Prevention and Management of Dural Tears

Spinal Surgeons Offer Guidelines for Prevention and Management of Dural Tears

There's nothing simple about any part of the human body. Even what appears to be a single layer of covering around the spinal cord and brain (the dura) has three layers. Thanks to the invention of the electron microscope, it is possible to magnify tissues enough to see the finest detail.

Spinal surgeons and patients having spinal surgery are affected most by this discovery. Any time surgery is done on the spine, there is a risk that the dura will get torn or damaged. And if all three layers are torn, then the cerebrospinal fluid (CSF), a plasma fluid that cushions the brain and spinal cord can leak out. If that happens, watch out! Major headache, nausea, and light sensitivity can develop after surgery.

Because dural tears are common during spinal surgery, the surgeon usually makes sure the patient understands the risk and the side effects of this complication. Patients are fully informed up front (before surgery) about the risk of a dural tear and the fact that if a dural tear occurs, a second surgery to repair the tear may be needed.

In this article, spinal surgeons review the complex anatomy of the dura mater and cerebrospinal fluid, point out risk factors (who is most likely to have a tear of this type), and guide surgeons through the intricate process of performing a dural repair.

Three intricate drawings are provided to show the various layers of tissue and fluid that surround the brain and the spinal cord. Besides the three-layer dura and cerebrospinal fluid, there are structures and layers such as the transverse sinus, tentorium cerebelli, cistern, and subarachnoid space.

That's just around the brain. The protective coverings around the spinal cord are equally complex. Between the vertebra (spinal bone) and dura is the epidural space. Outside the dura are the arachnoid, denticulate ligament, subarachnoid space, and pia mater.

The average patient doesn't really need to know the ins and outs of spinal anatomy. But the surgeon does in order to make a successful repair. The surgeon must also know what puts patients at an increased risk of dural tears. The plan of care must include prevention of dural tears. If such an event occurs, then the plan of care shifts toward management of the problem.

So, who's at greatest risk for this complication? Naturally, anyone who is having spine surgery. Older adults who have developed stiffening of the spinal ligaments are at increased risk for intraoperative dural tears. In particular, a condition known as ossification of the ligaments is a big risk factor.

Ossification refers to tiny bits of bone infiltrating the soft tissue. Trying to cut through this tough ligament to get to the spine can results in a tear of the underlying dura. In the cervical spine (neck), ossification of the posterior longitudinal ligament (OPLL) increases the risk of dural tears. In the lumbar spine (low back), it's more likely to be ossification of the ligamentum flavum (another supportive spinal ligament).

Another risk factor is previous spinal surgery. Scar tissue (adhesions and fibrosis) make it more difficult for the surgeon to see anatomic landmarks used to guide the procedure. When the surgeon must cut through the
previous scar (now altered by adhesions), the risk of dural tears increases as well.

Other degenerative effects of aging can compromise the dura. For example, bone spurs, cysts, and narrowing of the spinal canal are typical effects seen in the older adult's spine. And the ossification mentioned can be sharp enough to erode through the dura over time.

During the dural repair procedure, the surgeon will do everything possible to avoid puncturing this delicate structure. Smaller needles are being used now. Once a tear occurs, the surgeon makes every effort to repair it as quickly as possible. The smaller the tear, the better the expected results.

The authors offer several guiding principles for dural tear repairs. The surgeon is advised to keep the area well-lit (e.g., use a head lamp and an operating microscope) and dry (e.g., stop any bleeding or leakage of cerebrospinal fluid).

Stitch the tear carefully through all three layers. Test the strength of the repair. Add a graft if necessary or use a fat plug to make a water tight seal around the hole and/or around the sutures.

As you might expect, smaller tears (pinhole size) are easier to manage. Larger tears with more damage to the dural layers may actually require reconstruction of the dura. It's easy to be fooled into thinking the tear is smaller than it is or that there is only one tear. If cerebrospinal fluid continues to leak, the surgeon knows the job is not finished yet.

Patients are warned that even with a dural repair, the problem can come back. In fact, studies show that five to 10 per cent of all patients who have a dural repair procedure will spring a leak again. The main reason for this is that cerebrospinal fluid can leak out of the suture holes made to thread the stitches through the tissue. Efforts are being made to come up with alternate ways to repair the tear without using sutures.

Sometimes it's not possible to repair the tear. Reconstruction with a graft material may be needed. But finding the right dural substitute has been a challenge. The surgeon can use a xenograft (material taken from another species such as a pig) but there's a risk of disease transmission. Collagen sponges are another option but these aren't always water tight.

A popular technique right now is the use of graft material taken from the patient's own tensor fascia lata. The connective tissue around this muscle along the outside of the upper thigh is a good substitute for the dura that can't be repaired.

Once the repair or reconstruction has been done the patient must rest. The goal is to reduce pressure against the repair site until healing has gotten a good foothold. For tears in the cervical spine, sitting upright reduces fluid pressure. For the lumbar spine, lying flat is best.

How long does the patient have to stay in the prescribed position? Well, that's a matter of debate. The old standard was 10 days -- until healing took place. Gradually, that has been reduced with the use of medications to one to three days.

But more recent studies have even looked at no bed rest as a possible option with some good results. The surgeon will decide the optimal time for bed rest based on the size and location of the tear as well as the type of surgery done.

In the end, the goal of dural repair is to have a symptom-free result: no headache, no nausea, and no sensitivity to light. If tears can be prevented in the first place, then dural tear surgery can be avoided.
completely. Understanding spinal anatomy and assessing patients for risk factors are keys to prevention.