The Intercristal Line (ICL) is an imaginary line corresponding to the highest palpable level of the bilateral iliac crests. It is a common anatomical surface marker used by interventionalists to accurately guide needle access of lumbar cistern for cerebrospinal fluid (CSF) needed for diagnostic or therapeutic purposes. Recent evidence has questioned appropriateness of using ICL\textsuperscript{1-4} because of its variable anatomical proximity to conus medullaris (CM), the terminal lower end of spinal cord. However, the recent literature must NOT be misinterpreted as evidence to make the use of ICL completely redundant especially when palpation of ICL is required while blindly accessing lumbar cistern without fluoroscopy. In this regards, we would like to share our results about ICL and CM proximity (or lack of it) that were analyzed as an independent and exclusive sub-group analysis within the larger but non-overlapping data of our internal review board approved clinical investigation geared to identify the incidence of epidural lipomatosis among our pain clinic patients.

A retrospective sub-group analysis of 76 patients was performed among our pain clinic patients over a time-period of one year. In these patients, radiological proximity between ICL and CM was reviewed in the T1-weighted and T2-weighted magnetic resonance imaging (MRI) of lumbar spine available in our electronic medical record system. The results as elicited in Table 1 and Figure 1 show that in as many as 13% patients, CM can be prone to getting injured even when lumbar cistern access needle is introduced at lower than L1-L2 interspinous space; however, as a radiological marking based on the level of medial-most origin of iliacus muscle in the MRI, ICL appears to consistently cross at or above the L5 level. Consequently, when ICL is used as marker, up to 21% patients have only 1 or 2 interspinous spaces available cranially to safely access the lumbar cistern without the possibility of injuring CM. However, in difficult cases of lumbar cistern access, the interventionists can still injure CM when they steeply angulate and inappropriately re-direct their lumbar cistern access needles cranially despite the skin puncture site being in a safer lower level interspinous space with initial angle being appropriately perpendicular to the lumbar spine's skin.

There are few pearls highlighted by these results. Lumbar spine MRI based results can only give an overview of how spine behaves anatomically in supine position. The literature describes that palpated ICL, either with patients sitting upright during ultrasound\textsuperscript{1-3} or with patients in prone position during fluoroscopy\textsuperscript{4}, is commonly cranial to radiological ICL per the confirming images of ultrasound\textsuperscript{1-3} or fluoroscopy\textsuperscript{4}. However, it is not clear whether the proximity of palpated ICL to CM is due to erroneous palpation methods (as explained later in the text) or cranial movement of pelvis.
as a whole in relation to the spine when the patients are in sitting position or knee-chest position which are the two most common positions patients are in when being palpated for blind access to their lumbar cisterns. As displayed by Chakraverty et al, the radiological ICL being different (and usually caudal) than surface ICL potentially further decreases the number of available interspinous spaces for safely accessing lumbar cistern when interventionists are relying their decisions on inappropriately palpated surface ICL. Herein, we suggest a solution. To overcome the "belly fat tire" causing the surface ICL to be inappropriately palpated cranial to the radiological ICL (Figure 2), the best way is to locate ICL by step-up method of palpation (moving up in caudo-cranial direction). This is different from erroneous step-down method (moving down in cranio-caudal direction) that squeezes the "belly fat tire" between palpating hands and radiological ICL. The ideal hand positioning ensures that both index fingers of interventionists' pronated hands are parallel (and NOT at any angle) to the plane of ICL. Palpation by this method may commonly ensure that the surface ICL overlies on the radiological ICL and NOT cranial to it. This will further ensure that the number of good interspinous spaces are NOT decreased due to any erroneous method of ICL palpation. Subsequent to appropriate palpation of ICL, it is also important to ensure that the interventionists' thumbs are in the same plane as ICL and palpating index fingers so as to avoid the up-angled thumbs palpating (and identifying) interspinous space that can be inappropriately one level cranial to the intended interspinous space that is ideally located on the ICL plane or just caudal to the ICL plane (Figure 3).

In summary, all this micro-management for simple palpation of ICL and identifying appropriate interspinous space is to ensure that already restricted opportunity (in terms of number of available interspinous spaces) to safely access lumbar cistern does NOT become unsafe and/or inaccessible due to erroneously overlooked simple logistics of palpat ing spine for lumbar cistern's access.

**Table 1**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Spinous Process Level of Thoracolumbar Vertebrae</th>
<th>n (%) (Total 76 patients)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conus Medullaris Accessible By Needle's Skin Puncture At Which Interspinous Level</td>
<td>T12-L1: 23 (30%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>L1-L2: 43 (57%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>L2-L3: 9 (12%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>L3-L4: 1 (1%)</td>
<td></td>
</tr>
<tr>
<td>Intercristal Line NOT Below This Level Based On Iliacus Muscle Medial-Most Origin</td>
<td>L4: 11 (14%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>L4-L5: 34 (45%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>L5: 30 (40%)</td>
<td></td>
</tr>
<tr>
<td>Good Interspinous Spaces Available Cranial To ICL for Needle Access (Median=3; Mode=3)</td>
<td>1: 2 (3%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2: 14 (18%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3: 40 (53%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4: 20 (26%)</td>
<td></td>
</tr>
</tbody>
</table>

In summary, all this micro-management for simple palpation of ICL and identifying appropriate interspinous space is to ensure that already restricted opportunity (in terms of number of available interspinous spaces) to safely access lumbar cistern does NOT become unsafe and/or inaccessible due to erroneously overlooked simple logistics of palpating spine for lumbar cistern's access.
Fig. 2
Step-Up vs. Step-Down Method for Palpation of Intercristal Line

Fig. 3
Appropriate Alignment of Palpating Thumbs and Fingers in Relation to Intercristal Line
References


BRIDION—for **optimal neuromuscular blockade management** and improved recovery

### Predictable and complete reversal

- 98% of BRIDION patients recovered to a TOF* ratio of 0.9 from reappearence of T2 within 5 minutes
- 97% of BRIDION patients recovered to a TOF* ratio of 0.9 from 1 to 2 PTCs within 5 minutes

### Rapid reversal

- BRIDION rapidly reversed patients from reappearance of T2 in 1.4 minutes
- BRIDION rapidly reversed patients from 1 to 2 PTCs in 2.7 minutes

**BRIDION is indicated for the reversal of neuromuscular blockade induced by rocuronium or vecuronium. In children and adolescents (aged 2-17 years), BRIDION is only recommended for routine reversal of moderate rocuronium-induced neuromuscular blockade.**

**Important safety information**

BRIDION is not recommended in patients with severe renal impairment. Studies in patients with hepatic impairment have not been conducted and, therefore, patients with severe hepatic impairment should be treated with great caution. Caution should be exercised when administering BRIDION to pregnant women as no clinical data on exposed pregnancies are available.

BRIDION has not been investigated in patients receiving rocuronium or vecuronium in the intensive care unit (ICU) setting.

If neuromuscular blockade is required within 24 hours of BRIDION administration, a non-neuronal neuromuscular blocking agent should be used instead of rocuronium or vecuronium. The most commonly reported adverse reactions were dysgeusia (metal or bitter taste) and anesthetic complications (movement, coughing, grimacing, or swelling on the endotracheal tube). In patients treated with BRIDION, a few cases of awareness were reported. The relation of BRIDION was uncertain. In a few individuals, allergic-like reactions (e.g., flushing, erythematous rash) following BRIDION were reported. Clinicians should be prepared for the possibility of allergic reactions and take the necessary precautions. In a trial of patients with a history of pulmonary complications, bronchospasm was reported in 2 patients and a causal relationship could not be fully excluded.

Volunteer studies have demonstrated a slight (17%-22%) and transient (<30 minutes) prolongation of the prothrombin time/activated partial thromboplastin time (PT/aPTT) with BRIDION; however, clinical studies have demonstrated no clinically relevant effect on peri- or postoperative bleeding complications with BRIDION alone or in combination with anticoagulants. As BRIDION has demonstrated an in vitro pharmacodynamic interaction with anticoagulants, caution should be exercised in patients on anticoagulation for a pre-existing or coronal condition. This pharmacodynamic interaction is not clinically relevant for patients receiving routine postoperative prophylactic anticoagulation. Although formal interaction studies have not been conducted, no drug interactions were observed in clinical trials. Preclinical data suggest that clinically significant drug interactions are unlikely with the possible exceptions of tetracaine, fusidic acid, and hormonal contraceptives.

* Train-of-four
* Post-tetanic count
* Second twitch

**REFERENCES**

1. BRIDION Summary of Product Characteristics (SPC).

Please see summary of product characteristics for full prescribing information.

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