Intrathecal Drug Delivery Device Infection

A major complication of Intrathecal Drug Delivery Device (IDDD) implantation is infection.

Morgalla et al., assessed IDD-related complications in 51 patients who had IDD systems implanted for the treatment of chronic pain or spasticity.

Twelve patients (23.5%) presented a total of 22 complications. The main type of complication was catheter-related (50%), followed by pump failure, infection, and inappropriate refilling [1].

Device-related and surgical wound infection occurred in 12 patients (3%), and nine were regarded as severe in the series of Taira et al., [2].

Risk Factors

Patients with extremely low muscle bulk, visceral pumps may be impractical or impossible, with increased risks of dehiscence and infection [3].

Periodic refills of intrathecal implanted pumps do not seem to be a risk factor for infection if standard sterile refill procedures are performed. In a study, it was clear that comorbid infections from other parts of the body do not present as a risk for device contamination [4].

Prevention

Follett et al., concluded from the available data that the most effective antiinfection measures consist of adherence to published guidelines and recommendations that apply to surgical site infections (SSIs) in general [5].

The use of vancomycin powder in patients with implants in the series of is series of Ghobrial et al., did not reduce infection rates compared to published historical controls, and was elevated compared to institutional controls [6].

The combination of local neomycin/polymyxin with systemic antibiotic therapy can lead to a significantly lower rate of postoperative infection than when systemic antibiotics are used alone [7].

The subfascial implantation technique was associated with a reduced rate of local wound and pump infections and provided optimal cosmetic results as compared with that observed in retrospective cases [8].

Treatment

The current standard of care in the treatment of IDDD infection necessitates that the pump be explanted and the infection treated prior to implantation of a new IDDD. This process leads to long hospital stays, interruptions in optimal medical management, and a high risk for dangerous drug withdrawals.

Infections can be treated with repetitive local application of gentamicin-impregnated collagen fleece [9].

Leibold et al., describe a technique that allows for the explantation of the infected pump and implantation of a new pump concurrently, which they have named the “Turner Switch” technique in honor of its inventor.

The authors conducted a retrospective analysis of cases of infected IDDDs in which patients underwent simultaneous explantation of the infected pump and implantation of a new pump. Demographics and clinical data were collected.

Data from a total of 17 patients (11 male, 6 female) who underwent simultaneous IDDD explantation and implantation to treat infections were analyzed from a 3-year period. No patients experienced infection of the newly implanted pump or catheter. Of the 17 patients, 14 (82.4%) had baclofen pumps to treat spasticity and 3 (17.6%) had fentanyl pumps to treat chronic pain. The median hospital stay was 7 days, with 16 of 17 (94.1%) patients able to be discharged home or to a facility with a level of care similar to their preoperative care. All patients ultimately experienced complete resolution of their initial infections. Five patients (29.4%) required a return to the operating room within the next 5 months (for repair of a CSF leak in 2 cases, for treatment of infection at the old pump site in 2 cases, and for treatment of a CSF leak compounded with infection in 1 case). No patient experienced infection of the newly implanted pump or catheter.

IDDD infections represent a large portion of morbidity associated with these devices. The current standard of care for deep pump infections requires pump explantation and a course of antibiotics prior to reimplantation of the IDDD. The authors demonstrate the effectiveness of a procedure involving simultaneous explantation of an infected pump and implantation of a new pump on the contralateral side in the treatment of IDDD infections [10].

Ingale et al., suggested that consideration should be given to selective dorsal rhizotomy (SDR) as an alternative in patients previously implanted with Intrathecal Drug Delivery systems complicated by infection or nearing end of battery life [11].

Case reports

A patient with pump-site infection and Escherichia coli meningitis secondary to transcolonic perforation of an intrathecal baclofen pump catheter. While this is rare, we review the intraoperative precautions and best practices that should be taken to prevent and manage this unusual complication [12].

Intrathecal drug delivery device infection with Mycobacterium fortuitum was not been reported previously. Aliabadi et al., reported a case of an implanted baclofen pump infection and associated mycobacterium meningitis due to Mycobacterium fortuitum. The entire pump system was removed and the patient was treated successfully with a prolonged regimen of antibiotics [13].

In a case neurological complaints were pain and dysaesthesiae in the lower back and thigh, as well as paresis of the ileopsoas muscle. MRI of the lumbar spine showed an intradural-extramedullary mass at the level of L1 homogeneously enhancing with gadolinium. This mass was situated at the tip of an intrathecal catheter implanted 11 years before for a morphine trial infusion as therapy for phantom pain after amputation of the right arm. Now, removal of the catheter was performed. Cultures of lumbar CSF and the catheter tip demonstrated coagulase negative staphylococcus. Antibiotic medication with cephalosporines was given for 6 weeks. After removal of the catheter, the patient was free of pain and he progressively regained full neurological function. Although most catheter-associated granulomas reported so far were sterile in nature, bacterial infection should still be considered even years after catheter placement [14].

A patient who experienced a prolonged course of intrathecal baclofen withdrawal syndrome after removal of an implantable baclofen pump for treatment of pump infection and meningitis. The current literature outlines management options for the acute management of this syndrome. In this report the authors discuss the long-term presentation of this syndrome and suggest a treatment strategy for management of the syndrome. A 37-year-old man who presented with a baclofen pump infection and meningitis experienced acute onset of intrathecal baclofen withdrawal syndrome 12 hours after the pump had been surgically removed. The patient's symptoms evolved into a severe, treatment-refractory withdrawal syndrome lasting longer than 1 month. Oral baclofen replacement with

adjunctive administration of parenteral gamma-aminobutyric acid agonists only served to stabilize the patient's critical condition throughout his hospital course. Replacement of the baclofen pump and restoration of intrathecal delivery of the medication was necessary to trigger the patient's dramatic recovery and complete reversal of the withdrawal syndrome within approximately 48 hours. These findings indicate that a more direct method of treating infected baclofen pumps than immediate surgical removal is necessary to prevent the onset of intrathecal baclofen withdrawal syndrome. Various options for preventing the onset of the syndrome while simultaneously treating the infection are discussed [15].

References

1)

Morgalla M, Fortunato M, Azam A, Tatagiba M, Lepski G. High-Resolution Three-Dimensional Computed Tomography for Assessing Complications Related to Intrathecal Drug Delivery. Pain Physician. 2016 Jul;19(5):E775-80. PubMed PMID: 27389121.

2)

Taira T, Ueta T, Katayama Y, Kimizuka M, Nemoto A, Mizusawa H, Liu M, Koito M, Hiro Y, Tanabe H. Rate of complications among the recipients of intrathecal baclofen pump in Japan: a multicenter study. Neuromodulation. 2013 May-Jun;16(3):266-72; discussion 272. doi: 10.1111/ner.12010. Epub 2012 Dec 14. PubMed PMID: 23240625.

3)

Waqar M, Ellenbogen JR, Kumar R, Sneade C, Zebian B, Williams D, Pettorini BL. Indwelling intrathecal catheter with subcutaneous abdominal reservoir: a viable baclofen delivery system in severely cachectic patients. J Neurosurg Pediatr. 2014 Oct;14(4):409-13. doi: 10.3171/2014.6.PEDS13686. Epub 2014 Aug 1. PubMed PMID: 25084089.

4)

Dario A, Scamoni C, Picano M, Fortini G, Cuffari S, Tomei G. The infection risk of intrathecal drug infusion pumps after multiple refill procedures. Neuromodulation. 2005 Jan;8(1):36-9. doi: 10.1111/j.1094-7159.2005.05218.x. PubMed PMID: 22151381.

5)

Follett KA, Boortz-Marx RL, Drake JM, DuPen S, Schneider SJ, Turner MS, Coffey RJ. Prevention and management of intrathecal drug delivery and spinal cord stimulation system infections. Anesthesiology. 2004 Jun;100(6):1582-94. Review. PubMed PMID: 15166581.

6)

Ghobrial GM, Thakkar V, Singhal S, Oppenlander ME, Maulucci CM, Harrop JS, Jallo J, Prasad S, Saulino M, Sharan AD. Efficacy of intraoperative vancomycin powder use in intrathecal baclofen pump implantation procedures: single institutional series in a high risk population. J Clin Neurosci. 2014 Oct;21(10):1786-9. doi: 10.1016/j.jocn.2014.04.007. Epub 2014 Jun 14. PubMed PMID: 24938386.

7)

Miller JP, Acar F, Burchiel KJ. Significant reduction in stereotactic and functional neurosurgical hardware infection after local neomycin/polymyxin application. J Neurosurg. 2009 Feb;110(2):247-50. PubMed PMID: 19263587.

8)

Kopell BH, Sala D, Doyle WK, Feldman DS, Wisoff JH, Weiner HL. Subfascial implantation of intrathecal baclofen pumps in children: technical note. Neurosurgery. 2001 Sep;49(3):753-6; discussion 756-7. PubMed PMID: 11523691.

9)

Peerdeman SM, de Groot V, Feller RE. In situ treatment of an infected intrathecal baclofen pump implant with gentamicin-impregnated collagen fleece. J Neurosurg. 2010 Jun;112(6):1308-10. doi: 10.3171/2009.8.JNS081692. PubMed PMID: 19731988.

10)
Leibold AT, Weyhenmeyer J, Lee A. Simultaneous explantation and implantation of intrathecal pumps: a case series. J Neurosurg. 2019 Apr 12:1-7. doi: 10.3171/2019.1.JNS18919. [Epub ahead of print] PubMed PMID: 30978693.
11)
Ingale H, Ughratdar I, Muquit S, Moussa AA, Vloeberghs MH. Selective dorsal rhizotomy as an alternative to intrathecal baclofen pump replacement in GMFCS grades 4 and 5 children. Childs Nerv Syst. 2016 Feb;32(2):321-5. doi: 10.1007/s00381-015-2950-9. Epub 2015 Nov 9. PubMed PMID: 26552383.
12)
Devine OP, Harborne AC, Lo WB, Price R. Colonic perforation by an intrathecal baclofen pump catheter causing delayed Escherichia coli meningitis. BMJ Case Rep. 2017 Dec 20;2017. pii: bcr-2017-222539. doi: 10.1136/bcr-2017-222539. PubMed PMID: 29269368.
13)
Aliabadi H, Osenbach RK. Intrathecal Drug Delivery Device Infection and Meningitis due to Mycobacterium Fortuitum: A Case Report. Neuromodulation. 2008 Oct;11(4):311-4. do 10: i: 10.1111/j.1525-1403.2008.00181.x. PubMed PMID: 22151146.
14)
Lehmberg J, Scheiwe C, Spreer J, van Velthoven V. Late bacterial granuloma at an intrathecal drug delivery catheter. Acta Neurochir (Wien). 2006 Aug;148(8):899-901; discussion 901. Epub 2006 Jun 23. PubMed PMID: 16791432.
15)
Douglas AF, Weiner HL, Schwartz DR. Prolonged intrathecal baclofen withdrawal syndrome. Case report and discussion of current therapeutic management. J Neurosurg. 2005 Jun;102(6):1133-6. Review. PubMed PMID: 16028775.