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The occasional lumbar puncture

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Time passes, and indications for lumbar puncture (LP) come and go, but don't seem to completely disappear. Computed tomographic (CT) scanners (touted as rendering LP unnecessary in certain instances) are yet to be found in every rural hospital. Even if they were, they are not infallible, and we are left with the reality that to fully serve our patients we will, on occasion, need to perform an LP.

This procedure may fill us, no less than our patients, with apprehension. What exactly is happening at the end of that needle? The needle is so long, and seems to go in so far before hitting "paydirt"! All this causes physicians to shy away from a procedure that in reality is quite straightforward, and quite safe.

Indications

The indication most likely to be encountered by the rural physician is to exclude meningitis. This indication may occur in a variety of clinical contexts, including "fever of unknown origin" in a child, when symptoms and signs are suggestive of the diagnosis, or when the diagnosis is evident, but cerebrospinal fluid (CSF) is nonetheless required urgently for culture.

Less clear are the indications for LP in the context of headache to rule out a subarachnoid hemorrhage (SAH). A lively discussion of this issue can be followed in the cited references,1–3 all turning on the sensitivity and specificity of modern CT scanning, the expertise of the radiologists interpreting the scans, and the corresponding risks of false-positive LPs as a result of bloody taps. The issue is, however, moot if you happen to be 500 km from the nearest scanner in the middle of a snowstorm on a cold Canadian February Friday night. One adage that might apply is: "If you think of it, do it." There is some wisdom here, and individual physicians will follow their logic tree to where it leads them. If it leads to a valid indication for an LP, these following images may be of assistance.

Contraindications

There are few absolute contraindications to LP, but one certainly is infection in the tissues, which will be traversed by the needle. This might lead to an iatrogenic meningitis. There are also reports of herniation following LP in people with intracranial abscesses or brain tumours, although the risk seems to be less when smaller needles are used.

Technique

1) Equipment
Equipment is straightforward and includes the following items (Fig. 1).

- sterile drapes
- manometer
- 3-way stopcock
- 3 to 4 test tubes
- spinal needle (disposable or stainless)
- syringe and local anesthetic.

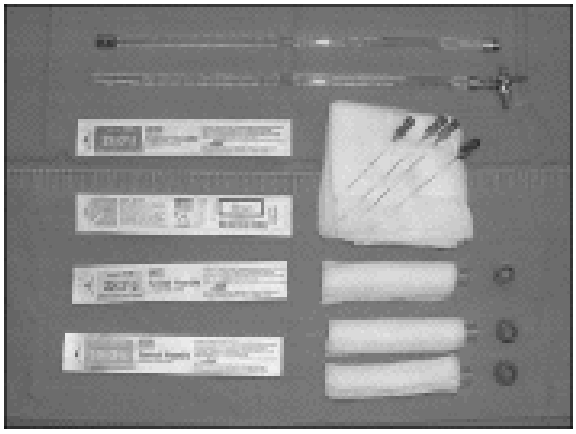

Fig. 1.

2) Position the patient and identify the landmarks
A common position places the patient on his or her side, curled into a fetal position (Fig. 2). This opens up the lumbar spaces. A line joining the iliac crests will intersect the lumbar spine (in adults) well below the level where the spinal cord turns into the filamentous cauda equina. One space above or below this spot can be an alternate site.

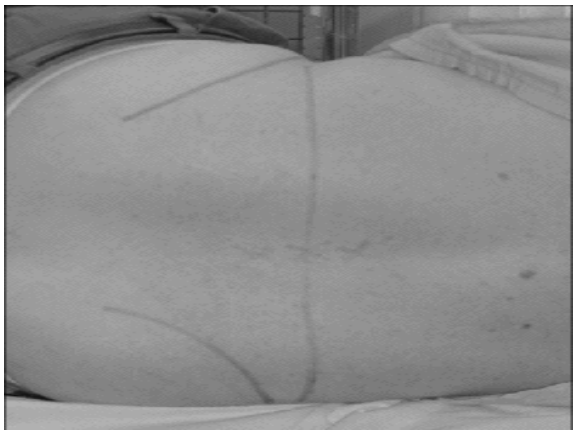

Fig. 2.

3) Choose the needle
Disposable needles of various sizes are available (Fig. 3). Twenty-five–gauge needles are less traumatic and are useful for procedures such as myelography, but they are more difficult for withdrawing samples of CSF or for measuring opening pressures. Eighteen-gauge needles are discouraged because they leave a relatively large hole in the dura and are associated with an increased incidence of headache following the spinal tap. Twenty-two–gauge needles are most commonly used. Disposable needles are

Fig. 3.

very sharp, and the "pop" as the needle goes through the dura may be more difficult to appreciate. Non-cutting needles (Sprotte® — not illustrated here) require special introducers and are more difficult to master.

4) The procedure

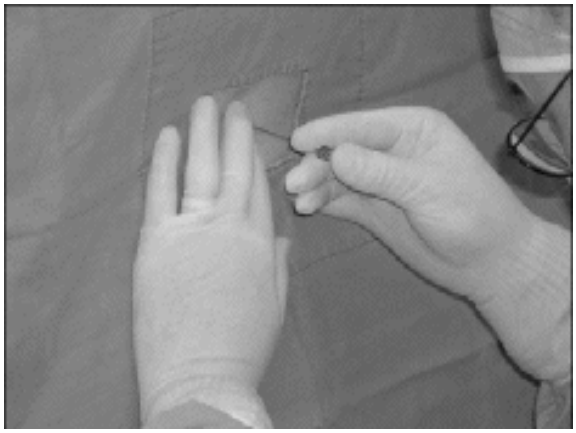

Fig. 4.

Prep and drape the skin in the usual fashion. It is appropriate to be even more fastidious than usual with this step to avoid contaminating the procedure. Infiltrate generously with local anesthetic. This may obscure some palpable landmarks of the space chosen, so it is helpful if you mark the spot before you prep the skin. Use your fingernail to imprint an "X" in the appropriate place. With the stylet inserted in place, advance the needle in the midline, at right angles to the back, aiming slightly cephalahad (Fig. 4).

There is evidence that you should orient the plane of the bevel of the needle to be in the same direction as the longitudinal fibres of the dura to minimize the size of the dural defect that is created. In this illustration this would be accomplished by facing the bevel either up or down.

5) Check for CSF

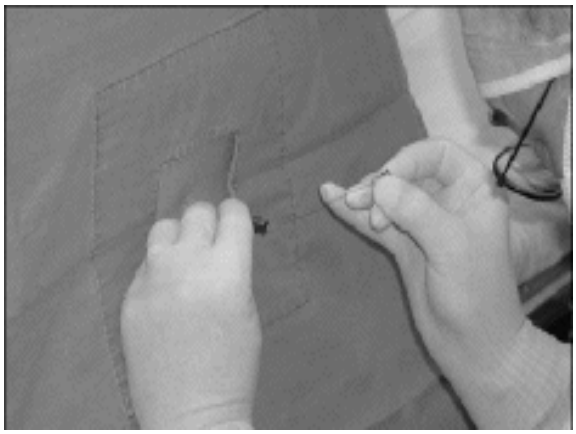

Fig. 5.

As you advance, check frequently for CSF by withdrawing the stylet and watching for a drop of fluid to emerge from the needle (Fig. 5). You may feel a distinct "pop" as the needle and stylet go through the dura, and it is surprising (particularly in the obese) how far the needle goes in before you reach the spinal canal. Frequently, especially in older individuals, you will hit bone. If this happens, draw the needle back (or out) and try again, checking to make sure you are in the midline and still at right angles to the back. It helps to aim slightly more cephalahad in subsequent attempts, and to ask the patient to flex his or her back as much as they can. Children can be held in this position by an assistant.

6) Measure opening pressure

As soon as CSF is encountered, insert the stopcock with the manometer attached (Fig 6). In

order to route the CSF up the tube, the moveable long arm of the stopcock needs to be pointed in the appropriate direction, long arm down to route the fluid up the manometer, and horizontal to route it out of the end of the needle. Placing the lever straight up will stop flow in both directions. You will be able to follow the rise of the fluid in the calibrated tube. Note the level at which it stops rising, and then prepare to collect the samples for analysis.

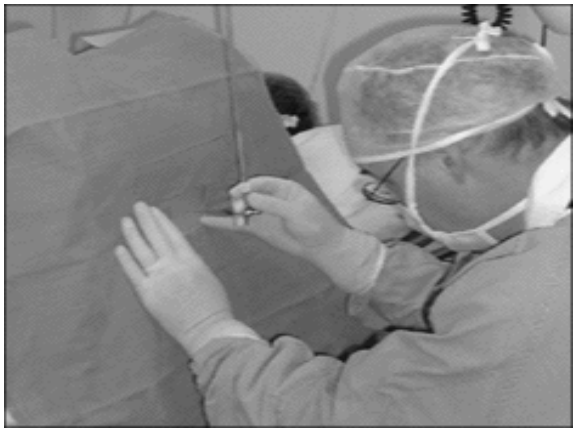

Fig. 6.

7) Collect the samples
Move the stopcock lever to the horizontal position (or remove it and the manometer from the needle entirely) and begin to collect the fluid that is dripping out of the needle (Fig. 7). Collect at least 10 drops into each of 3 to 4 sterile tubes, and have an assistant cap them and label them in the order in which they are collected. This will help determine if blood in the CSF is from a traumatic tap, an SAH or from some other pathology. Once sufficient CSF has been collected, re-insert the stylet and remove the needle.

Fig. 7.

Analysis

The following analyses are commonly carried out and will be influenced by what is available in your reference lab.

- tube 1: glucose and protein (+ cell count if it's a bloody tap)
- tube 2: culture and cytology
- tube 3: cell count

Any of the tubes can be used to assess zanthrochromia. The red-cell counts of tubes 1 and 3 should be compared if a bloody tap is suspected. The red-cell count should be at least 25% lower in tube 3 to support this diagnosis.

Post-procedure headache

The following factors related to post-lumbar puncture headache (PLPH) have been identified:4

- being in the 18- to 30-year age group, female, and with a prior history of headaches increases the risk of PLPH;
- needle size: the smaller the needle the fewer headaches;
- orientation of the needle bevel parallel to dural fibres on insertion reduces the incidence of headaches;
- replacement of the stylet prior to withdrawal reduces the incidence of headaches.

The following factors have NOT been shown to be related to PLPH:

- volume of CSF removed;
- period of recumbency following LP;
- increased hydration following LP.

Conclusion

The advent of effective vaccines (particularly for Haemophilus influenza) have dramatically reduced the number of LPs done in our emergency departments. Technology continues to improve our ability to gain information non-invasively (albeit at significant cost). Although the place of LP in our quiver of procedural skills will continue to evolve, it is unlikely, I submit, to completely disappear anytime soon. In the meantime, rural patients will be well served if their physicians are able, when necessary, to offer this service.

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