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CASE REPORT

Case Report: Portable X-Ray Guided Blood Patch in Treating Post Dural Puncture Headache Status Post Intrathecal Pump Placement

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Abstract: Post dural puncture headache (PDPH) is common after placement of an intrathecal pump (ITP). Treatment of refractory PDPH requires an epidural blood patch (EBP) with fluoroscopic guidance to avoid damaging the intrathecal catheter. However, when patients' symptoms are severe and advanced imaging resources are unavailable, a safe and effective alternative would need to be explored. Here, we describe a successful application of portable X-ray in guiding EBP in the post-anesthesia care unit (PACU) to treat a patient with refractory and debilitating PDPH status post ITP placement. This approach afforded us the advantage of portability as well as real-time imaging guidance in a resource limited setting. The patient's PDPH resolved after the procedure and remained headache-free two months later at follow up with a functioning ITP in place.

Keywords: lumbar epidural, intrathecal catheter, fluoroscopic guidance, post-anesthesia care unit, PACU

Introduction

To control severe cancer pain or spasticity, the intrathecal pump (ITP) is surgically implanted in the abdominal wall, with the intrathecal catheter (ITC) threaded subcutaneously into the intrathecal space.[1] The incidence of post dural puncture headache (PDPH) after ITP placement ranges from 23–33%.[2,3] While most patients recover with symptomatic management such as bed rest, hydration, and analgesia, the epidural blood patch (EBP) has been the gold standard in treating refractory PDPH, with a success rate upwards of 85–90%.[4] Other methods, such as the use of fibrin glue and DuraSeal for the treatment and prevention of PDPH, have also been described.[5–7] Due to the existence of ITC along the spinal column, the placement of EBP requires careful planning and execution to avoid damaging the catheter. Thus, fluoroscopic guidance and interventional radiology (IR) suite are often warranted.[8,9] However, these assets may not always be readily available in urgent or emergent scenario, or in facilities with limited access to advanced imaging resources. Here, we describe a successful case of portable X-ray guided blood patch therapy in the post-anesthesia care unit (PACU) for a patient status post (s/p) ITP placement complicated by debilitating and refractory PDPH as a proof-of-concept alternative to fluoroscopic guidance.

Case Report

Introduction

This is a 54-year-old male with hereditary spastic paraplegia s/p elective baclofen ITP (Medtronic SynchroMed III, MRI compatible, radiopaque) placement by the neurosurgery team. The pump was placed in the left abdominal wall with catheter entry at L2–L3 verified by X-ray (Figure 1). To reduce the risk of PDPH, 10 mL of DuraSeal was injected into the epidural space slightly below the level of catheter entry. The procedure was uncomplicated, and he was admitted to inpatient unit to work with physical and occupational therapy given his medical history. On postoperative day (POD) 3,

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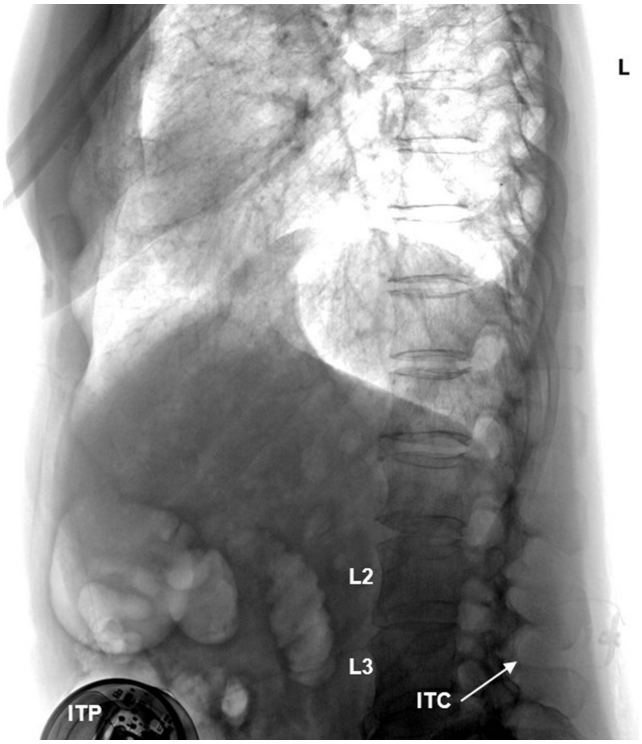

Figure 1 Lateral view of lumbar spine X-ray showing location of ITP with the radiopaque ITC entering the intrathecal space at L2–L3. Arrow indicates the site of ITC entry into the intrathecal space.

the patient developed a headache. On POD 4, the headache became positional and consistent with PDPH, for which intravenous fluid, caffeine, Tylenol, and NSAIDs were initiated. Head and spine CT at that time showed proper positioning of the ITC, with entry at L2–L3 (Figure 2a). The patient felt that his headache was tolerable and thus discharged on POD 5 with recommendations to continue conservative medical management. However, the patient's PDPH became debilitating enough to keep him immobile over the following week, and he presented to the emergency department on POD 11, where he rated his headache 10/10 pain when upright and 1/10 when lying flat. Given his symptoms, he was admitted to neurosurgery service for further workup, which included CT of the head, abdomen, and pelvis, XR pump series, and MRI of the lumbar spine with specific cerebral spinal fluid (CSF) leak sequences. Magnetic resonance imaging (MRI) of spine demonstrated signs of CSF leak with right posterolateral epidural collection at L1–L2 (Figure 2b and c). The remainder of imaging was unremarkable without disruption of the device, hardware malfunction, or any intracranial abnormalities. The decision was initially made to perform an urgent EBP for PDPH via fluoroscopic guidance with IR given the presence of an ITC as per standard protocol. Unfortunately, due to the radiology case volume and proceduralist availability, the patient could not be scheduled for at least another week. In consideration of the urgent nature of this therapy and the need for earlier rehabilitation with his new ITP, an alternative EBP using a portable X-ray machine in the PACU with the combined effort of neurosurgery and anesthesiology teams was discussed. The risks, benefits, alternatives, and procedural details were discussed with the patient by the neurosurgery team. Patient agreed to proceed, and consent was obtained via written informed consent and uploaded onto the patient's medical record prior to setting up for the procedure.

Procedural Preparation and Setup

To perform bedside EBP with portable X-ray, we chose a specially designed PACU suite used for either minimally invasive procedures, such as bronchoscopy, or for accommodating patients with isolation protocols, at the authors' hospital. This room is more spacious and well equipped with standard monitors to allow intensive nursing care and monitoring anesthesia care. It has sliding doors and is further away from the standard PACU rooms. Apart from the

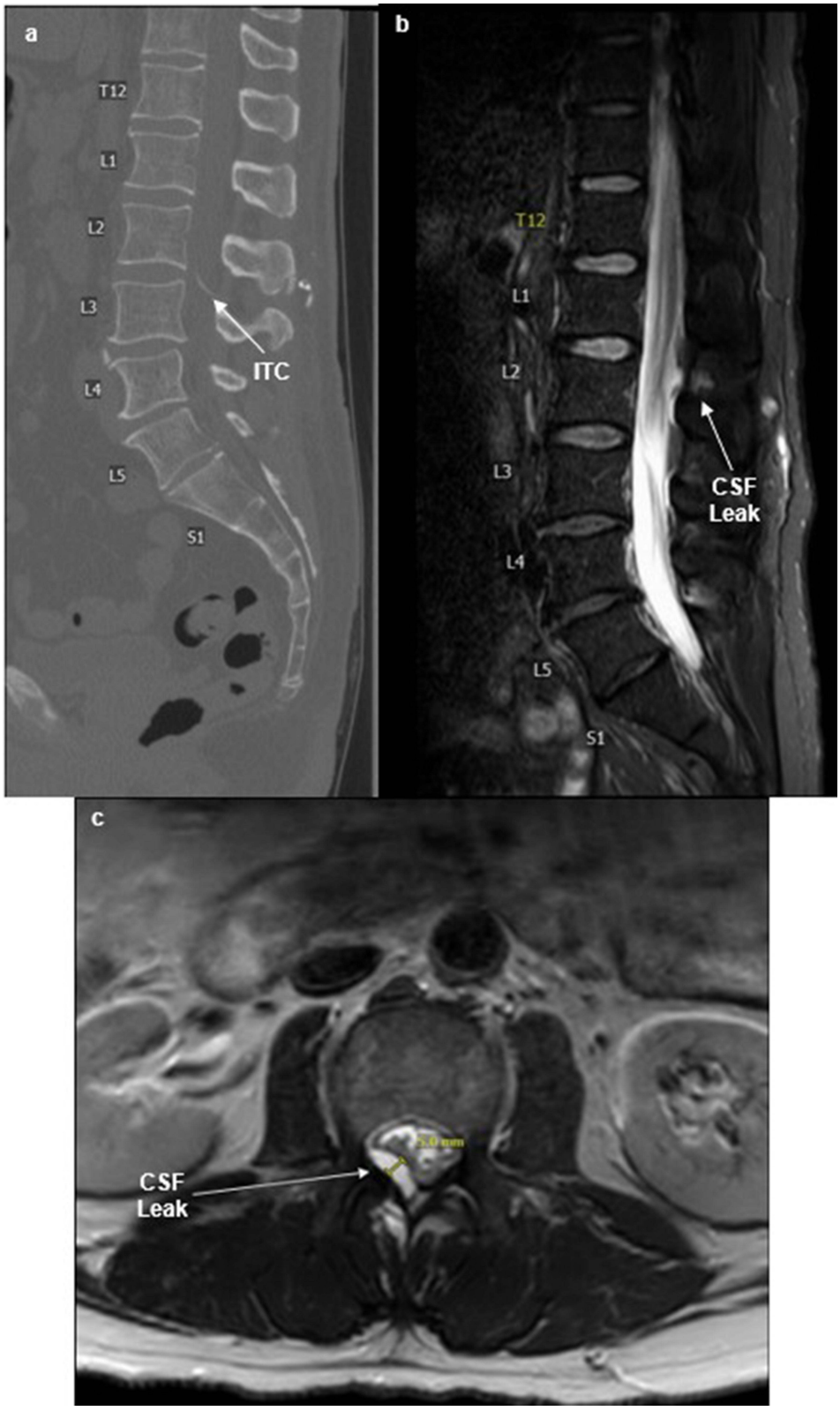

Figure 2 Midline sagittal CT of lumbar spine showing the entry at L2–L3 and the projection of ITC toward the anterior portion of the intrathecal space indicated by arrow in panel (**a**), midline sagittal MRI of lumbar spine identifying CSF collection in the posterior epidural space at L1–L2 level indicated by arrow in panel (**b**), and axial view of MRI at L1–L2 level demonstrating a 5 mm fluid pocket suspicious for CSF leak on the right side of the posterior epidural space indicated by arrow in panel (**c**).

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patient, there was one neurosurgery team member, one anesthesiology team member, one PACU nursing team member, and one radiology team member. In terms of personal protection, team members either left the room when X-rays were taken or wore a lead apron and stayed in the room during the procedure. The basic setup is shown in Figure 3, where the layouts of the equipment, monitors, and personnel are recreated.

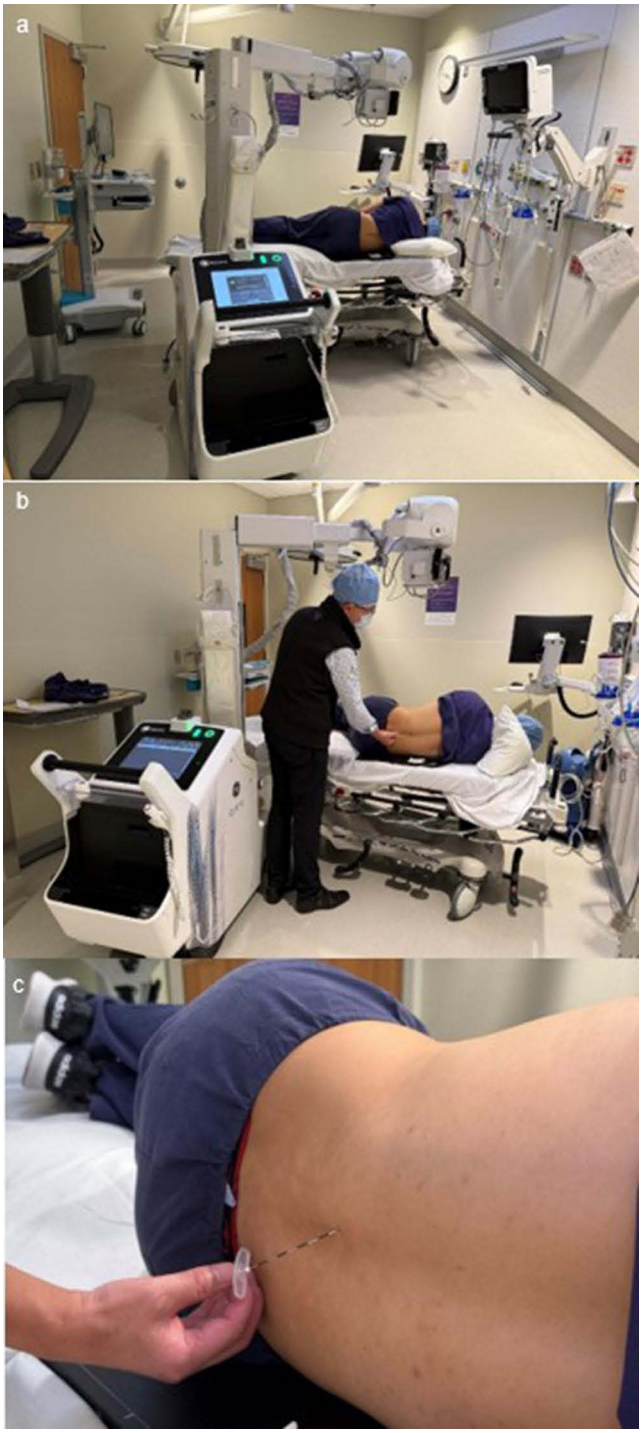

Figure 3 Recreated room set up in PACU for EBP. The patient is laying in the right lateral decubitus position with a portable X-ray machine at bedside along with standard monitors (**a**). Proceduralist standing at the bedside and holding the Tuohy needle in hand (**b**). The Tuohy needle is moving along the spinous processes to locate the targeted level at L1–L2 under lateral films (**c**), a loss-of-resistance technique was used to find the epidural space for the remainder of the procedure.

Epidural Blood Patch Therapy

The patient was transported to the PACU and placed in the right lateral decubitus position on a regular stretcher. The lumbar spine was maintained in neutral position with a pillow support. The X-ray board was placed on the stretcher just below the lumbar spine (Figure 3) and the field of X-ray exposure was limited to the area of interest. The targeted lumbar area was prepared in a sterile fashion. The operator wore X-ray protection gear. The target interspinous L1–L2 space (level of CSF collection on MRI) and ITC were both identified under the lateral view using a single shot of a portable X-ray machine (GE Optima), while the tip of the epidural needle was placed on the back of the patient (Figure 4). Local anesthesia was provided by infiltration with 2.5 mL of 1% lidocaine. An 18-gauge 3.5-inch Tuohy needle followed the midline approach and was incrementally advanced parallel to the floor under the lateral view. A loss of resistance (LOR) syringe filled with saline was attached when the needle tip was just posterior to the facet line. Intermittent LOR technique was used to identify the lumbar epidural space. Once LOR was detected, the aspiration of the syringe was negative for blood or cerebrospinal fluid. Subsequently, sterilely drawn autologous venous blood from a sterilely placed 18 gauge IV was injected slowly via tubing connected to the Tuohy needle into the epidural space in aliquots of 5 mL with negative aspiration prior to each injection. After a total of 20 mL of blood was injected, 4 mL of fibrin glue was injected prior to withdrawing the Tuohy needle. The patient was allowed to resume supine position and was instructed to lay flat for the next two hours before resuming head-up activity.

Procedural Outcome

The EBP provided the patient with immediate symptomatic relief from PDPH. The patient was discharged the next day with complete resolution of the headache. We were able to follow-up with the patient two months after and confirmed that he had remained headache-free while maintaining a functioning ITP for his muscle spasticity.

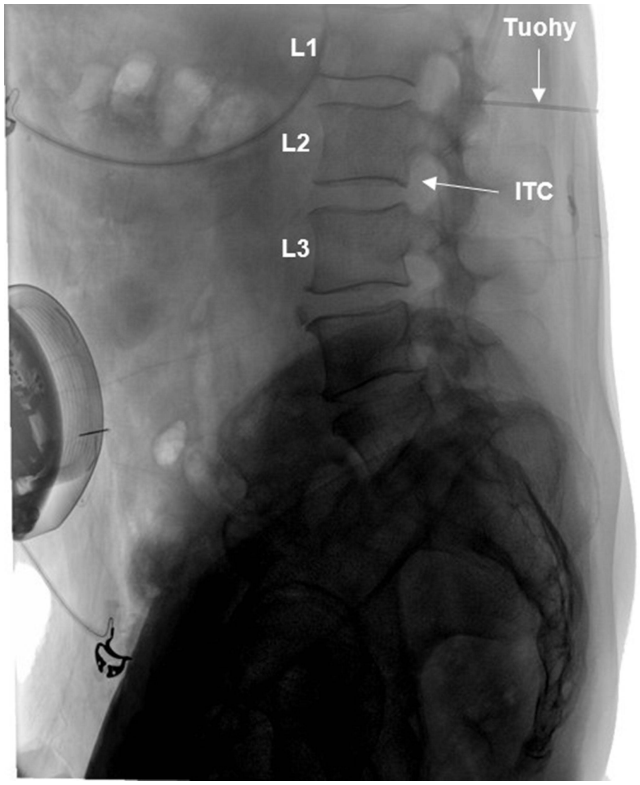

Figure 4 Lateral view of portable X-ray machine demonstrated the Tuohy needle entering the epidural space at L1–L2 level above ITC. The locations of the Tuohy needle and ITC are indicated with arrows respectively.

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Discussion

In need of urgent EBP therapy in treating refractory and debilitating PDPH s/p ITP placement, fluoroscopic guidance to ensure both safe and accurate epidural access and to avoid damaging the existing ITC is paramount. Under fluoroscopic guidance, the ITC was radiopaque, which would allow us to ensure that the trajectory of the Tuohy needle did not transect its path. Additionally, the intended level of epidural space can be accurately identified and accessed. Therefore, fluoroscopic-guided EBP is warranted in this scenario. However, when fluoroscopic guidance and IR suites are unavailable in urgent or emergent scenarios, an alternative setup should be explored. Here, we presented a combined team effort of both neurosurgery and anesthesiology teams to successfully perform EBP therapy in the PACU using a portable X-ray machine that allows only one view of the lumbar spine. A portable X-ray machine with digital imaging function integrated into one unit can be conveniently transported to any space within the hospital. The PACU is a commonly used space for minimally invasive procedures and is equipped with standard monitors to allow intensive nursing care and monitoring anesthesia care. This novel approach allowed us to circumvent logistical challenges of scheduling IR suites with fluoroscopic guidance in such scenarios. Furthermore, this case serves as an example of adaptability in anesthesiology daily practice in overcoming similar logistical difficulties while providing safe patient care with excellent outcomes.

Although the described portable X-ray guidance in PACU is safe and effective in providing EBP therapy in patients with hardware or ITC in place, there are limitations compared to the traditional IR fluoroscopic guidance. Portable X-ray machines do not have the ability to perform live fluoroscopy when the pattern of contrast spread needs to be observed. It only allows one view (lateral or anterior-posterior) of the lumbar spine for guidance, rather than multiple views of Tuohy needle placement. Furthermore, this approach requires close collaboration among the multiple teams including neurosurgery, anesthesiology, PACU nurse and radiology team members working in a remote area other than IR suite. Most importantly, this approach demands an experienced proceduralist who is adept in both interpreting X-ray images of lumbar spine as well as performing blood patch therapy. Thus, it is prudent to promote the applicability of this approach only in certain clinical scenarios. Another potentially portable alternative imaging guidance for placing EBP is ultrasound (US) guidance.[10] However, it is unclear that US guidance would provide clear advantages in accurate identification of the ITC pathway and the targeted interlaminar space, especially in patients with higher BMI or complex spine anatomy. As a result, the use of portable X-ray provided a balanced technical and logistical tradeoff for placing urgent EBP for our patient.

The routine use of fibrin glue has been reported in different cases for preventing or treating CSF leak, and in cases where the use of autologous blood may be inappropriate.[11–13] The use of fibrin glue is safe and there is no strong evidence to suggest increased risk for the patient.[14] Therefore, fibrin glue was injected as part of the EBP process in addition to autologous blood to reduce the risk of further CSF leak, which has been a standard at the authors' institution.

Conclusion

Our case demonstrated the successful application of portable X-ray machine in guiding EBP therapy in the PACU to treat a patient with refractory and debilitating PDPH s/p ITP placement. The portable X-ray machine afforded us both the advantage of portability as well as real-time imaging guidance. It is a proof-of-concept alternative to fluoroscopic guidance in facilities with limited access to advanced imaging resources, or in an urgent or emergent scenario when advanced imaging is not available, particularly in the face of global healthcare challenges.

Disclosure

The authors report no conflict of interest in this work.

Ethics Statement

Health Insurance Portability and Accountability Act (HIPAA) authorization for this case report was obtained from the patient and uploaded to the patient's online medical record. In addition, written informed consent for publication of the patient's details, including images, was obtained from the patient and is available upon request. No institutional approval was required to publish the case details.

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