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The Hidden Risk of Gadolinium-Based Radiocontrast Agents during Interventional Pain Medicine Procedures

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Introduction

Epidural steroid injections and epidural blood patches are common procedures performed by pain medicine physicians. During these elective procedures, a small amount of radiocontrast media (RCM) (1.5-3 mL) is administered to properly identify the target tissue or anatomic space and prevent off-target delivery of the therapeutic or diagnostic drugs. Although iodine-based RCM is typically used, gadolinium-based preparations have historically been utilized as an off-label preparation for patients with iodine-related allergy labels.(1)

Even though iodine-related allergy labels are not uncommon in pain medicine practice, the initial reaction is often erroneously documented as a hypersensitivity reaction instead of a non-allergic reaction. This inappropriate allergy label highly increases the use of gadolinium-based radiocontrast media (GRMC) and the odds of severe adverse reactions when it is unintentionally injected intrathecally during interventional pain medicine procedures. In fact, in recent years several reports have shown the increased risk of severe neurological adverse events and even fatal cases after unintentional intrathecal injection of GRMC.(2-4)

The risk of severe adverse reactions to GRMC that could permanently affect patients' quality of life, ultimately defeats the benefit of switching to GRMC in patients with iodine-related allergies. Moreover, IRMC allergies have been attributed to high-osmolar preparations that can rarely be confirmed by allergy testing and are no longer used for pain medicine procedures in the United States.(5) Thus, the following study aims to evaluate the impact of GRMC during interventional pain medicine procedures in patients with an iodine-related allergy label.

Materials and Methods

A retrospective chart review was conducted and included all patients who received gadolinium-based contrast media for epidural steroid injections and blood patches at all institutions without our academic enterprise from 01-01-2000 to 05-01-2022. However, electronic medical records from 2019 were chosen due to availability of data. After the study was deemed exempt from Institutional Review Board approval (IRB# 22-007119), patient records were screened using Epic - Slicer Dicer. Information on

patient demographics, allergy label information, and procedure description were documented from all patients who received GRCM for axial spine procedures. We included procedures that had a risk of inadvertent intrathecal injection including epidural steroid injections (using transforaminal or epidural approaches) and epidural blood patch procedures, Additionally, we recorded all possible side effects related to an inadvertent intrathecal GRCM administration within a month of the procedure. All patients with documented adverse events were retrospectively reviewed by a senior pain medicine physician. Descriptive statistical analysis was performed using REDCap and IBM SPSS Statistics Version 25.

Results/Case Report

After patient screening with Slicer Dicer, we identified 465 patients who received Gadolinium-based contrast media during an axial spine procedure. A total of 365 patients and 512 procedures were identified after chart review. The number of procedures performed on each patient ranged from 1 to 10 procedures (Median 1). There were 502 epidural steroid injections (98.04%) and 10 interlaminar epidural blood patches (1.9%) performed in our cohort. Epidural steroid injections are described in Figure 1.
In our cohort 14 (2.73%) patients reported adverse reactions within a month of the procedure (Mean 4.29 days). Most patients required less than 48 hours of observation; however, one patient developed bilateral acute multifocal strokes two weeks after an epidural steroid injection and was hospitalized for five days for further management. A Computed Tomography scan performed at the time of the stroke evidenced indeterminant bilateral lesions reported as multiple subtle foci of diffusion restriction without corresponding enhancement but with corresponding T2 hyperintensity. Given the suspicion for stroke, a Magnetic Resonance Imaging was not obtained; however, there was no explanation for stroke that could be identified at the time. Mild and moderate adverse events were also reported (n=13/14). (Figure 2)
The most common adverse event overall was severe pain (n=5, 0.96%) defined as pain requiring admission to the emergency department within two weeks of the procedure.
The most common indication to switch to GRCM was an iodinated contrast allergy label (n=438), followed by iodine allergy (n= 84) and shellfish (n=51). Some patients reported more than one iodine-related allergy. Eight severe allergic reactions to iodine (including seven cases of organ involvement and one case of severe cutaneous adverse reaction) were reported as indications for using GRCM.

Discussion

We reported a rate of 2.73% of adverse events documented in patients who received GABC before steroid epidural injections and blood patches. However, the incidence of mild and moderate adverse reactions to GRCM such as severe pain, spam, or headaches could be a gross underestimation as we found that these symptoms were often minimized and possibly under documented in our cohort. By contrast, it is less likely that severe adverse events like altered mental status, seizures, or strokes were not documented by providers. The case of multifocal strokes after an epidural steroid injection raises the concern about the safety profile of GRCM as indetermined lesions were documented by the radiology team. The incidence of severe neurological adverse events was 1:512 in our study.
Even though we documented all patients with EMR from 2020 until 2022, the data pool does not allow associations with low incidence symptoms. Additionally, some symptoms reported by the patients in our cohort on the same day of the procedures have not been previously reported.(4, 5) For example, two elderly patients reported new prolonged dizziness and vertigo starting the same day of the procedure resulting in falls.
In conclusion, there has been a hidden risk of severe adverse reactions after unintentional intrathecal injection of GRCM media that has been recently illuminated by pain medicine researchers. The current trend of avoiding GRCM preparations during procedures with a risk of intrathecal administration should be completed and iodine-based alternatives should be considered instead by pain medicine providers.

We recommended evaluating the real incidence of adverse reactions of inadvertent intrathecal injection Gadolinium-based preparations with prospective or match controlled studies.

References

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Disclosures

No

Tables / Images

Figure 1. Epidural Steroid Injections: Procedure Description

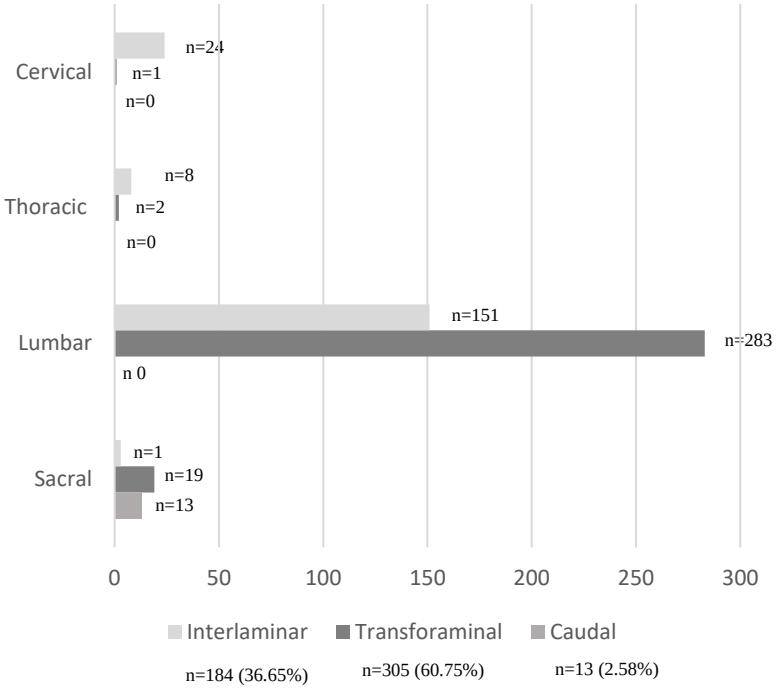
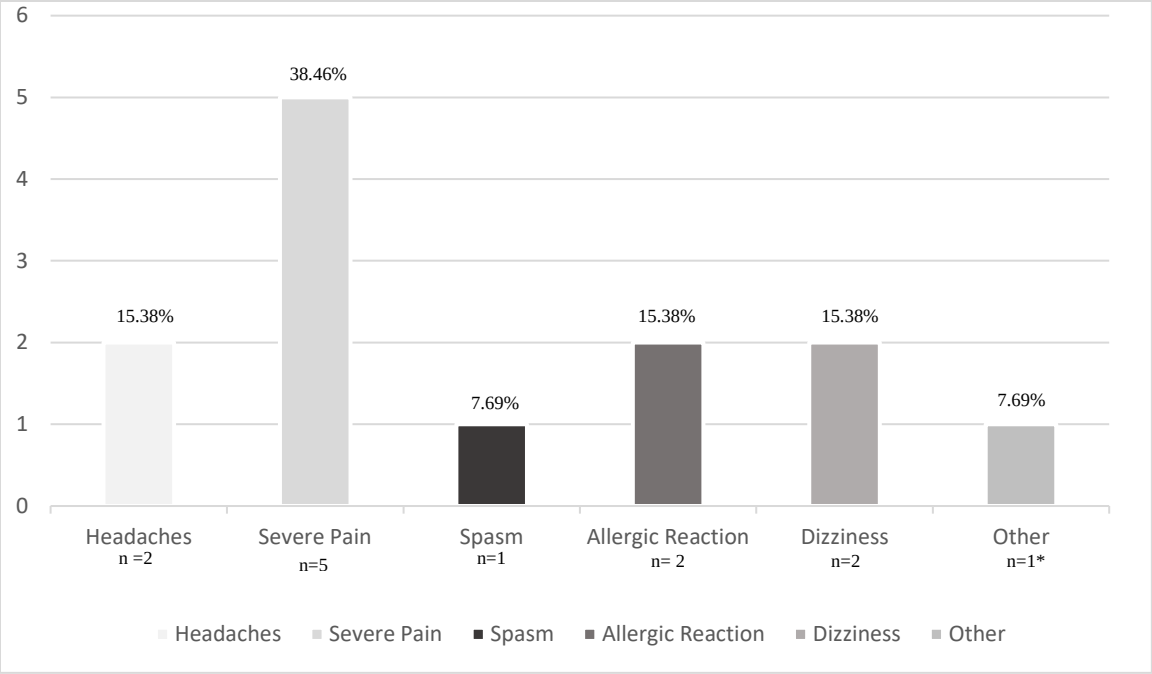


Figure 2. Mild and Moderate Adverse Event Description



*Patients reported blurred vision within a week of the procedure