Guidelines for Mepivacaine Dosing for Spinal Anesthesia

- The minimum dose for mepivacaine spinal anesthesia for TKAs should be 60 mg (either 4 ml of the 1.5% solution or 3 ml of the 2% solution, concentration does not matter for spinal anesthesia. This should cover all of our “efficient surgeons”. Total time less than 2 hours.

- If your surgeon takes longer than 2 hours, consider 70-80 mg of mepivacaine. The total added time will only be 20-30 minutes and is very predictable (in contrast to bupivacaine which can be highly variable).

- For longer operations, bupivacaine should be used. The choice of using hyperbaric 0.75% bupivacaine in the kit or using plain 0.5% bupivacaine from the anesthesia block cart is based on your judgement (and knowledge) that hyperbaric solutions will typically have a higher peak block height, and thus have a higher risk of clinically relevant hypotension and bradycardia.

Basic review of plain mepivacaine spinal anesthesia vs. hyperbaric bupivacaine spinal anesthesia.

1. **Hyperbaric** solutions (when the patient is positioned supine) will have more rapid onset to peak cephalad rise compared to plain (so-called “isobaric”) solutions. Hyperbaric solutions spread-distribute within the intrathecal space via gravity based on patient position. They will have rapid bimodal spread caudal and more importantly cephalad. The peak (cephalad) block height for hyperbaric solutions is typically T2-T4 based on the pooling within the natural thoracic kyphosis.

2. In contrast, plain solutions will distribute within the intrathecal space by bulk flow from the initial injection site. Plain solutions (compared to hyperbaric) will tend to have a slower onset to cephalad distribution for any given local anesthetic or dose, as well as lower peak cephalad level (typically T6-T8).

3. When hyperbaric solutions are used, they all reach a T10 level (what we need for tourniquet tolerance) within 5 minutes. In contrast, plain mepivacaine takes approximately 10 minutes to reach T10. **See table.**

4. A very subtle point when injecting plain solutions via the Whitacre (pencil point) needle is the direction of the aperture (located a few millimeters distant from the conical tip and on the side). Since the direction of the needle aperture has been shown to influence the distribution
of sensory anesthesia with plain solutions (cephalad direction results in more cephalad distribution and vice versa), make sure that the needle aperture is ideally NOT facing away opposite the knee being operated, as this may potentially lead to a slower onset in the operative knee. We have all “rotated” the Whitacre spinal needle trying to optimize CSF flow. Aperture direction does not matter with hyperbaric solutions.

Since the knee is innervated by the lumbar plexus femoral nerve (L2-L4), obturator nerve (L2-L4) and the sciatic nerve (S1-S3), patient will likely have clinically relevant postoperative knee pain when the spinal block regression reaches L1, maybe earlier. Based on the table I have revised; I have estimated that it is likely that:

- 50 mg (a dose never used in published studies) of plain mepivacaine will regress to L1 on average by 100 minutes from the time of injection.
- 60 mg will reach L1 by 110 minutes and
- 80 mg will reach by 125 minutes.

<table>
<thead>
<tr>
<th>Mepivacaine Dose (mg)</th>
<th>T10 Sensory Block (min)</th>
<th>Peak Block (T6-T7) (min)</th>
<th>Onset of 2-Dermatome Regression (min)</th>
<th>T10 Regression 1SD (min)</th>
<th>L1 Regression 1SD (min)</th>
<th>S1 Regression 1SD (min)</th>
<th>Full Motor Recovery 1SD (min)</th>
<th>Spontaneous Voiding 1SD (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>45 mg</td>
<td>10</td>
<td>20-30</td>
<td>60-70</td>
<td>90</td>
<td>90</td>
<td>182 (30)</td>
<td>142 (37)</td>
<td>191 (30)</td>
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<tr>
<td>50 mg</td>
<td>XX</td>
<td>XX</td>
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<td>XX</td>
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<tr>
<td>60 mg</td>
<td>10</td>
<td>30-40</td>
<td>80-90</td>
<td>110 (10-15)</td>
<td>140 (10-15)</td>
<td>203 (36)</td>
<td>168 (36)</td>
<td>203 (35)</td>
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<tr>
<td>80 mg</td>
<td>10</td>
<td>30-40</td>
<td>80-90</td>
<td>125 (10-20)</td>
<td>160 (10-20)</td>
<td>220 (35)</td>
<td>200 (40)</td>
<td>280 (40)</td>
</tr>
</tbody>
</table>

Estimated Pharmacodynamics and Anesthetic Profile of Plain Mepivacaine

References:


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