

# Incidental Dural Tears during Spine Surgery: Prevention and Management

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## Abstract

Incidental dural tears are not uncommon events. Certain factors like the degree of stenosis, surgeon experience, ossification of the ligamentum flavum and compromised dural integrity are discussed. The consequences can range from mild and benign headache to tonsillar herniation, infection and even death. Early diagnosis is essential and MRI is the investigation of choice. Dural rents or tears should be identified during surgery and should be proactively tackled to avoid post operative complications. The authors discuss the various treatment options available for intraoperative dural tears depending on the stage of diagnosis and extent of the lesion.

**Keywords:** Dural tear, spine surgery.

## Introduction

The spinal cord is surrounded by three layers of meninges which contain the cerebrospinal fluid (CSF). The dura mater is the outer most layer. The next layer is the transparent arachnoid membrane, which contains CSF in the subarachnoid space. The pia mater envelops the neural elements. The dural and arachnoid layers end at S2 level.

Durotomy means breach in the integrity of the dural layer. However, this commonly involves the delicate arachnoid membrane also, resulting in CSF leaks. The most common cause of CSF leaks is iatrogenic, although they may be encountered in trauma cases also.

**Incidence:** CSF leaks are not uncommon. The reported incidence in literature ranges from 1% to 14% [1, 2, 3]. Khan et al reported what appears to be the largest series of dural tears in the literature (10.6%

of 3183 patients over a 10 year period [4]. This wide range of incidence implies that there are a number of factors which predispose to CSF leaks.

**Risk factors:** A number of studies have studied the factors associated with dural tears. Weakened strength of the dural layer may be seen in the elderly and infections. Epstein reported ossification of the yellow ligament as the most significant cause of unintentional dural leaks in the elderly [5]. Similarly, an adhered and thinned out dura is often encountered in revision surgeries. Severe (very tight) spinal stenosis leads to folding of the redundant dura under the ligamentum flavum predisposing it to be caught in the Kerrison punch. Level of surgeon experience/expertise is understandably associated with higher incidence, although no surgeon is immune from it [6]. Kerrison is the most common instrument causing the CSF leak [7].

Instrumentation malposition is also associated with CSF leaks. Failure to preoperatively recognize spina bifida occulta and other defects of the posterior elements also increase the risk. CSF leaks following anterior cervical durotomies are also reported, though not well defined [8]. **Consequences of dural tear:** A CSF leak requires a high level of patient care as the consequences can be serious. A spinal headache is not only a telltale sign of CSF leak but also leads to significant disability to the patient and creates panic. A persistent CSF collection impedes the wound healing and acts as a direct entry for the organisms to the meninges. Superficial infections can spread deep and lead to subfascial infections, epidural abscesses and rarely meningitis. A long term continuous CSF leak may lead to pseudomeningocele which can cause cord compression and even trap the nerve rootlets causing symptoms. Severe leaks can affect the blood-CSF flow dynamics and lead to cerebellar tonsillar herniation, intracranial haemorrhages, cranial nerve palsies and cerebral vasospasm. The CSF erodes the bone graft and hinders fusion. CSF leaks are a common cause of Medico-legal malpractice suits against surgeons [9].

**Diagnosis of dural tears:**

Most of the dural tears are noticed intra-operatively as clear fluid. Only some are diagnosed post-operatively as clear

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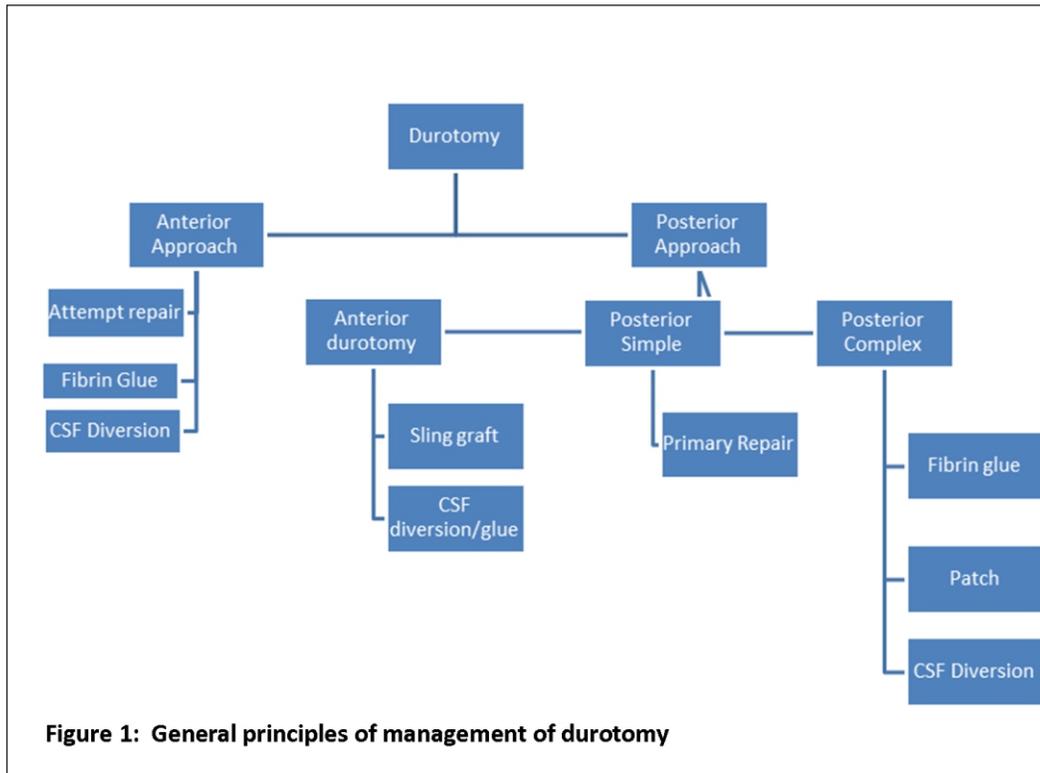
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muscle patch is easier with interrupted suturing technique. Additional sealing can be done with the help of fibrin glue over the dural repair, although not necessary if water tight closure of the dural layer has been achieved. In a literature review Epstein compared four different types of spinal sealants and found Tisseel (fibrin glue) to be the safe [10]. A Valsalva's maneuver should be done to check for integrity of the repair. In the event that the dural margins are ragged and cannot be approximated, then dural patch may be used to substitute the defect. Alternatively, the dura can be left un-repaired making sure that the CSF is diverted away from the wound though a drain or a sub arachnoid lumbar CSF drain. The wound drain may be tunneled through the subcutaneous layer rather than direct 'head on'

fluid in drain or through the wound. Patients often complain of postural headache which is pathognomic. Other patients with recent surgery may develop wound swelling that may increase with Valsalva's maneuver. MRI is the investigation of choice, although all patients do not need it. Those with neurological symptoms and CSF leak, suspicion of infection/meningitis undergo an MRI. A pseudomeningocele with its 'stalk' directed towards the dura helps to differentiate from a seroma apart from the signal characteristics. CT myelography is an alternative when MRI is not feasible or when instrumentation is suspected to be the cause of CSF leak.

### Management

Dural rents have to be closed primarily whenever possible. CSF outflow releases the tamponade effect on the epidural veins leading to brisk epidural bleeding. Blood in the CSF is a risk factor for late arachnoiditis and hence all efforts should be taken to reduce bleeding. Great care should be taken to avoid rootlets being sucked into the

suction system. It helps to reduce the suction pressure and having the assistant pinch kink the suction tubing to block the suction immediately in case of entrapment. At times the rent margins are ragged and may not approximate. Pulling up the margins to approximate may lead to iatrogenic stenosis and should be avoided. Not uncommonly, there is a breach in the dural layer with pouting of the intact CSF filled arachnoid layer. These rents must be repaired to avoid root entrapment. Full thickness dural tears with CSF outflow are best addressed by primary suturing. A round body needle is preferred to prevent CSF leak from the needle entry point. For the same reason, the needle diameter should be smaller than the suture diameter. Monofilament sutures should be avoided as they are difficult to handle due to filament memory and the knot tends to slide and unfurl. Both interrupted and continuous techniques with non-absorbable suture material are recommended. We prefer to use simple continuous suturing technique with 5-0 silk with a muscle patch. Incorporation of the

puncture, to allow it to self-collapse when removed. In principle, the diversion has to be maintained till the surgical wound has healed adequately, usually 4 to 7 days, to contain the CSF. In the ward the patient should be kept supine, preferably in head low position (not well tolerated by patients), for 24 to 72 hours and the CSF output in the drain should be monitored every 24 hours. It is safe to remove the drain when the CSF output is less than 100ml in 24 hours. In case of CSF leak from the drain site/wound site, additional stitch may be taken in the ward to achieve water tight closure. Use of anti-secretory drugs (Acetazolamide) is controversial.

### Clinical Message

Dural tears and CSF leaks are not uncommonly found in spine surgery. These are known to discomfort the patient in the post-operative period, taking attention away from an otherwise well performed surgery. Optimal management with minimal discomfort and maximum counseling of the patient is essential.

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