Interventional Pain Medicine 4 (2025) 100618

Contents lists available at ScienceDirect

Interventional Pain Medicine

journal homepage: www.journals.elsevier.com/interventional-pain-medicine

Safety profile of cervical transforaminal epidural steroid injections performed while maintaining anticoagulation, aspirin, or NSAIDs

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A B S T R A C T

Summary of background data: The risk of a symptomatic epidural bleed in patients continuing anticoagulation during most types of spinal injection procedures is extremely low. Cervical epidural steroid injections involve a unique risk of a catastrophic complication if an epidural hematoma is to occur secondary to spinal cord compression due to the anatomic confines of the cervical spinal canal. There is minimal research on the risk of cervical transforaminal epidural steroid injections (CTFESI) with anticoagulation.

Objective: Evaluate the risk of performing CTFESI with patients continuing prescribed anticoagulation medication.

Methods: A retrospective review was performed at two practice settings, a community-based outpatient practice and an academic practice, to identify all CTFESI performed between June 2018 through November 2023. Patient medical records were reviewed for the presence of anticoagulation and NSAID medication the day of the CTFESI. Data analysis used descriptive statistics to summarize the distribution of anticoagulants, NSAIDs, and cervical levels across practices, along with medication frequencies and percentages.

Results: A total of 2792 CTFESIs were performed across both settings between June 2018 and November 2023. Of those, 1040 CTFESIs (37.2 %) were performed on patients taking some form of anticoagulant medication. 277 CTFESI were performed on patients taking anticoagulants or aspirin or a combination of anticoagulants and ASA. 763 were performed on patients taking NSAIDs. There were no reported cases of symptomatic epidural hematomas or other bleeding complications in the immediate post-procedural period or up to 1 week following the procedure.

Conclusion: It is likely that CTFESI can be safely performed in patients continuing anticoagulation, aspirin (ASA), or NSAIDs. Discontinuing anticoagulants or NSAIDs for CTFESIs may not be necessary. Further studies are warranted to confirm these results.

1. Introduction

Cervical transforaminal epidural steroid injections (CTFESI) are commonly used in the treatment of radicular upper extremity pain [1]. Many patients with cervical radicular symptoms are on anticoagulation for a variety of medical reasons. In the past, anticoagulation was commonly held during the periprocedural period for all spinal injections to lessen the presumed increased risk of epidural hematoma posed by the medication. This theoretical increased risk of bleeding in the epidural space was based on the use of spinal catheters in the anesthesia literature [2]. In the last decade, however, it has been demonstrated in numerous studies that the risk of a symptomatic epidural bleed in patients continuing anticoagulation during most types of spinal injection procedures is extremely low [3–11]. In fact, there is weak evidence that the risk of thromboembolic events, such as stroke or myocardial infarction from discontinuing the anticoagulation, may be higher than the risk of a symptomatic epidural hematoma if the anticoagulation is continued during a spinal injection procedure [3].

Cervical epidural steroid injections do involve a unique risk of a catastrophic complication if an epidural hematoma is to occur secondary to spinal cord compression due to the anatomic confines of the cervical spinal canal. Although recent literature has explored the risk of the cervical interlaminar injection approach with anticoagulation [6], the cervical transforaminal approach on anticoagulation has had only minimal research [7].

Based upon several factors, including the existing literature [3–11], needle placement location, and the anatomical configuration of the cervical foramen, it is felt by the authors that CTFESI pose a very low theoretical risk of a symptomatic epidural hematoma or other significant bleeding complications. In light of this, anticoagulation is not typically withheld for CTFESI in the authors' practices. The aim of the current study is to evaluate the risk of performing CTFESI with patients

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https://doi.org/10.1016/j.inpm.2025.100618
Received 19 May 2025; Received in revised form 12 July 2025; Accepted 15 July 2025
Available online 24 July 2025

continuing prescribed anticoagulants, Aspirin (ASA), or non-steroidal anti-inflammatory (NSAIDS) medication.

2. Methods

An IRB exemption was obtained from Stirling IRB. A retrospective review was performed at two locations: A physiatric interventional spine community outpatient practice of two of the authors (DL, SH). The second was performed at an academic practice with attendings, fellows, and residents performing the procedures at the institution of two of the authors (JL, DR). In order to identify all CTFESI performed between June 2018 through November 2023, a query of the practices' electronic medical record systems was performed. All CTFESI were performed using 25-gauge needles and in accordance with IPSIS guidelines [1] with conventional or, more commonly, the modified approach [1,12] (Fig. 1).

To determine the presence of blood thinning medication at the time of the injection, the individual patient medical records were reviewed for the presence of anticoagulants, ASA, or NSAIDS on the day of the CTFESI and whether the patient held the medication for any pre-procedural period of time.

Information extracted from the medical record included anticoagulant medication, ASA, or NSAIDs, level and side of CTFESI, and any evidence of spinal hematoma or other significant bleeding complication from the immediate post-procedure period out to 1 week. Although the formal review included medical record review out to 1 week, any known epidural hematoma or other complication beyond that time, was recorded.

Blood thinning medications were categorized into the following groups: ASA, NSAIDS, and traditional anticoagulants. Anticoagulant medication was divided into four categories based upon structure and mechanism of action (Table 1).

3. Results

During the five-year study period, a total (including both practice settings) of 2792 CTFESI were performed on 1936 patients. Of those, 1040 CTFESI (37.2 %) were performed on 878 patients taking some form of anticoagulant, ASA, or NSAID at the time of the injection (Table 2). This included 277 injections performed on patients taking anticoagulants and/or aspirin, and 763 performed on patients taking NSAIDs only (Table 2).

In Practice One (community), a total of 2608 CTFESI were performed on 1752 patients. Of those, 920 CTFESI were performed on 732 patients who were on an anticoagulant, ASA, or NSAID medication. This included two injections that were discontinued but remained accounted for in the analysis. All but 25 CTFESI were performed at a single level. For the analysis, each of the twenty-five two-level injections were considered a single injection (Tables 2 and 3).

In Practice Two (academic), a total of 184 CTFESI were performed on 146 patients, of which 120 CTFESI were performed on patients who were on an anticoagulant, ASA, or NSAID medication. This included four injections that were discontinued but remained accounted for in the

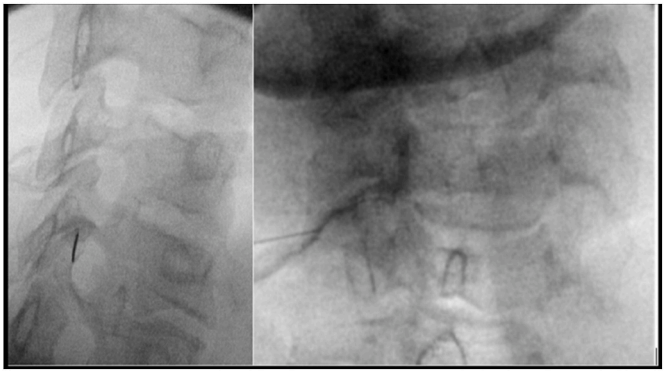

Fig. 1. Left C5/6 cervical transforaminal epidural steroid injection. Please note the modified approach was used to determination the obliquity for needle insertion, based upon the C6 superior articular process ventral surface angle on MRI.

Table 1
Categorization of anticoagulants.

Category	Medications
Direct Oral Anticoagulants (DOACs)	apixaban (Eliquis), rivaroxaban (Xarelto), dabigatran (Pradaxa)
Low Molecular Weight Heparin (LMWH)	enoxaparin (Lovenox), pentosan polysulfate sodium (Elmiron)
Other Antiplatelet Medications	clopidogrel (Plavix), cilostazol (Pletal), dipyridamole (Attia), prasugrel (Effient), ticagrelor (Brilinta), ticlopidine (Ticlid), aspirin/dipyridamole (Aggrenox)
Vitamin K Antagonists	warfarin (Coumadin)

Table 2
Medication maintained and number of cervical transforaminal epidural steroid injections. ASA = aspirin, NSAID = non-steroidal anti-inflammatory drug, Direct Oral Anticoagulant (DOAC): apixaban (Eliquis), rivaroxaban (Xarelto), and dabigatran (Pradaxa). Low molecular weight heparin (LMWH): enoxaparin (Lovenox), pentosan polysulfate sodium (Elmiron). Other antiplatelets: clopidogrel (Plavix), cilostazol (Pletal), dipyridamole (Attia), prasugrel (Effient), ticagrelor (Brilinta), ticlopidine (Ticlid), and aspirin/dipyridamole (Aggrenox). Vitamin K antagonists: warfarin (Coumadin).

Anticoagulant	Practice 1 (Community)	Practice 2 (Academic)	Combined
ASA	115	8	123
DOAC	44	6	50
DOAC + ASA	6	1	7
LMWH	0	0	0
Other Antiplatelet	14	1	15
Other Antiplatelet + ASA	14	0	14
ASA + NSAID	16	14	30
DOAC + NSAID	9	0	9
Other Antiplatelet + NSAID	13	0	13
NSAID + DOAC + Other Antiplatelet + Unfractionated Heparin	1	0	1
Vit K Antagonist	0	0	0
Vit K Antagonist + NSAID	11	0	11
Vit K Antagonist + ASA + Other Antiplatelet	3	0	3
NSAID only	0	1	1
Total	674	89	763
	920	120	1040

Table 3
Distribution of cervical transforaminal epidural steroid injection (CTFESIs) by level. *C1/2 were C2 dorsal root ganglion blocks.

Cervical Level	Practice 1 (Community-based)	Practice 2 (Academic)	Combined
C1-2	2	0	2
C2-3	1	0	1
C3-4	32	10	42
C3-4 and C4-5	2	0	2
C4-5	133	7	140
C4-5 and C5-6	5	1	6
C5-6	383	50	433
C5-6 and C6-7	17	0	17
C6-7	316	51	367
C6-7 and C4-5	1	0	1
C7-T1	28	1	29
Total	920	120	1040

analysis. All but one injection were one-level CTESI, and the one two-level injection was considered a single injection for the analysis (Tables 2 and 3).

Across all 1040 CTFESI among 878 patients on blood thinning medication, there were no reported cases of symptomatic epidural hematomas or other significant bleeding complications in the immediate post-procedural period or up to 1 week following the procedure. Additionally, no delayed epidural hematomas were identified beyond the 1-week follow-up period (Table 4).

Confidence intervals (CI) were computed for each subgroup of medications. Although a 95 % CI was used, there was a zero incidence of bleeding complications. Therefore, one sided, upper limit CI using 95 % actually represents 97.5 % CI, as a negative number for the 2.5 % lower limit is non-sensible. The group taking anticoagulants and/or ASA, had a 97.5 % CI of 0–1.32 % risk of hematoma. For the NSAID group, the 97.5 % CI range was 0–0.48 % (Table 4).

4. Discussion

This is the first study to specifically examine the risk of performing CTFESI on patients continuing anticoagulants, ASA, and NSAIDs. A total of 277 CTFESI were performed while the patient remained on an oral anticoagulant or ASA without evidence of bleeding complications. Additionally, over 763 CTFESI were performed with patients taking NSAIDs without an adverse event.

Published data evaluating the safety of spinal injections in the presence of anticoagulants has primarily focused upon lumbar injections [3,4,7,10]. Specifically, lumbar transforaminal injections (LTFESI) have been studied in this context and consistently demonstrated to be a low or very low risk procedure [1,4,10]. There is some evidence that holding the anticoagulant may present a higher overall risk for the patient in terms of the risk of a cardiovascular or cerebrovascular event compared to the risk of a spinal hematoma or other bleeding complication encountered during LTFESI [10]. As the authors' practice pattern, in this retrospective study, was to continue the anticoagulation during the CTFESI, no comparable cohort was available to assess the risk of an embolic event attributed to holding the anticoagulant.

As no bleeding complications occurred in this cohort of patients undergoing CTFESI on anticoagulation, this provides evidence that this procedure may be performed safely in this context. Confidence intervals are useful in this setting to help determine risk for clinical guidance. Arguably, the most crucial finding in this study is for the subgroup of patients on anticoagulants and/or ASA. In this subgroup of 277 CTFESI, the risk of a symptomatic hematoma was found to be 0–1.32 % with a one sided 97.5 % CI. Stated differently, there is a 97.5 % chance that the risk of a hematoma following a CTFESI performed on anticoagulant or ASA is between 0 and 1.32 %. When NSAIDS are included, which increases the sample to 1040 CTFESI, the risk of a symptomatic hematoma is 0.35 % or less, which may be stated with 97.5 % certainty.

Prior studies evaluating spinal injections on anticoagulation have had very low numbers of CTFESI. Ehsanian and colleagues [7] reported on 14 CTFESI performed in patients on blood thinning medication but this appears to have included only 8 patients on ASA and the remaining on NSAIDS.

Based upon the paucity of case reports, it is very likely that epidural hematoma resulting from CTFESI is exceedingly rare regardless of anticoagulant status. At the time of this manuscript, to the authors' knowledge, there has been only one published report of an epidural hematoma caused by a cervical transforaminal injection [13]. The patient became symptomatic four days following her third CTFESI in a series of three at C7/T1. No description of the technique or fluoroscopic images were provided. The patient was not on anticoagulants, ASA or NSAIDS. In addition, a survey regarding CTFESI complications completed by 287 members of The American Pain Society provided a response indicating knowledge of a single case of an epidural hematoma [14]. Unfortunately, this could not be confirmed in terms of the CTFESI approach based upon the nature of the survey method and may have been related to knowledge of the above aforementioned single case. Another reported bleeding complication from CTFESI is vertebral artery dissection [15]. In this case, a patient died following a left C6-7 TFESI using a 25gauge needle to inject methylprednisolone and bupivacaine. Autopsy demonstrated a left vertebral artery dissection and subsequent thrombosis. A few months prior to the procedure, the patient had been prescribed an NSAID to take three times per week, however it is not clear if the patient was taking the NSAID immediately prior to the procedure.

Cervical interlaminar epidural injections have been studied to a greater degree than CTFESI in the context of anticoagulation. Interlaminar epidural steroid injections are presumed to be higher risk for symptomatic hematoma in light of the needle location and confined space of the central canal. This is particularly of concern in the thoracic and cervical regions in light of the vulnerability of the spinal cord. Furman and colleagues [6] performed a similar retrospective investigation to the current study with similar findings but with a cervical interlaminar approach. They performed 240 cervical or thoracic interlaminar epidural injections with patients on anticoagulant or antiplatelet medication. No symptomatic epidural hematomas occurred. A prospective trial [16] reported 278 cervical epidural injections performed on clopidogrel, warfarin, or ASA in combination or alone without evidence of a clinical epidural hematoma. Although the cervical epidural technique was not specified, it was assumed to be interlaminar based upon the authors' prior studies.

There are several limitations to our study. The retrospective nature is subject to incomplete and potentially inaccurate data. It is possible that the medication record was inaccurate at the time of the injection. It is also conceivable that a patient may have held an anticoagulant medication without being instructed to do so. It was typically confirmed by the physician at the time of the procedure that the patient had remained on the anticoagulant or ASA.

It is possible that a symptomatic hematoma could have occurred and not have been present in the records reviewed. However, it is felt to be extremely unlikely that such a complication could have occurred without the physicians' knowledge as both practices have routine follow up and patients are generally followed very closely.

The vast majority of these injections were performed using the modified CTFESI approach [1,12]. This, therefore, might limit the generalizability of our findings. Although the modified approach needle trajectory may be less likely to encounter the vertebral artery [17–19], any advantage over the conventional CTFESI approach in reducing the risk of a symptomatic epidural hematoma is purely theoretical.

5. Conclusion

This is the first study to examine a relatively large number of patients undergoing CTFESI while on anticoagulation, ASA, or NSAIDS. No symptomatic epidural hematomas or other significant bleeding complications occurred. Our findings are consistent with the expectation that when performed properly, CTESI are of low risk of bleeding complication.

Table 4
Observed rate of epidural hematoma and predicted risk (95 %–97 % CI). CI = confidence interval, ASA = aspirin, NSAID = non-steroidal anti-inflammatory drug.

Medication	Number CTFESI	Percent Hematoma	95 % CI lower limit	97.5 % CI (one-sided) upper limit
ASA	**123**	**0**	**0**	**2.95**
Anticoagulant	**154**	**0**	**0**	**2.37**
ASA and/or anticoagulant	**277**	**0**	**0**	**1.32**
NSAID alone	**763**	**0**	**0**	**0.48**
Combined total	**1040**	**0**	**0**	**0.35**

Funding

No external funding was recieved for this study.

Conflict of interest

None of the authors has any conflicts of interest to disclose.

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