Successful treatment of methicillin-resistant *Staphylococcus aureus* meningitis using linezolid without removal of intrathecal infusion pump

Case report

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Infection of an intrathecal pump system is a rare but serious complication and usually leads to the removal of the pump. The authors report the first case of methicillin-resistant *Staphylococcus aureus* (MRSA) meningitis in a patient with such a pump successfully treated with linezolid without the need for removal of the intrathecal pump. A 77-year-old woman with cervical myelopathy underwent implantation of an intrathecal pump system for baclofen administration. Two weeks after the procedure she developed meningitis caused by MRSA as isolated in cerebrospinal fluid (CSF) cultures, blood samples, and serum obtained from the pump pouch. Clinically she presented with meningism, somnolence, and signs of sepsis. When a combined intravenous antibiotic treatment regimen of vancomycin and rifampicin resulted in no clinical improvement, that regimen was discontinued and linezolid was administered intravenously as monotherapy. Within 3 days clinical and laboratory findings showed significant improvement. After 1 week of linezolid treatment, blood and CSF cultures were sterile. Intravenous treatment was administered for a total of 3 weeks, after which the patient was treated with oral linezolid for 3 months. During 18 months of follow-up, no new clinical or laboratory signs of infection were observed. These results confirm previous reports of the efficacy of linezolid for the treatment of severe infections of the central nervous system caused by multidrug-resistant Gram-positive bacteria, especially postneurosurgical infections. (DOI: 10.3171/JNS-07/09/0651)

**Key Words** • intrathecal infusion pump • linezolid • meningitis • methicillin-resistant *Staphylococcus aureus*

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**Intrathecal** administration of antispastic or analgesic medication via an implantable intrathecal pump system is being increasingly used for the treatment of severe spasticity. Infection of the system is a rare but serious complication. The considered treatment of choice is the removal of the pump system and the intravenous administration of antibiotic agents, such as vancomycin or teicoplanin. Regarding the published literature to date, this is the first reported case of a successful treatment of MRSA meningitis with linezolid without removal of the intrathecal infusion pump system.

**Case Report**

**History and Presentation.** This 77-year-old woman was admitted to our hospital with a 2-day history of fever and increasing somnolence. Two weeks previously she had undergone implantation of an intrathecal infusion pump system, which continuously delivered baclofen (250 µg/day) for treatment of severe spasticity due to cervical myelopathy. Previous antispastic treatment had not been successful. She also had diabetes mellitus, but was not known to have any other disorder.

**Examination.** Physical examination revealed fever up to 39.9°C and strong nuchal rigidity. A chest X-ray demonstrated no abnormality, and the results of urinalysis were normal. Analysis of a blood sample demonstrated a WBC...
count of 18.3 cells/ml with 87% neutrophils and an elevated C-reactive protein level of 14.62 mg/dl. A specimen of CSF obtained by lumbar puncture contained 703 cells/μl with 81% neutrophils; protein content (1.02 g/L) and glucose concentration (0.51 g/L) were both elevated. Gram staining revealed Gram-positive cocci in clusters. Empirical intravenous antibiotic treatment was started with vancomycin (1 g/12 hr) in combination with rifampicin (600 mg/12 hr). Cultures of CSF, blood, and serum taken from the pump pouch demonstrated a Staphylococcus aureus isolate resistant to oxacillin and almost all of the other tested antibiotics (MRSA). The isolates were only susceptible to vancomycin, teicoplanin, and linezolid.

Treatment and Posttreatment Course. Intrathecal pump and catheter removal was discussed with the patient’s family. We decided to continue the antibiotic treatment and not to remove the pump system.

After 72 hours of treatment with vancomycin and rifampicin no clinical improvement could be observed. The laboratory findings improved slightly (WBC count 14.5 cells/ml, C-reactive protein 12.5 mg/dl), but still indicated infection. We discontinued the antibiotic treatment and switched to the intravenous administration of linezolid (600 mg/12 hr) as monotherapy. Within 3 days the patient’s temperature decreased to 37.0°C. Cultures of blood, CSF, and serum taken from the pump pocket after 1 week of treatment with linezolid were sterile. Examination of CSF revealed 8 cells/μl with 60% lymphocytes, protein levels of 0.51 g/L, a glucose concentration of 0.65 g/L, a normal WBC count of 9.3 cells/ml, and a C-reactive protein level of 0.8 mg/dl (Fig. 1). Intravenous treatment was continued for a total of 3 weeks, after which the patient was treated with orally administered linezolid (600 mg/12 hr) for 3 more months. The patient developed a mild reversible thrombocytopenia (120,000 cells/ml), which is a known side-effect of the treatment, but no severe adverse events occurred. Of particular importance, no signs of optical or peripheral neuropathy could be observed.

The patient has been continuously followed up (18 months as of this writing) without any clinical or laboratory signs of infection. The intrathecal pump system is working well and baclofen treatment is resulting in a marked reduction in spasticity.

Discussion

Intrathecal infusion pump systems are implanted to treat spasticity and/or pain caused by CNS or spinal lesions (for example, cervical myelopathy or multiple sclerosis). The major complication of intrathecal infusion pump systems, after dislocation and malfunction of the system, is infection. Intracranial or intrathecal prosthetic device infections may be caused by coagulase-negative staphylococci, for example, S. epidermidis. Other frequently isolated agents are Gram-positive bacteria such as S. aureus, with a growing incidence of infections due to multidrug resistant S. aureus. The treatment of choice is generally considered to be the removal of the infected system (pump and catheter) and the intravenous administration of an organism-specific antibiotic agent appropriate for that route of delivery. Gram-positive CNS infections are usually treated with penicillinase-resistant antibiotic agents such as oxacillin or a combination of vancomycin and rifampicin. Because of the increasing incidence of multidrug-resistant infections, such as MRSA or vancomycin-resistant Enterococcus faecium, especially after neurosurgical treatment, there is a need for potent treatment alternatives such as linezolid (Zyvox or Zyvoxid, Pfizer).

Linezolid, an oxazolidinone, has bacteriostatic properties against Gram-positive bacteria and overcomes even multi-

![Line graph showing our patient’s response to treatment.](image-url)
Linezolid-treatment of MRSA meningitis

resistant bacteria. Reports on resistance to linezolid are rare and no cross-resistance to other classes of antibiotics has been reported so far. Another advantage of this agent, in addition to a bioavailability of 100%, is its excellent penetration across the blood–brain barrier. The CSF levels of linezolid reach up to 70% of the serum levels, whereas CSF levels of vancomycin, for example, reach only approximately 20% of the serum levels. The marked improvement of our patient during linezolid therapy is in line with previous reports of successful treatment of severe CNS infections. Especially in patients who develop CNS infections subsequent to neurosurgical treatment, such as implantation of a shunt system, linezolid has proved to be an effective alternative to common empirical treatment. The long-term follow-up in our case (18 months at the time of this writing) provides further evidence for the efficacy of this treatment.

Conclusions

To our knowledge this is the first report of a complete reconstitution of MRSA-caused meningitis treated with linezolid as monotherapy without removal of an implanted intrathecal pump system.

These results confirm the results of previous studies of the efficacy of linezolid as treatment in severe CNS infections caused by multidrug-resistant Gram-positive bacteria. Further studies are needed to verify the antibiotic properties of linezolid as treatment of CNS infections in patients with an implanted intrathecal pump or shunt systems.

References


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