Intermittent Lumbar Drainage as a Viable Treatment Option for Cerebrospinal Fluid Rhinorrhea Complicating Pituitary Surgery

P Ganjoo, S Sejwal, S Sinha, M Tandon, D Daljit

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Abstract

Cerebrospinal fluid (CSF) rhinorrhea is a known complication of pituitary surgery. CSF diversion, either by continuous lumbar drainage or by serial lumbar punctures, is one of its treatment methods. But complications like over-drainage syndromes and infections are reported with continuous drainage and serial punctures can be uncomfortable for the patient. To avoid these problems, we drained CSF intermittently via indwelling subarachnoid catheters in 11 patients who had developed CSF rhinorrhea after pituitary surgery. CSF was aspirated twice daily via an epidural catheter placed in the subarachnoid space. Each time approximately 30-40 ml of CSF was aspirated over 15-20 minutes. The technique was successful in 10 out of 11 patients treated (91%). CSF leaks stopped within 2-4 days of drainage and the total duration of catheterization was 4-6 days. In 2 patients, blockage of catheter required reinsertion. No patient developed complications of over-drainage or meningitis. Intermittent lumbar drainage is a feasible non-operative alternative to re-operation and dural repair for the treatment of CSF rhinorrhea. The risk of developing serious side effects seen with continuous drainage may be avoided with this method and it requires only minimal support staff for management.

INTRODUCTION

Cerebrospinal fluid (CSF) rhinorrhea is a known complication of skull base surgery, seen most often after transnasal transsphenoidal pituitary surgery (TNTS) with a reported incidence of 0.5 to 15%.[1,2] Meningitis is the most frequent and severe complication of a CSF leak with a reported risk of up to 10% in the first 3 weeks and necessitates early closure of the fistula.[3,4] Lumbar drainage of CSF is a well known method of closure; continuous drainage is used more commonly than serial lumbar punctures.[3] However, over-drainage syndromes and infections have been reported with the continuous method,[5,6] and serial lumbar punctures are distressing for the patient besides being cumbersome to perform. To obviate the need for repeated punctures, we have started using indwelling lumbar subarachnoid catheters for intermittent drainage of CSF. We describe here our initial experience with this technique for the treatment of postoperative CSF rhinorrhea following surgical excision of pituitary tumors in 11 patients at our hospital.

CASE REPORTS

Surgical removal of pituitary tumors was undertaken in 76 patients (TNTS in 57 and craniotomy in 19 patients) between April 1, 2005 and March 31, 2007. Seventeen patients developed postoperative CSF rhinorrhea, out of which 6 patients responded to conservative management with bed rest and oral acetazolamide (250 mg three times a day). The remaining 11 patients who did not respond to this treatment within 72 hours were subjected to intermittent lumbar drainage (Table 1).

Lumbar catheterization, done in accordance with the ethical standards of our institute, was performed by a consultant anesthesiologist at the patient's bedside. After a written informed consent, the patient was placed in the lateral decubitus position, the lumbar region was prepared and 2 ml of 2% lignocaine was given for local anesthesia. A 16 G Touhy needle from a Perifix epidural set (Braun, Melsungen AG , Germany), was inserted through the L3-L4 interspace in midline till it was felt to penetrate the duramater. Following an outflow of CSF, an 18 G epidural catheter was advanced cephalad through the needle and 4-5 cm of its

length was placed inside the subarachnoid space. The needle was withdrawn and the distal end of the catheter was attached to an epidural flat filter which was secured within a sterile plastic bag and taped securely over the anterior chest.

CSF was aspirated twice daily (in the morning around 7 am and in the afternoon around 2 pm). Taking strict aseptic precautions, CSF was slowly aspirated with a 2 ml syringe till it came out freely. Approximately 30-40 ml of CSF could be removed over a period of 15-20 minutes every time. After each aspiration, 8.0 mg gentamicin was instilled intrathecally and the catheter flushed with 2 ml of sterile heparinized saline to prevent blockage. The aspirated CSF was sent daily for culture, cell count and biochemistry to detect any infection. Antibiotics were administered prophylactically during the entire drainage period. Though the patients were not strictly confined to bed, their movements were restricted.

Once the leak stopped visibly, CSF aspiration was continued for one more day. Thereafter, no more CSF was removed for the next 24 hours and if the fistula remained closed, the catheter was removed. Treatment was considered unsuccessful if the fistula failed to close or reopened within 7 days of drainage necessitating surgical repair or placement of a permanent shunt (ventriculo-peritoneal or theco-peritoneal shunts). The patients were also observed for procedure- related complications like over-drainage syndrome and meningitis and for catheter related mechanical problems like nerve-root irritation or injury and catheter occlusion. When detected, these complications were managed with appropriate methods.

Lumbar CSF drainage was successful in 10 out of the 11 patients treated (91%). Visible cessation of CSF leak was observed within 2-4 days of starting aspiration and the total duration of catheterization was 4-6 days. None of the treated patients has had a recurrence of CSF rhinorrhea. In one patient, lumbar drainage was discontinued as she developed transient weakness of both lower limbs following insertion of catheter. The weakness resolved within 24 hours of catheter removal and this patient subsequently underwent surgical closure of the fistula. In 2 patients (20%), the catheters got blocked on the second day and had to be replaced. One patient developed mild headache after CSF aspiration which got relieved with bed rest without the need for analgesics. No patient developed nausea, vomiting, fever, signs of meningitis or any serious manifestations of over-drainage syndrome (Table 1). CSF investigations were normal in all patients.

DISCUSSION

Management of postoperative CSF rhinorrhea can often be problematic. Though a CSF leak may close spontaneously after 1-2 weeks of conservative treatment with bed rest and acetazolamide, many neurosurgeons prefer to intervene early to expedite closure in view of the high mortality rate associated with post-leak meningitis.[3] Surgical intervention with direct dural repair is the ideal closure option, but involves major redo surgery without guaranteed success. Accurate localization of the fistula may be difficult at times and the leak may persist even after multiple operations.[7] Lumbar subarachnoid drainage of CSF is a feasible non-operative alternative to surgical repair that permits spontaneous healing of the fistula. Due to the CSF diversion and concomitant decrease in intradural pressures secondary to drainage, early contraction and healing of the fistula can be achieved.[8]

The continuous, gravity- dependent system is the most commonly used lumbar drainage method with a reported success rate of 83 to 100% of closing CSF leaks within 5-10 days of drainage.[5691011] Though efficacious, this system can result in an unpredictable drainage and widely fluctuating drainage rates of 60 to 600 ml/day have been reported with its use.[8] The rate of drainage by this method is directly dependant on the placement of the drainage chamber in relation to the patient and any error in positioning can lead to under-drainage with persistent leaks or over-drainage with serious consequences.[12]

Excessive and rapid CSF drainage that can inadvertently happen with this method can lead to pneumocephalus due to simultaneous siphoning in of air through fistulas that are communicating with air sinuses.[1113] Tension pneumocephalus is a life-threatening situation necessitating urgent drain clamping and percutaneus needle aspiration.[51415] Other serious over-drainage complications reported with the use of continuous drainage include intracranial hemorrhage, development of subdural hematoma, brain stem compression and acute herniation of the tonsil resulting in occlusion of the posterior cerebral artery and vocal cord paralysis.[5111316] To keep the drainage rate constant, flow-regulated continuous drainage systems have also been devised.[1217] Though effective in closing CSF leaks (86 % success rate), tension pneumocephalus has been reported with one of these systems.[12] Transient headaches, nausea and vomiting are

milder manifestations of over- drainage with a reported incidence of 58-62% with the gravity-dependant method[5,10,16] and 4.8 % with the flow regulated system.[12] High drainage rates of 300-400 ml/ day have been blamed for these complications[5,10,12] and it is recommended to keep the drainage rate less than 5-10 ml/ hour[12] or not more than 150 ml/ day.[3] Bed rest, analgesics and anti-emetics are usually sufficient for treatment.

Early intervention by lumbar drainage has been shown to reduce the risk of meningitis after CSF leaks.[18] Yet, serious meningitis with an incidence of 2-10.5 % is reported with the gravity-dependant continuous drainage system.[5,9,10,19] It has been suggested that excessive drainage, which could happen with this method, can cause a reversal of CSF flow gradient and subsequent induction of infections into the subarachnoid space.[3] Close observation for early signs of infection[10] and preferably, use of prophylactic antibiotics[5,12] are advocated during lumbar drainage.

Thus, to prevent these complications of over-drainage and infections, meticulous attention to the gravity-dependant continuous draining system is necessary. This would require round-the- clock monitoring and nursing care of the drainage system[20] which is not always feasible due to the persistent shortage of medical staff faced by many hospitals. The flow-regulated system[12] is complex, requires a special set-up and any mistake can result in improper drainage-circuit connections with disastrous consequences like large saline infusions into the subarachnoid space or rapid egresses of CSF with pneumocephalus.[21] These concerns with the continuous systems prompted us to use the intermittent drainage technique for treating CSF rhinorrhea at our hospital.

Our intermittent lumbar drainage involves aspiration of limited amounts of CSF only twice in 24 hours. It is known that CSF production follows a circadian variation with maximum formation late at night. This may be responsible for possibly higher intradural pressures and greater CSF leaks in the mornings.[22] Hence aspiration was done as soon as the patient woke up in the morning, repeated once in the afternoon and thereafter no more CSF was removed till next morning. By limiting drainage only to periods of possibly higher intradural pressures instead of draining continuously, the serious side effects of continuous drainage could be avoided while complete closure of the fistulae could be achieved. Though it has been hypothesized that intermittent drainage can create highs and lows of CSF flow which could prevent fistulas from closing,[12] we have successfully treated 10 out of 11 patients (91%) of CSF rhinorrhea within 4-6 days of catheterization. Complications like over-drainage and meningitis are less likely with this method as excessive drainage and CSF flow reversal is avoided. This technique does not require continuous supervision and can be managed with a minimal support staff. Further, chances of deep vein thrombosis (DVT) with intermittent drainage are less because patients are not confined to bed like in the gravity-dependent continuous drainage system.[23]

Mechanical problems related to catheter insertion can occur irrespective of whether the method of drainage is continuous or intermittent. Transient lumbar nerve root irritation from the use of large diameter silicone catheters was described in14% patients in one report.[5] One of our patients also developed temporary weakness of the lower limbs. Prompt removal of the catheter is advocated to allow early resolution of symptoms. Catheter blockage with debris can occur necessitating multiple re-insertions. Blockage is lesser with silicone catheters (5%) and polyethylene catheters (10%) [9] than with teflon catheters (33%).[5] Following catheter blockage in 2 of our patients, we now routinely flush our catheters with heparinized saline after each aspiration.

We feel intermittent lumbar drainage for postoperative CSF leak is an effective and safe treatment option where the serious complications of continuous drainage and the difficulties in performing serial lumbar punctures are avoided. This non-operative course should be tried before undertaking re-operation and dural repair. As more patients get treated by this method, a clearer picture regarding its efficacy and complication rate should emerge.

Figure 1

Table 1: Efficacy and Complications of Intermittent Lumbar drainage

Patient	Age	Sex	Diagnosis	Operation	Duration of CSF leak (days)	Duration of catheterization (days)	Complications
1	45	M	Pituitary adenoma	Craniotomy and tumor removal	3	5	None
2	31	F	Pituitary adenoma	TNTS	4	6	Catheter blocked, reinserted
3	38	M	Sellar meningioma*	Craniotomy and tumor removal	3	5	Catheter blocked, reinserted
4	40	F	Pituitary adenoma	TNTS	2	4	None
5	30	F	Pituitary adenoma	TNTS	3	5	None
6	35	M	Pituitary adenoma	TNTS	2	4	Mild headache
7	34	F	Pituitary adenoma	TNTS	-	-	Transient weakness in lower limbs, catheter removed
8	50	F	Pituitary adenoma	TNTS	3	5	None
9	35	F	Pituitary adenoma	TNTS	4	6	None
10	38	F	Pituitary adenoma	TNTS	4	6	None
11	44	M	Pituitary adenoma	TNTS	3	5	None

*Diagnosed after surgery

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Author Information

Pragati Ganjoo, DA, DNB
Department of Anaesthesiology & Intensive Care, GB Pant Hospital

Shikha Sejwal, MD
Department of Anaesthesiology & Intensive Care, GB Pant Hospital

Sanjiv Sinha, MCh
Department of Neurosurgery, GB Pant Hospital

Monica S. Tandon, MD
Department of Anaesthesiology & Intensive Care, GB Pant Hospital

Daljit Singh Daljit, MCh
Department of Neurosurgery, GB Pant Hospital