Intrathecal Bupivacaine-Induced Chemical Arachnoiditis

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**Introduction**

Bupivacaine hydrochloride is a local anesthetic that has been used clinically since 1970s. In more recent years bupivacaine has been used via intrathecal delivery alone or in combination with opioids for improved pain management. Adverse reactions of intrathecal administration include paralysis, paresthesia, gut impairment, urinary retention, anal sphincter dysfunction, and arachnoiditis.[1] Despite these rare adverse reactions, intrathecal bupivacaine appears to be safe and efficacious in the treatment of both cancer and noncancer pain according to a MEDLINE literature review performed by Doott et al in 2002 which analyzed intrathecal bupivacaine's safety, adverse reactions, toxicology, and bacteriology.[2] This is a presentation of a rare case of presumed intrathecal bupivacaine induced chemical arachnoiditis.

**Case Report**

A 60 year old male with past medical history of chronic lumbar back pain with metastatic radiation, multilevel degenerative spine disease, C5-T1 decompression, L4-L5 decompression, two non-therapeutic spinal cord stimulator placements, and intrathecal pump placement, presented to the emergency room for acute onset of bilateral lower extremity weakness and recurrent falls. Proceeding this event, the patient's pain had worsened in his bilateral lower extremities. He was unable to tolerate an increased dose of morphine due to constipation. Therefore, his intrathecal morphine dose was lowered and bupivacaine was added. This was followed by 3 weeks of flanks/rear symptoms which progressed to decreased bowel movement, lower extremity muscle spasm, urinary retention, constipation, and decreased sensation below the waist and lower extremity weakness resulting in an inability to stand.

**Diagnosis**

Routine serum lab at presentation were normal. CSF analysis revealed increased cell count, increased total protein, and decreased glucose (see Table 1). Infectious, malignag and rheumatologic work-up were negative. His previous non-therapeutic spinal cord stimulators were removed in order to perform an MRI of the spine. The MRI of the spine pictured in figure 1-4 showed dural thickening at T8-T9, diffuse linear leptomeningeal enhancement from T7-T12, sacral multileido and cauda equina consistent with arachnoiditis. The patient was diagnosed with bupivacaine induced spinal arachnoiditis.

**Treatment**

His intrathecal morphine and bupivacaine pump was turned off, and a morphine PCA was started for pain management. He was then started on high dose predonol and developed some functional return in his bilateral lower extremities. He was placed on a predonol taper and his intrathecal pump was restarted with morphine alone. He reported some transient weakness when the intrathecal catheter was flushed, and within 5 days he began developed persistent paralysis in his lower extremities. After receiving IV somnambum, his symptoms did not improve. The sudden return of symptoms was thought to be secondary to residual bupivacaine in the intrathecal catheter, at which point it was decided to replace the intrathecal system and refill the pump with morphine alone.

**Outcome**

Over the next 2 months, the patient's neurologic function stabilized at T10 AS and incomplete paraplegia with voluntary anal control and intact anal sensation. At time of discharge from inpatient rehabilitation, he was functionally independent with performing bowel and bladder programs, transfers using a slide board, and mobility using a manual wheelchair.

**Similar Case Reports**

Kato et al reported a 79 year male who received 0.5% hyperbaric bupivacaine spinal anesthesia and ropivacaine epidural anesthesia prior to surgical removal of a skin tumore that resulted in cauda equina syndrome which resolved after 10 months. Pelaez et al reported a 47 year old woman who received hyperbaric bupivacaine prior to hysterectomy resulting in gaital and lower limb pain and paraparesis which resolved in the peroperaive period.[3] Lopez-Suarna et al reported a 68 year old male who received subarachnoid anesthesia with bupivacaine and fentanyl prior to a hip surgery who developed unilateral cauda equina syndrome with permanent disability. The CSF pattern of increased cell count, increased protein, decreased glucose and negative CSF infections is similar to CSF results in reported cases of bupivacaine induced chemical arachnoiditis, as depicted in Table 1, possibly due to similar inflammatory response.

**Neurohistological Studies**

Histologic studies performed in canine models after receiving continuous intrathecal bupivacaine showed mononuclear inflammation of the leptomeninges in both the intrathecal bupivacaine and control groups. Three clinical studies performed in cancer patients with intrathecal opioid-induction for a period of 30-90 days showed lamellar fibrosis, and mononuclear cell inflammation thought to be related to the presence of an intrathecal catheter alone and not drug-induced. Wageman and colleagues studied the neurophathological findings of 16 cancer patients following intrathecal administration of morphine and bupivacaine for a mean of 58 days and found one patient to have had small aggregates of lymphocytes in the leptomeninges and cord parenchyma.[4]

**Conclusions and Limitations**

Intrathecal bupivacaine solutions can be prepared with preservatives such as methyldihydroxy. In addition, the preparation of intrathecal bupivacaine is not standardized between pharmacies and may have contributed to the patient's outcome. Currently morphine infusions is the only agent approved by the U.S Food and Drug Administration for intrathecal administration for the treatment of chronic pain. The patient appeared to have a direct correlation of worsening symptoms with administration of intrathecal bupivacaine, which did occur when morphine was given alone. Therefore, the implication of morphine alone or its compatibility with bupivacaine as the etiology of the arachnoiditis was not discussed during this report. Also, it is possible the spinal arachnoiditis was caused by repeated lumbar punctures and intrathecal catheter placement. However, exacerbation of symptoms with repeated exposure to intrathecal bupivacaine argues against this. This case report was also limited by review of outside hospital records as the patient did receive treatment at multiple institutions. In conclusion, although rare, bupivacaine induced chemical arachnoiditis may occur with intrathecal bupivacaine. Prompt diagnosis and cessation of intrathecal bupivacaine seems prudent. Further studies of long-term use of intrathecal bupivacaine are needed to characterize the adverse effects, toxicity, neurotoxicology, CSF analysis, and compatibility with other agents.

**References**