seth N, Macqueen S, Howard RF: Clinical signs of infection during continuous postoperative epidural analgesia in children: the value of catheter tip culture. Paediatr Anaesth 2004; 14:996-1000
108. Shealy CM: Dangers of spinal injections without proper diagnosis. J Am Med Assoc 1966; 197:1104-1106
109. Shintani S, Tanaka H, Irifune A, Mitoh Y, Udono H, Kaneda A, Shiigai T: Iatrogenic acute spinal epidural abscess with septic meningitis: MR findings. Clin Neurol Neurosurg 1992; 94:253-255
110. Sillevis Smitt P, Tsafka A, van den Bent M, de Bruin H, Hendriks W, Vecht C, Teng-van de Zande F: Spinal epidural abscess complicating chronic epidural analgesia in 11 cancer patients: clinical findings and magnetic resonance imaging. J Neurol 1999; 246:815-820
111. Siman-Tov T, Gadoth N: Enterococcal meningoencephalitis folowing epidural anesthesia. Isr Med Assoc J 2004; 6:780-781
112. Stallard N, Barry P: Another complication of the combined extradural-subarachnoid technique. Br J Anaesth 1995; 75:370-371
113. Strong WE: Epidural abscess associated with epidural catheterisation: a rare event? Report of two cases with markedly delayed presentation. Anesthesiology 1991; 74:943-946
114. Tabo E, Ohkuma Y, Kimura S, Nagaro T, Arai T: Successful percutaneous drainage of epidural abscess with epidural needle and catheter. Anesthesiology 1994; 80:1393-1395
115. Tay SM, Lee R: Case report: catheter-related epidural abscess. Ann Acad Med Singapore 2001; 30:62-65
116. Tham EJ, Stoodley MA, Macintyre PE, Jones NR: Back pain following postoperative epidural analgesia: an indicator of possible spinal infection. Anaesth Intensive Care 1997; 25:297-301
117. Thomas TA, Cooper GM: Maternal deaths from anaesthesia: an extract from Why Mothers Die 1997-1999, the confidential enquiries into maternal deaths in the United Kingdom. Br J Anaesth 2002; 89:499-508
118. Torres E, Albe D, Frank A, Diez-Tejedor E: Iatrogenic meningitis due to streptococcus salivarius following a spinal tap. Clin Invect Dis 1993; 17:525-526
119. Trautmann M, Lepper PM, Schmitz FJ: Three cases of bacterial meningitis after spinal and epidural anesthesia. Eur J Clin Microbiol Infect Dis 2002; 21:43-45
120. Videira RI, Ruiz-Neto PP,, Brandao-Neto M: Post spinal meningitis and sepsis. Acta Anaesthesiol Scand 2002; 46:639-646
121. Villevielle T, Vincent-Rouquette I, Petitjeans F, Koulmann P, Legulluche Y, Rousseau JM, Diraison Y, Brinquin: Strepoccus miitis-induced meningitis after spinal anesthesia. Anesth Analg 2000; 90:500-501
122. Wang JS, Fellows DG, Vakharia S, Rosenbaum AE, Thomas PS: Epidural abscess--early magnetic resonance imaging detection and conservative therapy. Anesth Analg 1996; 82:1069-1071
123. Watanakunakorn C: Escherichia coli meningitis and septicemia associated with an epidural catheter. Clin Infect Dis 1995; 21:713-714
124. Wood CE, Goresky GV, Klassen KA, Kuwahara B, Neil SG: Complications of continuous epidural infusions for postoperative analgesia in children. Can J Anaesth 1994; 41:613-620
125. Yaniv LG, Potasman I: Iatrogenic meningitis; an interesting role for resistant viridans streptococci? Case report and review of the last 20 years. Scand J Infect Dis 2000; 32:693-696
126. Yap KB, Finlay IG: Epidural infection associated with epidural catheterization in a cancer patient with back pain: case report. Palliat Med 1994; 8:251-253
127. Yuste M, Canet J, Garcia M, Gil MA, Vidal F: An epidural abscess due to resistant Staphylococcus aureus following epidural catheterisation. Anaesthesia 1997; 52:163-165

***Periodically checking patient's neurologic function.***

*Observational studies, case reports, or non-pertinent comparison groups*

1. Athmaja TR, Sanders GM: An unusual presentation of epidural Acinetobacter infection. Reg Anesth Pain Med 2005; 30:577-579
2. Bertol V, Ara JR, Oliveros A, Gros B: Neurologic complications of lumbar epidural analgesia: spinal and paraspinal abscess. Neurology 1997; 48:1732-1733
3. Brookman CA, Rutledge ML: Epidural abscess: case report and literature review. Reg Anesth Pain Med 2000; 25:428-431
4. Chan ST, Leung S: Spinal epidural abscess following steroid injection for sciatica. Spine 1989; 14:106-108
5. Cooper AB, Sharpe MD: Bacterial meningitis and cauda equina syndrome after epidural steroid injections. Can J Anaesth 1996; 43:471-474
6. Ericsson M, Algers G, Schliamser SE: Spinal epidural abscess in adults. Review and report of iatrogenic cases. Scand J Infect Dis 1990 22:249-257
7. Koka VK, Potti A: Spinal epidural abscess after corticosteroid injections. South Med J 2002; 95:772-774
8. Lehman RA, Jr., Lenke LG: Extensive epidural abscess treated with a thoracic laminoplasty. Spine J 2011; 11:798-799
9. Phillips JM, Stedeford JC, Hartsilver E, Roberts C: Epidural abscess complicating insertion of epidural catheters. Br J Anaesth 2002; 89:778-782
10. Raj V, Foy J: Paraspinal abscess associated with epidural in labour. Anaesth Intensive Care 1998; 26:424-426
11. Saady A: Epidural abcess complicating thoracic epidural analgesia. Anesthesiology 1976; 44:244-246
12. Sillevis Smitt P, Tsafka A, van den Bent M, de Bruin H, Hendriks W, Vecht C, Teng-van de Zande F: Spinal epidural abscess complicating chronic epidural analgesia in 11 cancer patients: clinical findings and magnetic resonance imaging. J Neurol 1999; 246:815-820
13. Simpson J, Foinette KM, Lobo DN, Rowlands BJ: Spinal epidural abscess: adding insult to injury? Injury 1999; 30:504-508

**Diagnostic testing.**

***Blood tests (e.g., white blood count, sedimentation rate, C-reactive protein).***

*Observational studies, case reports, or non-pertinent comparison groups*

1. Athmaja TR, Sanders GM: An unusual presentation of epidural Acinetobacter infection. Reg Anesth Pain Med 2005; 30:577-579
2. Bengtsson M, Nettelblad H, Sjoberg F: Extradural catheter-related infections in patients with infected cutaneous wounds. Br J Anaesth 1997; 79:668-670
3. Blackmore TK, Morley HR, Gordon DL: Streptococcus mitis-induced bacteremia and miningitis after spinal anesthesia. Anesthesiology 1993; 78:592-594
4. Bollensen E, Menck S, Buzanoski J, Prange HW: Iatrogenic epidural spinal abscess. Clin Invest 1993; 71:780-786
5. Bouhemad B, Dounas M, Mercier FJ, Benhamou D: Bacterial meningitis following combined spinal-epidural analgesia for labour. Anaesthesia 1998; 53:292-295
6. Brookman CA, Rutledge ML: Epidural abscess: case report and literature review. Reg Anesth Pain Med 2000; 25:428-431
7. Cascio M, Heath G: Meningitis following a combined spinal-epidural technique in a labouring term parturient. Can J Anaesth 1996; 43:399-402
8. Cesari M, Onder G, Torre S, Landi F, Carbonin P, Gambassi G: A "painful" epidural analgesia. J Am Geriatr Soc 2004; 52:329-330
9. Chiang HL, Chia YY, Chen YS, Hung CC, Liu K, Lo Y: Epidural abscess in an obstetric patient with patient-controlled epidural analgesia--a case report. Int J Obstet Anesth 2005; 14:242-245
10. Coapes CM, Roysam GS: Vertebral osteomyelitis secondary to epidural catheter use: a case report. Spine 2001; 26:1492-1494
11. Collis RE, Harries SE: A subdural abscess and infected blood patch complicating regional analgesia for labour. Int J Obstet Anesth 2005; 14:246-251
12. Cummings KC 3rd, Dolak JA: Case report: epidural abscess in a parturient with pruritic urticarial papules and plaques of pregnancy (PUPPP). Can J Anaesth 2006; 53:1010-1014
13. Edelstein S, Edoute Y: Bacterial sacroiliitis probably induced by lumbar epidural analgesia. Infect Dis Obstet Gynecol 2003; 11:105-108
14. Ericsson M, Algers G, Schliamser SE: Spinal epidural abscess in adults. Review and report of iatrogenic cases. Scand J Infect Dis 1990 22:249-257
15. Fine PG, Hare BD, Zahniser JC: Epidural abscess following epidural catheterization in a chronic pain patient: a diagnostic dilemma. Anesthesiology 1988; 69:422-424
16. Harding SA, Collis RE, Morgan BM: Meningitis after combined spinal-extradural anaesthesia in obstetrics. Br J Anaesth 1994; 73:545-547
17. Hernández-Palazón J, Puertas-García JP, Martínez-Lage JF, Tortosa JA: Lumbar spondylodiscitis caused by Propionibacterium acnes after epidural obstetric analgesia. Anesth Analg 2003; 96:1486-1488
18. Hooten WM, Kinney MO, Huntoon MA: Epidural abscess and meningitis after epidural corticosteroid injection. Mayo Clin Proc 2004; 79:682-686
19. Huang RC. Shapiro GS, Lim M, Sandhu HS, Lutz GE, Herzog RJ: Cervical epidural abscess after epidural steroid injection. Spine 2004; 29:E7-E9
20. Huang YY, Zuo Z, Yuan HB, Tsou MY, Chen MT, Tsai SK: A paraspinal abscess following spinal anaesthesia for caesarean section and patient-controlled epidural analgesia for postoperative pain. Int J Obstet Anesth 2005; 14:252-255
21. Ingelmo PM, Marino G, Fumagalli R: Sepsis after epidural catheterization in a child with chronic regional pain syndrome type I. Paediatr Anaesth 2005; 15:623-624
22. Iseki M, Okuno S, Tanabe Y, Mitsuhata H, Miyazaki T: Methicillin-resistant Staphylococcus aureus sepsis resulting from infection in paravertebral muscle after continuous epidural infusion for pain control in a patient with herpes zoster. Anesth Analg 1998; 87:116-118
23. Kindler C, Seeberger M, Siegemund M, Schneider M: Extradural abscess complicating lumbar extradural anaesthesia and analgesia in an obstetric patient. Acta Anaesthesiol Scand 1996; 40:858-861
24. Knight JW, Cordingley JJ, Palazzo MG: Epidural abscess following epidural steroid and local anaesthetic injection. Anaesth 1997; 52:576-578
25. Kocamanoglu IS, Sener EB, Tur A, Ustin E, Sahinoglu H: Streptococcal meningitis after spinal anesthesia: report of a case. Can J Anesth 2003; 50:314-315
26. Koka VK, Potti A: Spinal epidural abscess after corticosteroid injections. South Med J 2002; 95:772-774
27. Lindner A, Warmuth-Metz M, Becker G, Toyka VV: Iatrogenic spinal epidural abscesses: early diagnosis essential for good outcome. Eur J Med Res 1997; 2:201-205
28. Liu S, Pope A: Spinal meningitis masquerading as postdural puncture headache. Anesthesiology 1996; 85:1493-1494
29. Mahendru V, Bacon DR, Lema MJ: Multiple epidural abscesses and spinal anesthesia in a diabetic patient. Reg Anesth 1994; 19:66-68
30. McDonogh AJ, Cranney BS: Delayed presentation of an epidural abscess. Anaesth Intensive Care 1984; 12:364-365
31. Newton JA, Lesnik IK, Kennedt CA: Streptococcus salivarius meningitis following spinal anesthesia. Clin Infect Dis 1994; 18:840-841
32. Phillips JM, Stedeford JC, Hartsilver E, Roberts C: Epidural abscess complicating insertion of epidural catheters. Br J Anaesth 2002; 89:778-782
33. Pinder AJ, Dresner M: Meningococcal meningitis after combined spinal-epidural analgesia. Int J Obstet Anesth 2003; 12:183-187
34. Raj V, Foy J: Paraspinal abscess associated with epidural in labour. Anaesth Intensive Care 1998; 26:424-426
35. Rathmell JP, Garahan MB, Alsofrom GF: Epidural abscess following epidural analgesia. Reg Anesth Pain Med 2000; 25:79-82
36. Ready LB, Helfer D: Bacterial meningitis in parturients after epidural anesthesia. Anesthesiology 1989; 71:988-990
37. Sandkovsky U, Mihu MR, Adeyeye A, De Forest PM, Nosanchuk JD: Iatrogenic meningitis in an obstetric patient after combined spinal-epidural analgesia: case report and review of the literature. South Med J 2009; 102:287-290
38. Sarubbi FA, Vasquez JE: Spinal epidural abscess associated with the use of temporary epidural catheters: Report of two cases and review. Clin Infect Dis 1997; 25:1155-1158
39. Schroeder TH, Krueger WA, Neeser E, Hahn U, Unertl K: Spinal epidural abscess--a rare complication after epidural analgesia for labour and delivery. Br J Anaesth 2004; 92:896-898
40. Schroter J, Wa DD, Hoffmann V, Bach A, Motsch J: Epidural abscess after combined spinal-epidural block. Can J Anaesth 1997; 44:300-344
41. Shealy CM: Dangers of spinal injections without proper diagnosis. J Am Med Assoc 1966; 197:1104-1106
42. Siman-Tov T, Gadoth N: Enterococcal meningoencephalitis folowing epidural anesthesia. Isr Med Assoc J 2004; 6:780-781
43. Stallard N, Barry P: Another complication of the combined extradural-subarachnoid technique. Br J Anaesth 1995; 75:370-371
44. Strong WE: Epidural abscess associated with epidural catheterisation: a rare event? Report of two cases with markedly delayed presentation. Anesthesiology 1991; 74:943-946
45. Tham EJ, Stoodley MA, Macintyre PE, Jones NR: Back pain following postoperative epidural analgesia: an indicator of possible spinal infection. Anaesth Intensive Care 1997; 25:297-301
46. Wang JS, Fellows DG, Vakharia S, Rosenbaum AE, Thomas PS: Epidural abscess--early magnetic resonance imaging detection and conservative therapy. Anesth Analg 1996; 82:1069-1071
47. Yaniv LG, Potasman I: Iatrogenic meningitis; an interesting role for resistant viridans streptococci? Case report and review of the last 20 years. Scand J Infect Dis 2000; 32:693-696
48. Yap KB, Finlay IG: Epidural infection associated with epidural catheterization in a cancer patient with back pain: case report. Palliat Med 1994; 8:251-253

***Culture or CSF analysis.***

*Observational studies, case reports, or non-pertinent comparison groups*

1. Abaza KT, Bogod DG: Cerebrospinal fluid-cutaneous fistula and pseudomonas meningitis complicating thoracic epidural analgesia. Br J Anaesth 2004; 92:429-431
2. Anía BJ: Staphylococcus aureus meningitis after short-term epidural analgesia. Clin Infect Dis 1994; 18:844-845
3. Athmaja TR, Sanders GM: An unusual presentation of epidural Acinetobacter infection. Reg Anesth Pain Med 2005; 30:577-579
4. Baer ET: Post-dural puncture bacterial meningitis. Anesthesiology 2006; 105:381-393
5. Bajwa ZH, Ho C, Grush A, Kleefield J, Warfield CA: Discitis associated with pregnancy and spinal anesthesia. Anesth Analg 2002; 94:415-416
6. Barreto RS: Bacteriological culture of indwelling epidural catheters. Anesthesiology 1962; 23:643-646
7. Beaudoin MG, Klein L: Epidural abscess following multiple spinal anaesthetics. Anaesth Intensive Care 1984; 12:163-164
8. Bengtsson M, Nettelblad H, Sjoberg F: Extradural catheter-related infections in patients with infected cutaneous wounds. Br J Anaesth 1997; 79:668-670
9. Berga S, Trierweiler MW: Bacterial meningitis following epidural anesthesia for vaginal delivery: A case report. Obstet Gynecol 1989; 74:437-439
10. Berman RS, Eiselem JH: Bacteremia, spinal anesthesia and development of meningitis. Anesthesiology 1978; 48:376-377
11. Bertol V, Ara JR, Oliveros A, Gros B: Neurologic complications of lumbar epidural analgesia: spinal and paraspinal abscess. Neurology 1997; 48:1732-1733
12. Bevacqua BK, Slucky AV, Cleary WF: Is postoperative intrathecal catheter use associated with central nervous system infection? Anesthesiology 1994; 80:1234-1240
13. Blackmore TK, Morley HR, Gordon DL: Streptococcus mitis-induced bacteremia and miningitis after spinal anesthesia. Anesthesiology 1993; 78:592-594
14. Bollensen E, Menck S, Buzanoski J, Prange HW: Iatrogenic epidural spinal abscess. Clin Invest 1993; 71:780-786
15. Borum SE, McLeskey CH, Williamson JB, Harris FS, Knight AB: Epidural abscess after obstetric epidural analgesia. Anesthesiology 1995; 82:1523-1526
16. Bouhemad B, Dounas M, Mercier FJ, Benhamou D: Bacterial meningitis following combined spinal-epidural analgesia for labour. Anaesthesia 1998; 53:292-295
17. Brookman CA, Rutledge ML: Epidural abscess: case report and literature review. Reg Anesth Pain Med 2000; 25:428-431
18. Bubeck J, Boos K, Krause H, Thies KC: Subcutaneous tunneling of caudal catheters reduces the rate of bacterial colonization to that of lumbar epidural catheters. Anesth Analg 2004; 99:689-693
19. Bulow PM, Biering-Soeensen F: Paraplegia, a severe complication to epidural analgesia. Acta Anaesthesiol Scand 1999; 43:233-235
20. Bussink M, Gramke H, van Kleef M, Marcus M: Bacterial meningitis ten days after spinal anesthesia. Reg Anesth Pain Med 2005; 30:210-211
21. Cascio M, Heath G: Meningitis following a combined spinal-epidural technique in a labouring term parturient. Can J Anaesth 1996; 43:399-402
22. Cesari M, Onder G, Torre S, Landi F, Carbonin P, Gambassi G: A "painful" epidural analgesia. J Am Geriatr Soc 2004; 52:329-330
23. Chan ST, Leung S: Spinal epidural abscess following steroid injection for sciatica. Spine 1989; 14:106-108
24. Coapes CM, Roysam GS: Vertebral osteomyelitis secondary to epidural catheter use: a case report. Spine 2001; 26:1492-1494
25. Cohen S, Hunter CW, Sakr A, Hijazi RH: Meningitis following intrathecal catheter placement after accidental dural puncture. Int J Obstet Anesth 2006; 15:172
26. Collis RE, Harries SE: A subdural abscess and infected blood patch complicating regional analgesia for labour. Int J Obstet Anesth 2005; 14:246-251
27. Conangla G, Rodriquez I, Alonao-Tarres C, Avila A, de la Campa AG: Streptococcus salivarius meningitis after spinal anesthesia. Neurologia 2004; 19:331-333
28. Cooper AB, Sharpe MD: Bacterial meningitis and cauda equina syndrome after epidural steroid injections. Can J Anaesth 1996; 43:471-474
29. Couzigou C, Vuong TK, Botheral AH, Aggoune M, Astagneau P: Iatogenic streptococcus salivarius meningitis after spinal anesthesia: need for strict application of standard precautions. J Hosp Infect 2003; 53:313-314
30. Crawford JS: Pathology in the extradural space. Br J Anaesth 1975; 47:412-415
31. Cummings KC 3rd, Dolak JA: Case report: epidural abscess in a parturient with pruritic urticarial papules and plaques of pregnancy (PUPPP). Can J Anaesth 2006; 53:1010-1014
32. Darchy B, Forceville X, Bavoux E, Soriot F, Domart Y: Clinical and bacteriologic survey of epidural analgesia in patients in the intensive care unit. Anesthesiology 1996; 85:988-998
33. Darouiche RO, Hamill RJ, Greenberg SB, Weathers SW, Musher DM: Bacterial spinal epidural abscess. Review of 43 cases and literature survey. Medicine 1992; 71:369-385
34. Davis L, Hargreaves C, Robinson PN: Postpartum meningitis. Anaesthesia 1993; 48:788-789
35. Dawson P, Rosenfeld JV, Murphy MA, Hellyar AG: Epidural abscess associated with postoperative epidural analgesia. Anaesth Intens Care 1991; 19:569-572
36. De Cicco M, Matovic M, Castellani GT, Basaglia G, Santini G, Del Pup C, Fantin D, Testa V: Time-dependent efficacy of bacterial filters and infection risk in long-term epidural catheterization. Anesthesiology 1995; 82:765-771
37. Dhillon AR, Russell IF: Epidural abscess in association with obstetric analgesia. Int J Obstet Anesth 1997; 6:118-121
38. Dougherty JH Jr, Fraser RA: Complications following intraspinal injections of steroids: report of two cases. J Neurosurg 1978; 48:1023-1025
39. Dysart RH, Balakrishnan V: Conservative management of extradural abscess complicating spinal extradural anaesthesia for caesarean section. Br J Anaesth 1997; 78:591-593
40. Eisen DP, MacGinley R, Christensson B, Larsson L, Woods ML: Candida tropicalis vertebral osteomyelitis complicating epidural catheterisation with disease paralleled by elevated D-arabinitol/L-arabinitol ratios. Eur J Clin Microbiol Infect Dis 2000; 19:61-63
41. Ericsson M, Algers G, Schliamser SE: Spinal epidural abscess in adults. Review and report of iatrogenic cases. Scand J Infect Dis 1990 22:249-257
42. Evans PR, Misra U: Poor outcome following epidural abscess complicating epidural analgesia for labour. Eur J Obstet Gynecol Reprod Biol 2003; 109:102-105
43. Ferguson CC: Infection and the epidural space: a case report. AANA J 1992; 60:393-396
44. Ferguson JF, Kirsch WM: Epidural empyema following thoracic extradural block. J Neurosurg 1974; 41:762-764
45. Gosavi C, Bland D, Poddar R, Horst C: Epidural abscess complicating insertion of epidural catheters. Br J Anaesth 2004; 92:294
46. Goucke CR, Graziotti P: Extradural abscess following local anaesthetic and steriod injection for chronic low back pain. Br J Anaesth 1990; 65:427-429
47. Hadzic A, Koluder-Cimic N, Hadzovic-Cengic M, Gojak R, Gavrankapetanovic I, Becirbegovic S: Serratia marcescens meningitis following spinal anaesthesia and arthroscopy. Med Arch 2012; 66 (3 Suppl 1): 54-55
48. Halaby T, Leyssius A, Veneman T: Fatal bacterial meningitis after spinal anaesthesia. Scand J Infect Dis 2007; 39:280-283
49. Hearn M: Epidural abscess complicating insertion of epidural catheters. Br J Anaesth 2003; 90:706-707
50. Heller AR, Ragaller M, Koch T: Epidural abscess after epidural catheter for pain release during pancreatitis. Acta Anaesthesiol Scand 2000; 44:1024-1027
51. Hernandez JM, Coyle FP, Wright CD, Ballantyne JC: Epidural abscess after epidural anesthesia and continuous epidural analgesia in a patient with gastric lymphoma. J Clin Anesth 2003; 15:48-51
52. Hernández-Palazón J, Puertas-García JP, Martínez-Lage JF, Tortosa JA: Lumbar spondylodiscitis caused by Propionibacterium acnes after epidural obstetric analgesia. Anesth Analg 2003; 96:1486-1488
53. Hill JS, Hughes EW, Robertson PA: A Staphylococcus aureus paraspinal abscess associated with epidural analgesia in labour. Anaesthesia 2001; 56:873-878
54. Hoesni S, Bhinder R, Tan T, Hughes N, Carey M: Herpes simplex meningitis after accidental dural puncture during epidural analgesia for labour. Int J Obstet Anesth 2010; 19:466-467
55. Holt HM, Andersen SS, Andersen O, Gahrn-Hansen B, Siboni K: Infections following epidural catheterization. J Hosp Infect 1995; 30:253-260
56. Hooten WM, Kinney MO, Huntoon MA: Epidural abscess and meningitis after epidural corticosteroid injection. Mayo Clin Proc 2004; 79:682-686
57. Huang RC. Shapiro GS, Lim M, Sandhu HS, Lutz GE, Herzog RJ: Cervical epidural abscess after epidural steroid injection. Spine 2004; 29:E7-E9
58. Huang YY, Zuo Z, Yuan HB, Tsou MY, Chen MT, Tsai SK: A paraspinal abscess following spinal anaesthesia for caesarean section and patient-controlled epidural analgesia for postoperative pain. Int J Obstet Anesth 2005; 14:252-255
59. Hunt JR, Rogor BM, Collins JR: The potential for contamination of continuous epidural catheters. Anesth Analg 1977; 56:222-225
60. Idigoras P, Valiente A, Iglesias I, Trieu-Cuot P, Poyart C: Meningitis due to streptococcus salivarius. J Clin Microbiol 2001; 39:3017
61. Ingelmo PM, Marino G, Fumagalli R: Sepsis after epidural catheterization in a child with chronic regional pain syndrome type I. Paediatr Anaesth 2005; 15:623-624
62. Jakobsen KB, Chrsitensen M-K, Carlsson PS: Extradural anaesthesia for repeated surgical treatment in the presence of infection. Br J Anaesth 1995; 75:536-540
63. Jeffreys A, Horton R, Evans B: Epidural abscesses. Br J Anaesth 2006; 97:115-116
64. Kilpatrick ME, Girgis JI: Meningitis: A complication of spinal anesthesia. Anesth Analg 1983; 62:513-515
65. Kindler C, Seeberger M, Siegemund M, Schneider M: Extradural abscess complicating lumbar extradural anaesthesia and analgesia in an obstetric patient. Acta Anaesthesiol Scand 1996; 40:858-861
66. Knight JW, Cordingley JJ, Palazzo MG: Epidural abscess following epidural steroid and local anaesthetic injection. Anaesth 1997; 52:576-578
67. Kocamanoglu IS, Sener EB, Tur A, Ustin E, Sahinoglu H: Streptococcal meningitis after spinal anesthesia: report of a case. Can J Anesth 2003; 50:314-315
68. Koka VK, Potti A: Spinal epidural abscess after corticosteroid injections. South Med J 2002; 95:772-774
69. Kruger M, Harries K, Dumont S: Osteomyelitis following epidural analgesia in an immunocompromised patient. Anaesthesia 1998; 53:314-315
70. Kvalsvik O, Borchgrevink PC, Gisvold SE: Epidural abscess following continuous epidural analgesia in two traumatized patients. Acta Anaesthesiol Scand 1998; 42:732-735
71. Larsson BA, Lundeberg S, Olsson GL: Epidural abscess in a one-year-old boy after continuous epidural analgesia. Anesth Analg 1997; 84:1245-1247
72. Laurila JJ, Kostamovaara PA, Alahuhta S: Streptococcus salivarius meningitis after spinal anesthesia. Anesthesiology 1998; 89:1579-1580
73. Lee JJ, Parry H: Bacterial meningitis following spinal anaesthesia for Caesarean section. Br J Anaesth 1991; 66:383-386
74. Lin YC, Greco C: Epidural abscess following epidural analgesia in pediatric patients. Paediatr Anaesth 2005; 15:767-770
75. Lindner A, Warmuth-Metz M, Becker G, Toyka VV: Iatrogenic spinal epidural abscesses: early diagnosis essential for good outcome. Eur J Med Res 1997; 2:201-205
76. Liu S, Pope A: Spinal meningitis masquerading as postdural puncture headache. Anesthesiology 1996; 85:1493-1494
77. Lurie S, Feinstein M, Hiefetz C, Manet Y: Iatrogenic bacterial meningitis after spinal anesthesia for pain relief during labor. J Clin Anesth 1999; 11:438-439
78. Mamourian AC, Dickman CA, Drayer BP, Sonntag VKH: Spinal epidural abscess: three cases following spinal epidural injection demonstrated with magnetic resonance imaging. Anesthesiology 1993; 78:204-207
79. Mann TJ, Orlikowski CE, Gurrin LC, Keil AD: The effect of the biopatch, a chlorhexidine impregnated dressing, on bacterial colonization of epidural catheter exit sites. Anaesth Intensive Care 2001; 29:600-603
80. McDonogh AJ, Cranney BS: Delayed presentation of an epidural abscess. Anaesth Intensive Care 1984; 12:364-365
81. Meunier JF, Norwood P, Dartayet B, Dubousset AM, Ecoffey C: Skin abscess with lumbar epidural catheterization in infants: is it dangerous? Report of two cases. Anesth Analg 1997; 84:1248-1249
82. Mishra S, Bhatnagar S, Srikanti M, Gupta D: Clinical implication of routine bacterial culture from epidural catheter tips in postoperative cancer patients: a prospective study. Anaesthesia 2006; 61:878-882
83. Newton JA, Lesnik IK, Kennedt CA: Streptococcus salivarius meningitis following spinal anesthesia. Clin Infect Dis 1994; 18:840-841
84. Ngan Kee WD, Jones MR, Thomas P, Worth RJ: Extradural abscess complicating extradural anaesthesia for caesarean section. Br J Anaesth 1992; 69:647-652
85. Nickels JH, Poulos JG, Chaouki K: Risks of infection from short-term epidural catheter use. Reg Anesth 1989; 14:88-89
86. Nordberg G, Mark H: Epidural abscess after epidural analgesia treated successfully with antibiotics. Acta Anaesthesiol Scand 1998; 42:727-731
87. North JB, Brophy BP: Epidural abscess; a hazard of spinal epidural anaesthesia. Aust NZ J Surg 1979; 49:484-485
88. Pandian JD, Sarada C, Radhakrishnan VV, Kishore A: Iatrogenic meningitis after lumbar puncture: a preventable health hazard. J Hosp Infect 2004; 56:119-124
89. Pegues DA, Carr, DB, Hopkins C: Infectious complications associated with temporary epidural catheters. Clin Infect Dis 1994; 19:970-972
90. Phillips JM, Stedeford JC, Hartsilver E, Roberts C: Epidural abscess complicating insertion of epidural catheters. Br J Anaesth 2002; 89:778-782
91. Pinczower GR, Gyorke A: Vertebral osteomyelitis as a cause of back pain after epidural anesthesia. Anesthesiology 1996; 84:215-217
92. Pinder AJ, Dresner M: Meningococcal meningitis after combined spinal-epidural analgesia. Int J Obstet Anesth 2003; 12:183-187
93. Raj V, Foy J: Paraspinal abscess associated with epidural in labour. Anaesth Intensive Care 1998; 26:424-426
94. Rathmell JP, Garahan MB, Alsofrom GF: Epidural abscess following epidural analgesia. Reg Anesth Pain Med 2000; 25:79-82
95. Ready LB, Helfer D: Bacterial meningitis in parturients after epidural anesthesia. Anesthesiology 1989; 71:988-990
96. Roberts SP, Petts HV: Meningitis after obstetric spinal anaesthesia. Anaesthesia 1990; 45:376-377
97. Royakkers AANM, Willigers H, Van Der Ven AJ, Wilmink J, Durieux M, Van Kleef M: Catheter-related epidural abscesses. Don't wait for neurological deficits. Acta Anaesth Scand 2002; 46:611-615
98. Saady A: Epidural abcess complicating thoracic epidural analgesia. Anesthesiology 1976; 44:244-246
99. Sahay BM, Dahake S, Mendiratta DK: Bacteriological profile of epidural catheters. JK Sci 2010; 12:23-26
100. Sakuragi T, Yasunaka K, Hirata K, Hori K, Dan K: The source of epidural infection following epidural analgesia identified by pulsed-field gel electrophoresis. Anesthesiology 1998; 89:1254-1256
101. Sandkovsky U, Mihu MR, Adeyeye A, De Forest PM, Nosanchuk JD: Iatrogenic meningitis in an obstetric patient after combined spinal-epidural analgesia: case report and review of the literature. South Med J 2009; 102:287-290
102. Sarubbi FA, Vasquez JE: Spinal epidural abscess associated with the use of temporary epidural catheters: Report of two cases and review. Clin Infect Dis 1997; 25:1155-1158
103. Schneeberger PM, Janssen M, Voss A: Alpha-hemolytic streptococci: A major pathogen of iatrogenic meningitis following lumbar puncture. Case reports and a review of the literature. Infection 1996; 24:29-33
104. Schroter J, Wa DD, Hoffmann V, Bach A, Motsch J: Epidural abscess after combined spinal-epidural block. Can J Anaesth 1997; 44:300-344
105. Seth N, Macqueen S, Howard RF: Clinical signs of infection during continuous postoperative epidural analgesia in children: the value of catheter tip culture. Paediatr Anaesth 2004; 14:996-1000
106. Shintani S, Tanaka H, Irifune A, Mitoh Y, Udono H, Kaneda A, Shiigai T: Iatrogenic acute spinal epidural abscess with septic meningitis: MR findings. Clin Neurol Neurosurg 1992; 94:253-255
107. Sillevis Smitt P, Tsafka A, van den Bent M, de Bruin H, Hendriks W, Vecht C, Teng-van de Zande F: Spinal epidural abscess complicating chronic epidural analgesia in 11 cancer patients: clinical findings and magnetic resonance imaging. J Neurol 1999; 246:815-820
108. Siman-Tov T, Gadoth N: Enterococcal meningoencephalitis folowing epidural anesthesia. Isr Med Assoc J 2004; 6:780-781
109. Simpson J, Foinette KM, Lobo DN, Rowlands BJ: Spinal epidural abscess: adding insult to injury? Injury 1999; 30:504-508
110. Simpson RS, Macintyre PE, Shaw D, Norton A, McCann JR, Tham EJ: Epidural catheter tip cultures: results of a 4-year audit and implications for clinical practice. Reg Anesth Pain Med 2000; 25:360-367
111. Sowter MC, Burgess NA, Woodsford PV, Lewis MH: Delayed presentation of an extradural abscess complicating thoracic extradural analgesia. Br J Anaesth 1992; 68:103-105
112. Stallard N, Barry P: Another complication of the combined extradural-subarachnoid technique. Br J Anaesth 1995; 75:370-371
113. Strafford MA, Wilder RT, Berde CB: The risk of infection from epidural analgesia in children: a review of 1620 cases. Anesth Analg 1995; 80:234-238
114. Strong WE: Epidural abscess associated with epidural catheterisation: a rare event? Report of two cases with markedly delayed presentation. Anesthesiology 1991; 74:943-946
115. Tabo E, Ohkuma Y, Kimura S, Nagaro T, Arai T: Successful percutaneous drainage of epidural abscess with epidural needle and catheter. Anesthesiology 1994; 80:1393-1395
116. Tay SM, Lee R: Case report: catheter-related epidural abscess. Ann Acad Med Singapore 2001; 30:62-65
117. Tham EJ, Stoodley MA, Macintyre PE, Jones NR: Back pain following postoperative epidural analgesia: an indicator of possible spinal infection. Anaesth Intensive Care 1997; 25:297-301
118. Trautmann M, Lepper PM, Schmitz FJ: Three cases of bacterial meningitis after spinal and epidural anesthesia. Eur J Clin Microbiol Infect Dis 2002; 21:43-45
119. Videira RI, Ruiz-Neto PP, Brandao-Neto M: Post spinal meningitis and sepsis. Acta Anaesthesiol Scand 2002; 46:639-646
120. Wang JS, Fellows DG, Vakharia S, Rosenbaum AE, Thomas PS: Epidural abscess--early magnetic resonance imaging detection and conservative therapy. Anesth Analg 1996; 82:1069-1071
121. Watanakunakorn C: Escherichia coli meningitis and septicemia associated with an epidural catheter. Clin Infect Dis 1995; 21:713-714
122. Yaniv LG, Potasman I: Iatrogenic meningitis; an interesting role for resistant viridans streptococci? Case report and review of the last 20 years. Scand J Infect Dis 2000; 32:693-696
123. Yap KB, Finlay IG: Epidural infection associated with epidural catheterization in a cancer patient with back pain: case report. Palliat Med 1994; 8:251-253
124. Yuan HB, Zuo Z, Yu KW, Lin WM, Lee HC, Chan KH: Bacterial colonization of epidural catheters used for short-term postoperative analgesia: microbiological examination and risk factor analysis. Anesthesiology 2008; 108:130-137
125. Yuste M, Canet J, Garcia M, Gil MA, Vidal F: An epidural abscess due to resistant Staphylococcus aureus following epidural catheterisation. Anaesthesia 1997; 52:163-165

***Imaging (CT, MRI).***

*Observational studies, case reports, or non-pertinent comparison groups*

1. Abaza KT, Bogod DG: Cerebrospinal fluid-cutaneous fistula and pseudomonas meningitis complicating thoracic epidural analgesia. Br J Anaesth 2004; 92:429-431
2. Alpantaki K, Papoutsidakis A, Katonis P, Hadjipavlou A: Vertebral osteomyelitis, epidural and psoas abscess after epidural catheter use. Acta Orthop Belg 2007; 73:670-673
3. Arun R, Al-Nammari SS, Mehdian SM: Multilevel vertebral osteomyelitis and facet joint infection following epidural catheterisation. Acta Orthop Belg 2007; 73:665-669
4. Athmaja TR, Sanders GM: An unusual presentation of epidural Acinetobacter infection. Reg Anesth Pain Med 2005; 30:577-579
5. Baer ET: Post-dural puncture bacterial meningitis. Anesthesiology 2006; 105:381-393
6. Bajwa ZH, Ho C, Grush A, Kleefield J, Warfield CA: Discitis associated with pregnancy and spinal anesthesia. Anesth Analg 2002; 94:415-416
7. Beaudoin MG, Klein L: Epidural abscess following multiple spinal anaesthetics. Anaesth Intensive Care 1984; 12:163-164
8. Bengtsson M, Nettelblad H, Sjoberg F: Extradural catheter-related infections in patients with infected cutaneous wounds. Br J Anaesth 1997; 79:668-670
9. Bertol V, Ara JR, Oliveros A, Gros B: Neurologic complications of lumbar epidural analgesia: spinal and paraspinal abscess. Neurology 1997; 48:1732-1733
10. Bollensen E, Menck S, Buzanoski J, Prange HW: Iatrogenic epidural spinal abscess. Clin Invest 1993; 71:780-786
11. Borum SE, McLeskey CH, Williamson JB, Harris FS, Knight AB: Epidural abscess after obstetric epidural analgesia. Anesthesiology 1995; 82:1523-1526
12. Brookman CA, Rutledge ML: Epidural abscess: case report and literature review. Reg Anesth Pain Med 2000; 25:428-431
13. Bulow PM, Biering-Soeensen F: Paraplegia, a severe complication to epidural analgesia. Acta Anaesthesiol Scand 1999; 43:233-235
14. Cameron CM, Scott DA, McDonald WM, Davies MJ: A review of neuraxial epidural morbidity: experience of more than 8,000 cases at a single teaching hospital. Anesthesiology 2007; 106:997-1002
15. Cesari M, Onder G, Torre S, Landi F, Carbonin P, Gambassi G: A "painful" epidural analgesia. J Am Geriatr Soc 2004; 52:329-330
16. Chan ST, Leung S: Spinal epidural abscess following steroid injection for sciatica. Spine 1989; 14:106-108
17. Chiang HL, Chia YY, Chen YS, Hung CC, Liu K, Lo Y: Epidural abscess in an obstetric patient with patient-controlled epidural analgesia--a case report. Int J Obstet Anesth 2005; 14:242-245
18. Coapes CM, Roysam GS: Vertebral osteomyelitis secondary to epidural catheter use: a case report. Spine 2001; 26:1492-1494
19. Collier CB, Gatt SP: Epidural abscess in an obstetric patient. Anaesth Intensive Care 1999; 27:662-666
20. Collis RE, Harries SE: A subdural abscess and infected blood patch complicating regional analgesia for labour. Int J Obstet Anesth 2005; 14:246-251
21. Cooper AB, Sharpe MD: Bacterial meningitis and cauda equina syndrome after epidural steroid injections. Can J Anaesth 1996; 43:471-474
22. Cummings KC 3rd, Dolak JA: Case report: epidural abscess in a parturient with pruritic urticarial papules and plaques of pregnancy (PUPPP). Can J Anaesth 2006; 53:1010-1014
23. Darouiche RO, Hamill RJ, Greenberg SB, Weathers SW, Musher DM: Bacterial spinal epidural abscess. Review of 43 cases and literature survey. Medicine 1992; 71:369-385
24. Dawson P, Rosenfeld JV, Murphy MA, Hellyar AG: Epidural abscess associated with postoperative epidural analgesia. Anaesth Intens Care 1991; 19:569-572
25. Dhillon AR, Russell IF: Epidural abscess in association with obstetric analgesia. Int J Obstet Anesth 1997; 6:118-121
26. Dunn LT, Javed A, Findlay G, Green AD: Iatrogenic spinal infection following epidural anaesthesia: case report. Eur Spine J 1996; 5:418-420
27. Dysart RH, Balakrishnan V: Conservative management of extradural abscess complicating spinal extradural anaesthesia for caesarean section. Br J Anaesth 1997; 78:591-593
28. Edelstein S, Edoute Y: Bacterial sacroiliitis probably induced by lumbar epidural analgesia. Infect Dis Obstet Gynecol 2003; 11:105-108
29. Ericsson M, Algers G, Schliamser SE: Spinal epidural abscess in adults. Review and report of iatrogenic cases. Scand J Infect Dis 1990 22:249-257
30. Evans PR, Misra U: Poor outcome following epidural abscess complicating epidural analgesia for labour. Eur J Obstet Gynecol Reprod Biol 2003; 109:102-105
31. Ferguson CC: Infection and the epidural space: a case report. AANA J 1992; 60:393-396
32. Ferguson JF, Kirsch WM: Epidural empyema following thoracic extradural block. J Neurosurg 1974; 41:762-764
33. Fine PG, Hare BD, Zahniser JC: Epidural abscess following epidural catheterization in a chronic pain patient: a diagnostic dilemma. Anesthesiology 1988; 69:422-424
34. Flisberg P, Friberg H: Epidural anesthesia complications - early warning signs. Acta Anaesthesiol Scand 2007; 51:264-265
35. Gosavi C, Bland D, Poddar R, Horst C: Epidural abscess complicating insertion of epidural catheters. Br J Anaesth 2004; 92:294
36. Hearn M: Epidural abscess complicating insertion of epidural catheters. Br J Anaesth 2003; 90:706-707
37. Hernandez JM, Coyle FP, Wright CD, Ballantyne JC: Epidural abscess after epidural anesthesia and continuous epidural analgesia in a patient with gastric lymphoma. J Clin Anesth 2003; 15:48-51
38. Hernández-Palazón J, Puertas-García JP, Martínez-Lage JF, Tortosa JA: Lumbar spondylodiscitis caused by Propionibacterium acnes after epidural obstetric analgesia. Anesth Analg 2003; 96:1486-1488
39. Hill JS, Hughes EW, Robertson PA: A Staphylococcus aureus paraspinal abscess associated with epidural analgesia in labour. Anaesthesia 2001; 56:873-878
40. Hooten WM, Kinney MO, Huntoon MA: Epidural abscess and meningitis after epidural corticosteroid injection. Mayo Clin Proc 2004; 79:682-686
41. Hooten WM, Mizerak A, Carns PE, Huntoon MA: Discitis after lumbar epidural corticosteroid injection: a case report and analysis of the case report literature. Pain Med 2006; 7:46-51
42. Huang YY, Zuo Z, Yuan HB, Tsou MY, Chen MT, Tsai SK: A paraspinal abscess following spinal anaesthesia for caesarean section and patient-controlled epidural analgesia for postoperative pain. Int J Obstet Anesth 2005; 14:252-255
43. Ikushima I, Hirai T, Korogi Y, Norio M, Koganemaru M, Suga R, Morishita S, Yamashita Y: Spinal MR findings in continuous epidural analgesia without infection. AJNR 2005; 26:991-995
44. Ingelmo PM, Marino G, Fumagalli R: Sepsis after epidural catheterization in a child with chronic regional pain syndrome type I. Paediatr Anaesth 2005; 15:623-624
45. Iseki M, Okuno S, Tanabe Y, Mitsuhata H, Miyazaki T: Methicillin-resistant Staphylococcus aureus sepsis resulting from infection in paravertebral muscle after continuous epidural infusion for pain control in a patient with herpes zoster. Anesth Analg 1998; 87:116-118
46. Jeffreys A, Horton R, Evans B: Epidural abscesses. Br J Anaesth 2006; 97:115-116
47. Koka VK, Potti A: Spinal epidural abscess after corticosteroid injections. South Med J 2002; 95:772-774
48. Krishnakumar R1, Renjitkumar J: Methicillin-resistant staphylococcus aureus vertebral osteomyelitis following epidural catheterization: A case report and literature review. Global Spine J 2012; 2:231-234
49. Kruger M, Harries K, Dumont S: Osteomyelitis following epidural analgesia in an immunocompromised patient. Anaesthesia 1998; 53:314-315
50. Larsson BA, Lundeberg S, Olsson GL: Epidural abscess in a one-year-old boy after continuous epidural analgesia. Anesth Analg 1997; 84:1245-1247
51. Lehman RA, Jr., Lenke LG: Extensive epidural abscess treated with a thoracic laminoplasty. Spine J 2011; 11:798-799
52. Lin YC, Greco C: Epidural abscess following epidural analgesia in pediatric patients. Paediatr Anaesth 2005; 15:767-770
53. Lindner A, Warmuth-Metz M, Becker G, Toyka VV: Iatrogenic spinal epidural abscesses: early diagnosis essential for good outcome. Eur J Med Res 1997; 2:201-205
54. Mahendru V, Bacon DR, Lema MJ: Multiple epidural abscesses and spinal anesthesia in a diabetic patient. Reg Anesth 1994; 19:66-68
55. Mamourian AC, Dickman CA, Drayer BP, Sonntag VKH: Spinal epidural abscess: three cases following spinal epidural injection demonstrated with magnetic resonance imaging. Anesthesiology 1993; 78:204-207
56. McDonogh AJ, Cranney BS: Delayed presentation of an epidural abscess. Anaesth Intensive Care 1984; 12:364-365
57. McGahan JP, Dublin AB: Evaluation of spinal infections by plain radiographs, computed tomography, intrathecal metrizamide, and CT-guided biopsy. Diagn Imaging Clin Med 1985; 54:11-20
58. Morau EL, Lotthe AA, Morau DY, Parneix M, Hocquet AF, Colson PH: Bifocal tuberculosis highlighted by obstetric combined spinal-epidural analgesia. Anesthesiology 2005; 103:445-446
59. Ngan Kee WD, Jones MR, Thomas P, Worth RJ: Extradural abscess complicating extradural anaesthesia for caesarean section. Br J Anaesth 1992; 69:647-652
60. Noh SH, Heo DH: Whole cerebrospinal axis infection after lumbar epidural injection: a case report. Eur Spine J 2015; 24 (Suppl 4):S525-S528
61. Nordström O, Sandin R: Delayed presentation of an extradural abscess in a patient with alcohol abuse. Br J Anaesth 1993; 70:368-369
62. Okano K, Kondo H, Tsuchiya R, Naruke T, Sato M, Yokoyama R: Spinal epidural abscess associated with epidural catheterization: report of a case and a review of the literature. Jpn J Clin Oncol 1999; 29:49-52
63. Pegues DA, Carr, DB, Hopkins C: Infectious complications associated with temporary epidural catheters. Clin Infect Dis 1994; 19:970-972
64. Phillips JM, Stedeford JC, Hartsilver E, Roberts C: Epidural abscess complicating insertion of epidural catheters. Br J Anaesth 2002; 89:778-782
65. Pinczower GR, Gyorke A: Vertebral osteomyelitis as a cause of back pain after epidural anesthesia. Anesthesiology 1996; 84:215-217
66. Raj V, Foy J: Paraspinal abscess associated with epidural in labour. Anaesth Intensive Care 1998; 26:424-426
67. Rathmell JP, Garahan MB, Alsofrom GF: Epidural abscess following epidural analgesia. Reg Anesth Pain Med 2000; 25:79-82
68. Royakkers AANM, Willigers H, Van Der Ven AJ, Wilmink J, Durieux M, Van Kleef M: Catheter-related epidural abscesses. Don't wait for neurological deficits. Acta Anaesth Scand 2002; 46:611-615
69. Saady A: Epidural abcess complicating thoracic epidural analgesia. Anesthesiology 1976; 44:244-246
70. Sarubbi FA, Vasquez JE: Spinal epidural abscess associated with the use of temporary epidural catheters: Report of two cases and review. Clin Infect Dis 1997; 25:1155-1158
71. Schroeder TH, Krueger WA, Neeser E, Hahn U, Unertl K: Spinal epidural abscess--a rare complication after epidural analgesia for labour and delivery. Br J Anaesth 2004; 92:896-898
72. Schroter J, Wa DD, Hoffmann V, Bach A, Motsch J: Epidural abscess after combined spinal-epidural block. Can J Anaesth 1997; 44:300-344
73. Shashidhar N, Tripathy SK, Balasubramanian S, Dhanakodi N, Venkataramaiah S: Aspergillus spondylodiscitis in an immunocompetent patient following spinal anesthesia. Orthop Surg 2014; 6:72-77
74. Shealy CM: Dangers of spinal injections without proper diagnosis. J Am Med Assoc 1966; 197:1104-1106
75. Shintani S, Tanaka H, Irifune A, Mitoh Y, Udono H, Kaneda A, Shiigai T: Iatrogenic acute spinal epidural abscess with septic meningitis: MR findings. Clin Neurol Neurosurg 1992; 94:253-255
76. Shioya N, Ishibe Y, Kan S, Masuda T, Matsumoto N, Takahashi G, Makabe H, Yamada Y, Endo S: Sternoclavicular joint septic arthritis following paraspinal muscle abscess and septic lumbar spondylodiscitis with epidural abscess in a patient with diabetes: a case report. BMC Emerg Med 2012;12:7
77. Sillevis Smitt P, Tsafka A, van den Bent M, de Bruin H, Hendriks W, Vecht C, Teng-van de Zande F: Spinal epidural abscess complicating chronic epidural analgesia in 11 cancer patients: clinical findings and magnetic resonance imaging. J Neurol 1999; 246:815-820
78. Simpson J, Foinette KM, Lobo DN, Rowlands BJ: Spinal epidural abscess: adding insult to injury? Injury 1999; 30:504-508
79. Sollmann WP, Gaab MR, Panning B: Lumbar epidural hematoma and spinal abscess following peridural anesthesia. Reg Anaesth 1987; 10:121-124
80. Sowter MC, Burgess NA, Woodsford PV, Lewis MH: Delayed presentation of an extradural abscess complicating thoracic extradural analgesia. Br J Anaesth 1992; 68:103-105
81. Strong WE: Epidural abscess associated with epidural catheterisation: a rare event? Report of two cases with markedly delayed presentation. Anesthesiology 1991; 74:943-946
82. Tabo E, Ohkuma Y, Kimura S, Nagaro T, Arai T: Successful percutaneous drainage of epidural abscess with epidural needle and catheter. Anesthesiology 1994; 80:1393-1395
83. Tay SM, Lee R: Case report: catheter-related epidural abscess. Ann Acad Med Singapore 2001; 30:62-65
84. Tham EJ, Stoodley MA, Macintyre PE, Jones NR: Back pain following postoperative epidural analgesia: an indicator of possible spinal infection. Anaesth Intensive Care 1997; 25:297-301
85. Thomas TA, Cooper GM: Maternal deaths from anaesthesia: an extract from Why Mothers Die 1997-1999, the confidential enquiries into maternal deaths in the United Kingdom. Br J Anaesth 2002; 89:499-508
86. Tung GA, Yim JWK, Mermel LA, Philip L, Rogg JM: Spinal epidural abscess: correlation between MRI findings and outcome. Neuroradiology 1999; 41:904-909
87. Wang JS, Fellows DG, Vakharia S, Rosenbaum AE, Thomas PS: Epidural abscess--early magnetic resonance imaging detection and conservative therapy. Anesth Analg 1996; 82:1069-1071
88. Yamaguchi M, Kawakubo A, Ide R, Hara K, Sumikawa K: Epidural abscesses associated with epidural block in a patient with immunosuppressive disease. Masui 1999; 48:506-508
89. Yaniv LG, Potasman I: Iatrogenic meningitis; an interesting role for resistant viridans streptococci? Case report and review of the last 20 years. Scand J Infect Dis 2000; 32:693-696
90. Yuste M, Canet J, Garcia M, Gil MA, Vidal F: An epidural abscess due to resistant Staphylococcus aureus following epidural catheterisation. Anaesthesia 1997; 52:163-165

***IV. Management of infectious complications***

**Antibiotic therapy.**

*Observational studies, case reports, or non-pertinent comparison groups*

1. Abaza KT, Bogod DG: Cerebrospinal fluid-cutaneous fistula and pseudomonas meningitis complicating thoracic epidural analgesia. Br J Anaesth 2004; 92:429-431
2. Anía BJ: Staphylococcus aureus meningitis after short-term epidural analgesia. Clin Infect Dis 1994; 18:844-845
3. Aromaa U, Lahdensuu M, Cozanitis DA: Severe complications associated with epidural and spinal anaesthesias in Finland 1987-1993. A study based on patient insurance claims. Acta Anaesthesiol Scand 1997; 41:445-452
4. Bajwa ZH, Ho C, Grush A, Kleefield J, Warfield CA: Discitis associated with pregnancy and spinal anesthesia. Anesth Analg 2002; 94:415-416
5. Berga S, Trierweiler MW: Bacterial meningitis following epidural anesthesia for vaginal delivery: A case report. Obstet Gynecol 1989; 74:437-439
6. Berman RS, Eiselem JH: Bacteremia, spinal anesthesia and development of meningitis. Anesthesiology 1978; 48:376-377
7. Bertol V, Ara JR, Oliveros A, Gros B: Neurologic complications of lumbar epidural analgesia: spinal and paraspinal abscess. Neurology 1997; 48:1732-1733
8. Blackmore TK, Morley HR, Gordon DL: Streptococcus mitis-induced bacteremia and miningitis after spinal anesthesia. Anesthesiology 1993; 78:592-594
9. Bouhemad B, Dounas M, Mercier FJ, Benhamou D: Bacterial meningitis following combined spinal-epidural analgesia for labour. Anaesthesia 1998; 53:292-295
10. Bussink M, Gramke H, van Kleef M, Marcus M: Bacterial meningitis ten days after spinal anesthesia. Reg Anesth Pain Med 2005; 30:210-211
11. Cascio M, Heath G: Meningitis following a combined spinal-epidural technique in a labouring term parturient. Can J Anaesth 1996; 43:399-402
12. Cesari M, Onder G, Torre S, Landi F, Carbonin P, Gambassi G: A "painful" epidural analgesia. J Am Geriatr Soc 2004; 52:329-330
13. Chiang HL, Chia YY, Chen YS, Hung CC, Liu K, Lo Y: Epidural abscess in an obstetric patient with patient-controlled epidural analgesia--a case report. Int J Obstet Anesth 2005; 14:242-245
14. Collier CB, Gatt SP: Epidural abscess in an obstetric patient. Anaesth Intensive Care 1999; 27:662-666
15. Collis RE, Harries SE: A subdural abscess and infected blood patch complicating regional analgesia for labour. Int J Obstet Anesth 2005; 14:246-251
16. Cooper AB, Sharpe MD: Bacterial meningitis and cauda equina syndrome after epidural steroid injections. Can J Anaesth 1996; 43:471-474
17. Crawford ME, Andersen HB, Augustenborg G, Bay J, Beck O, Benveniste D, Larsen LB, Carl P, Djernes M, Eriksen J, Greall AM, Henriksen H, Johansen SH, Jorgensen HOK, Moller IW, Pedersen JEP, Ravlo O: Pain treatment on outpatient basis utilizing extradural opiates. A Danish multicenter study comprising 105 patients. Pain 1983; 16:41-47
18. Darouiche RO, Hamill RJ, Greenberg SB, Weathers SW, Musher DM: Bacterial spinal epidural abscess. Review of 43 cases and literature survey. Medicine 1992; 71:369-385
19. Davis L, Hargreaves C, Robinson PN: Postpartum meningitis. Anaesthesia 1993; 48:788-789
20. Dougherty JH Jr, Fraser RA: Complications following intraspinal injections of steroids: report of two cases. J Neurosurg 1978; 48:1023-1025
21. Dysart RH, Balakrishnan V: Conservative management of extradural abscess complicating spinal extradural anaesthesia for caesarean section. Br J Anaesth 1997; 78:591-593
22. Edelstein S, Edoute Y: Bacterial sacroiliitis probably induced by lumbar epidural analgesia. Infect Dis Obstet Gynecol 2003; 11:105-108
23. Emmanuel ER: Post-sacral extradural catheter abscess in a child. Br J Anaesth 1994; 73:548-549
24. Ferguson CC: Infection and the epidural space: a case report. AANA J 1992; 60:393-396
25. Hernández-Palazón J, Puertas-García JP, Martínez-Lage JF, Tortosa JA: Lumbar spondylodiscitis caused by Propionibacterium acnes after epidural obstetric analgesia. Anesth Analg 2003; 96:1486-1488
26. Hooten WM, Kinney MO, Huntoon MA: Epidural abscess and meningitis after epidural corticosteroid injection. Mayo Clin Proc 2004; 79:682-686
27. Hunt JR, Rogor BM, Collins JR: The potential for contamination of continuous epidural catheters. Anesth Analg 1977; 56:222-225
28. Idigoras P, Valiente A, Iglesias I, Trieu-Cuot P, Poyart C: Meningitis due to streptococcus salivarius. J Clin Microbiol 2001; 39:3017
29. Iseki M, Okuno S, Tanabe Y, Mitsuhata H, Miyazaki T: Methicillin-resistant Staphylococcus aureus sepsis resulting from infection in paravertebral muscle after continuous epidural infusion for pain control in a patient with herpes zoster. Anesth Analg 1998; 87:116-118
30. Jeffreys A, Horton R, Evans B: Epidural abscesses. Br J Anaesth 2006; 97:115-116
31. Kessler AT, Kourtis AP: Treatment of meningitis caused by methicillin-resistant Staphylococcus aureus with linezolid. Infection 2007; 35:271-274
32. Kindler C, Seeberger M, Siegemund M, Schneider M: Extradural abscess complicating lumbar extradural anaesthesia and analgesia in an obstetric patient. Acta Anaesthesiol Scand 1996; 40:858-861
33. Kocamanoglu IS, Sener EB, Tur A, Ustin E, Sahinoglu H: Streptococcal meningitis after spinal anesthesia: report of a case. Can J Anesth 2003; 50:314-315
34. Koka VK, Potti A: Spinal epidural abscess after corticosteroid injections. South Med J 2002; 95:772-774
35. Krishnakumar R1, Renjitkumar J: Methicillin-resistant staphylococcus aureus vertebral osteomyelitis following epidural catheterization: A case report and literature review. Global Spine J 2012; 2:231-234
36. Larsson BA, Lundeberg S, Olsson GL: Epidural abscess in a one-year-old boy after continuous epidural analgesia. Anesth Analg 1997; 84:1245-1247
37. Laurila JJ, Kostamovaara PA, Alahuhta S: Streptococcus salivarius meningitis after spinal anesthesia. Anesthesiology 1998; 89:1579-1580
38. Lee JJ, Parry H: Bacterial meningitis following spinal anaesthesia for Caesarean section. Br J Anaesth 1991; 66:383-386
39. Lin YC, Greco C: Epidural abscess following epidural analgesia in pediatric patients. Paediatr Anaesth 2005; 15:767-770
40. Lindner A, Warmuth-Metz M, Becker G, Toyka VV: Iatrogenic spinal epidural abscesses: early diagnosis essential for good outcome. Eur J Med Res 1997; 2:201-205
41. Lurie S, Feinstein M, Hiefetz C, Manet Y: Iatrogenic bacterial meningitis after spinal anesthesia for pain relief during labor. J Clin Anesth 1999; 11:438-439
42. Newton JA, Lesnik IK, Kennedt CA: Streptococcus salivarius meningitis following spinal anesthesia. Clin Infect Dis 1994; 18:840-841
43. Ngan Kee WD, Jones MR, Thomas P, Worth RJ: Extradural abscess complicating extradural anaesthesia for caesarean section. Br J Anaesth 1992; 69:647-652
44. Nordberg G, Mark H: Epidural abscess after epidural analgesia treated successfully with antibiotics. Acta Anaesthesiol Scand 1998; 42:727-731
45. Phillips JM, Stedeford JC, Hartsilver E, Roberts C: Epidural abscess complicating insertion of epidural catheters. Br J Anaesth 2002; 89:778-782
46. Pinczower GR, Gyorke A: Vertebral osteomyelitis as a cause of back pain after epidural anesthesia. Anesthesiology 1996; 84:215-217
47. Pinder AJ, Dresner M: Meningococcal meningitis after combined spinal-epidural analgesia. Int J Obstet Anesth 2003; 12:183-187
48. Ready LB, Helfer D: Bacterial meningitis in parturients after epidural anesthesia. Anesthesiology 1989; 71:988-990
49. Roberts SP, Petts HV: Meningitis after obstetric spinal anaesthesia. Anaesthesia 1990; 45:376-377
50. Royakkers AANM, Willigers H, Van Der Ven AJ, Wilmink J, Durieux M, Van Kleef M: Catheter-related epidural abscesses. Don't wait for neurological deficits. Acta Anaesth Scand 2002; 46:611-615
51. Sakuragi T, Yasunaka K, Hirata K, Hori K, Dan K: The source of epidural infection following epidural analgesia identified by pulsed-field gel electrophoresis. Anesthesiology 1998; 89:1254-1256
52. Sandkovsky U, Mihu MR, Adeyeye A, De Forest PM, Nosanchuk JD: Iatrogenic meningitis in an obstetric patient after combined spinal-epidural analgesia: case report and review of the literature. South Med J 2009; 102:287-290
53. Sarubbi FA, Vasquez JE: Spinal epidural abscess associated with the use of temporary epidural catheters: Report of two cases and review. Clin Infect Dis 1997; 25:1155-1158
54. Schneeberger PM, Janssen M, Voss A: Alpha-hemolytic streptococci: A major pathogen of iatrogenic meningitis following lumbar puncture. Case reports and a review of the literature. Infection 1996; 24:29-33
55. Siman-Tov T, Gadoth N: Enterococcal meningoencephalitis folowing epidural anesthesia. Isr Med Assoc J 2004; 6:780-781
56. Simpson J, Foinette KM, Lobo DN, Rowlands BJ: Spinal epidural abscess: adding insult to injury? Injury 1999; 30:504-508
57. Stallard N, Barry P: Another complication of the combined extradural-subarachnoid technique. Br J Anaesth 1995; 75:370-371
58. Thomas TA, Cooper GM: Maternal deaths from anaesthesia: an extract from Why Mothers Die 1997-1999, the confidential enquiries into maternal deaths in the United Kingdom. Br J Anaesth 2002; 89:499-508
59. Torres E, Albe D, Frank A, Diez-Tejedor E: Iatrogenic meningitis due to streptococcus salivarius following a spinal tap. Clin Invect Dis 1993; 17:525-526
60. Trautmann M, Lepper PM, Schmitz FJ: Three cases of bacterial meningitis after spinal and epidural anesthesia. Eur J Clin Microbiol Infect Dis 2002; 21:43-45
61. Wang JS, Fellows DG, Vakharia S, Rosenbaum AE, Thomas PS: Epidural abscess--early magnetic resonance imaging detection and conservative therapy. Anesth Analg 1996; 82:1069-1071
62. Watanakunakorn C: Escherichia coli meningitis and septicemia associated with an epidural catheter. Clin Infect Dis 1995; 21:713-714
63. Yaniv LG, Potasman I: Iatrogenic meningitis; an interesting role for resistant viridans streptococci? Case report and review of the last 20 years. Scand J Infect Dis 2000; 32:693-696

**Collaboration with appropriate medical specialists to determine optimal treatment.**

*Observational studies, case reports, or non-pertinent comparison groups*

1. Siddiq F, Chowfin A, Tight R, Salmoun AE, Sinego RA: Medical vs surgical management of spinal epidural abscesses. Arch Intern Med 2004; 164:2409-2412

**Percutaneous drainage of abscess.**

*Observational studies, case reports, or non-pertinent comparison groups*

1. Bengtsson M, Nettelblad H, Sjoberg F: Extradural catheter-related infections in patients with infected cutaneous wounds. Br J Anaesth 1997; 79:668-670
2. Hori K, Kano T, Fukushige T, Sano T: Successful treatment of epidural abscess with a percutaneously introduced 4-French catheter for drainage. Anesth Analg 1997; 84:1384-1386
3. Tabo E, Ohkuma Y, Kimura S, Nagaro T, Arai T: Successful percutaneous drainage of epidural abscess with epidural needle and catheter. Anesthesiology 1994; 80:1393-1395

**Surgery (with or without antibiotic therapy).**

*Observational studies, case reports, or non-pertinent comparison groups*

1. Beaudoin MG, Klein L: Epidural abscess following multiple spinal anaesthetics. Anaesth Intensive Care 1984; 12:163-164
2. Bollensen E, Menck S, Buzanoski J, Prange HW: Iatrogenic epidural spinal abscess. Clin Invest 1993; 71:780-786
3. Borum SE, McLeskey CH, Williamson JB, Harris FS, Knight AB: Epidural abscess after obstetric epidural analgesia. Anesthesiology 1995; 82:1523-1526
4. Brookman CA, Rutledge ML: Epidural abscess: case report and literature review. Reg Anesth Pain Med 2000; 25:428-431
5. Chan ST, Leung S: Spinal epidural abscess following steroid injection for sciatica. Spine 1989; 14:106-108
6. Coapes CM, Roysam GS: Vertebral osteomyelitis secondary to epidural catheter use: a case report. Spine 2001; 26:1492-1494
7. Collis RE, Harries SE: A subdural abscess and infected blood patch complicating regional analgesia for labour. Int J Obstet Anesth 2005; 14:246-251
8. Crawford JS: Pathology in the extradural space. Br J Anaesth 1975; 47:412-415
9. Cummings KC 3rd, Dolak JA: Case report: epidural abscess in a parturient with pruritic urticarial papules and plaques of pregnancy (PUPPP). Can J Anaesth 2006; 53:1010-1014
10. Dawson P, Rosenfeld JV, Murphy MA, Hellyar AG: Epidural abscess associated with postoperative epidural analgesia. Anaesth Intens Care 1991; 19:569-572
11. Dhillon AR, Russell IF: Epidural abscess in association with obstetric analgesia. Int J Obstet Anesth 1997; 6:118-121
12. Ericsson M, Algers G, Schliamser SE: Spinal epidural abscess in adults. Review and report of iatrogenic cases. Scand J Infect Dis 1990 22:249-257
13. Evans PR, Misra U: Poor outcome following epidural abscess complicating epidural analgesia for labour. Eur J Obstet Gynecol Reprod Biol 2003; 109:102-105
14. Ferguson JF, Kirsch WM: Epidural empyema following thoracic extradural block. J Neurosurg 1974; 41:762-764
15. Heller AR, Ragaller M, Koch T: Epidural abscess after epidural catheter for pain release during pancreatitis. Acta Anaesthesiol Scand 2000; 44:1024-1027
16. Hernandez JM, Coyle FP, Wright CD, Ballantyne JC: Epidural abscess after epidural anesthesia and continuous epidural analgesia in a patient with gastric lymphoma. J Clin Anesth 2003; 15:48-51
17. Hill JS, Hughes EW, Robertson PA: A Staphylococcus aureus paraspinal abscess associated with epidural analgesia in labour. Anaesthesia 2001; 56:873-878
18. Huang RC. Shapiro GS, Lim M, Sandhu HS, Lutz GE, Herzog RJ: Cervical epidural abscess after epidural steroid injection. Spine 2004; 29:E7-E9
19. Huang YY, Zuo Z, Yuan HB, Tsou MY, Chen MT, Tsai SK: A paraspinal abscess following spinal anaesthesia for caesarean section and patient-controlled epidural analgesia for postoperative pain. Int J Obstet Anesth 2005; 14:252-255
20. Ingelmo PM, Marino G, Fumagalli R: Sepsis after epidural catheterization in a child with chronic regional pain syndrome type I. Paediatr Anaesth 2005; 15:623-624
21. Jeffreys A, Horton R, Evans B: Epidural abscesses. Br J Anaesth 2006; 97:115-116
22. Knight JW, Cordingley JJ, Palazzo MG: Epidural abscess following epidural steroid and local anaesthetic injection. Anaesth 1997; 52:576-578
23. Konig H-J, Schleep J, Krahling KH: Transverse lesion of the cord after contamination of a peridural catheter. A case report. Reg Anesth 1985; 8:60-62
24. Kundra S, Singh RM, Grewal A, Gupta V, Chaudhary AK: Necrotizing fasciitis after spinal anesthesia. Acta Anaesthesiol Scand 2013; 57:257-261
25. Lehman RA, Jr., Lenke LG: Extensive epidural abscess treated with a thoracic laminoplasty. Spine J 2011; 11:798-799
26. Lindner A, Warmuth-Metz M, Becker G, Toyka VV: Iatrogenic spinal epidural abscesses: early diagnosis essential for good outcome. Eur J Med Res 1997; 2:201-205
27. Mamourian AC, Dickman CA, Drayer BP, Sonntag VKH: Spinal epidural abscess: three cases following spinal epidural injection demonstrated with magnetic resonance imaging. Anesthesiology 1993; 78:204-207
28. Meunier JF, Norwood P, Dartayet B, Dubousset AM, Ecoffey C: Skin abscess with lumbar epidural catheterization in infants: is it dangerous? Report of two cases. Anesth Analg 1997; 84:1248-1249
29. Nordström O, Sandin R: Delayed presentation of an extradural abscess in a patient with alcohol abuse. Br J Anaesth 1993; 70:368-369
30. Phillips JM, Stedeford JC, Hartsilver E, Roberts C: Epidural abscess complicating insertion of epidural catheters. Br J Anaesth 2002; 89:778-782
31. Rathmell JP, Garahan MB, Alsofrom GF: Epidural abscess following epidural analgesia. Reg Anesth Pain Med 2000; 25:79-82
32. Royakkers AANM, Willigers H, Van Der Ven AJ, Wilmink J, Durieux M, Van Kleef M: Catheter-related epidural abscesses. Don't wait for neurological deficits. Acta Anaesth Scand 2002; 46:611-615
33. Saady A: Epidural abcess complicating thoracic epidural analgesia. Anesthesiology 1976; 44:244-246
34. Sarubbi FA, Vasquez JE: Spinal epidural abscess associated with the use of temporary epidural catheters: Report of two cases and review. Clin Infect Dis 1997; 25:1155-1158
35. Schroeder TH, Krueger WA, Neeser E, Hahn U, Unertl K: Spinal epidural abscess--a rare complication after epidural analgesia for labour and delivery. Br J Anaesth 2004; 92:896-898
36. Schroter J, Wa DD, Hoffmann V, Bach A, Motsch J: Epidural abscess after combined spinal-epidural block. Can J Anaesth 1997; 44:300-344
37. Shealy CM: Dangers of spinal injections without proper diagnosis. J Am Med Assoc 1966; 197:1104-1106
38. Shintani S, Tanaka H, Irifune A, Mitoh Y, Udono H, Kaneda A, Shiigai T: Iatrogenic acute spinal epidural abscess with septic meningitis: MR findings. Clin Neurol Neurosurg 1992; 94:253-255
39. Simpson J, Foinette KM, Lobo DN, Rowlands BJ: Spinal epidural abscess: adding insult to injury? Injury 1999; 30:504-508
40. Sollmann WP, Gaab MR, Panning B: Lumbar epidural hematoma and spinal abscess following peridural anesthesia. Reg Anaesth 1987; 10:121-124
41. Sowter MC, Burgess NA, Woodsford PV, Lewis MH: Delayed presentation of an extradural abscess complicating thoracic extradural analgesia. Br J Anaesth 1992; 68:103-105
42. Strong WE: Epidural abscess associated with epidural catheterisation: a rare event? Report of two cases with markedly delayed presentation. Anesthesiology 1991; 74:943-946
43. Tay SM, Lee R: Case report: catheter-related epidural abscess. Ann Acad Med Singapore 2001; 30:62-65
44. Yamaguchi M, Kawakubo A, Ide R, Hara K, Sumikawa K: Epidural abscesses associated with epidural block in a patient with immunosuppressive disease. Masui 1999; 48:506-508
45. Yuste M, Canet J, Garcia M, Gil MA, Vidal F: An epidural abscess due to resistant Staphylococcus aureus following epidural catheterisation. Anaesthesia 1997; 52:163-165