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The Impact of Post-Spine Surgery Sandbag Pressure on Cerebrospinal Fluid Leakage

Hussein Imran Mousa

M.B.Ch.B, F.I.B.M.S (Neurosurgeon)

Neurosurgery Department, Alsadr Teaching Hospital, Basrah, Iraq

Email: hussain_badran@yahoo.com

ABSTRACT

One of the most well-known side effects of lumbar spine surgery is dural tears, which can be successfully treated using a variety of methods. Some of the procedures include primary repair, closed subarachnoid drainage, tissue grafting, fibrin-adhesive closure, and bed rest. A new strategy of preventing Cerebrospinal fluid (CSF) leak is employed in this study, which includes post-operative sand bag pressure. Evaluation use sand bag to preventing postoperative CSF leak in lumbar spine surgeries. A prospective study 96 patients at the Hospital. Student t-test and Chi-squared or Fisher Exact's tests used for CSF leak following various lumbar spine surgeries. Between March 2006 and March 2010, 52 patients were treated using standard treatments, and between March 2010 and March 2013, 44 patients with a post-operative CSF leak were treated with sand bag pressure. Patients in the traditionally treated group mean age 28.33, male to female ratio 11:2, (13.5 percent) ceased CSF leaks on the first day, but those in the post-operative sand bag pressure group mean age 31.32, male to female ratio 10.6:2, (68.2 percent) ceased CSF leaks on the first day. In terms of post-operative complications, the classically treated group had headache (55.7 percent), photophobia (25.0 percent), nausea (32.7 percent), vomiting (15.4 percent), meningitis (5.8 percent), and revision surgery (9.6 percent), whereas the post-operative sand bag pressure group had headache (20.5 percent), photophobia (9.1 percent), nausea (11.4 percent), vomiting (2.3 percent), meningitis (2.3 percent), and revision surgery (0 percent). Sand bag pressure is a great way to shorten the length and severity of a CSF leak.

Keywords: Sandbag, CSF leak, dural tears, vertebral fracture, meningitis.

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1. INTRODUCTION

One of the most known complications of spine surgeries is a dural tears with postoperative CSF leak, which can be difficult to repair. The incidence of durotomy-induced CSF leak varied with different spinal procedures. Cerebrospinal fluid (CSF) leak can be spontaneous (primary) or nonspontaneous (secondary) [1]. The reported incidence of CSF leak requiring intervention after spinal tumor surgery varies widely (0–28.6%) (3-5, 47-67). If handled improperly, it may lead to a number of adverse sequelae, such as CSF fistulas (persistent leak through the incision), meningitis, brain abscess, intracranial hemorrhage, hematoma and neurological deficits [2,3]. All treatment approaches were classified into two groups based on fluid flow mechanics: 1) stopping CSF leak by direct suture or augmented closure with dural substitute material 8-15; 2) retarding CSF leak by reducing the subarachnoid fluid pressure and/or increasing the epidural space pressure [4-7]. Because the study included a limited number of patients, it was challenging to assess the effectiveness of various therapy; nonetheless, the authors advised for a combination of these strategies [6-9].

To minimize meningitis and the formation of pseudocysts, those authors recommended meticulous repair of all durotomies sites, as well as avoiding the use of subfascial drains in the postoperative period to avoid cutaneous fistula formation. The use of bed rest alone was shown to be unsuccessful [8,9].

In this study select sand bag used to preventing postoperative CSF leak in lumbar spine surgeries.

Ethical measures: This study was conducted in compliance with the ethical principles in the Declaration of Helsinki regarding biomedical research on human subjects and with standard informed consent regulations. Prior to study initiation, the investigators obtained Institutional Review Board's approval.

2. MATERIALS AND METHODS

Prospective study for 96 patients admitted to the Neurosurgery Division of the Hospital, a postoperative CSF leak was detected for 6 months duration between March 2006 and March 2013.

Selected patients those with CSF leaks following various lumbar spine procedures, including decompression laminectomy, minotomy, spine fixation due to trauma or degenerative process, and intraspinal tumors Table1.

Eclusion criteria patients below 14 years, scoliosis, myelomeningocele, and others congenital spinal deformity.

Table 1. Distribution of the study patientsbycause of CSF leak

Type of surgery		Group 1	Group 2
1	Decompression laminectomy	10	7
2	Decompression laminectomy with discectomy	14	10
3	Foraminotomy	6	11
4	Intraspinal tumor	5	7
5	Fixation trauma	8	6
6	Fixation degenerative disease	9	3
	Total	52	44

P-value = 0.341

The sample size divided into two group, traditional therapies (group 1) had 52 patients mean age 28.33, male to female ratio 11:2, while those used post-operative sand bag pressure (group 2) 44 patients mean age 31.32, male to female ratio 10.6:2 Table 2.

Table 2. Distribution of the study patients by group of treatment, mean age and sex

Group	Age/ years Mean	Sex		Total
		Male	Female	
Group 1	28.33	44	8	52
		84.6%	15.4%	100.0%
Group 2	31.32	37	7	44
		84.1%	15.9%	100.0%
Total		81	15	96
		84.4%	15.6%	100.0%
P-value	0.242	1.000		

3. STATISTICAL ANALYSES

The following tests were used for statistical analysis:

- Student t-test was used to compare the difference in the means of number of days of CSF leaks and postoperative complications.
- Chi-squared or Fisher Exacta's tests were used to compare the differences in the postoperative complications, included: headache, photophobias, nausea, vomiting, meningitis, and revision surgery between classical and sand bag groups.

The traditional treatment in group one used 4-0 or 5-0 silk interlocking suture, Gelfoam over the repair site (with or without Gelfoam), a subfascial closed suction wound drain, and a multilayer closure were used to heal dural tears. Rest in bed. There was no fibrin adhesive or dural closure utilized. In the second group, in addition to the identical treatment as the first group, all forty-four patients with a post-operative CSF leak were treated by placing a one-kilogram of sand bag in prone position at the location of the CSF leak. During this period, the patient is allowed to move into a comfortable posture, eat, drink, and go to the bathroom Fig. 1.

Figure 1. Sandbag put on comfortable position

The researcher followed the rule below during the management course: [Number of days for applying the sand bag = Number of days need for CSF leak to be stop after when applying sand bag + one] e.g. patient had CSF leak stopped one day after applied salt bag plus one day, so kept the patient with bed rest and salt bag pressure for two days [10].Positional headaches, photophobia, nausea and vomiting, apparent wound drainage, or meningitis were all documented and closely watched in both groups until they were treated.

4. RESULTS

Patients in both groups had a variable onset of CSF leak between 1- 13 days post opearatively. Acute CSF leak refers to a leak occurs within less than 3 day post-operative, subacuteleak occurs between 3-7 days (usually follow subcutaneous drain removal) and delay CSF leak occurs more than 7days after stitches removal. Table 3.

Table 3. Distribution of the two management groups according to the onset of leak.

Group	Onset of CSF leak			Total
	< 3 days	3 to 7 days	> 7 days	
Group 1	28	10	14	52
	53.8%	19.2%	26.9%	100.0%
Group 2	25	26	13	44
	56.8%	13.6%	29.5%	100.0%
Total	53	16	27	96
	55.2%	16.7%	28.1%	100.0%

P-value= 0.762

Seven patients in the conventionally treated group ceased CSF leaks on the first day, ten on the second day, and 35 took more than two days to halt the leak. Thirty patients in the postoperative sand bag pressure group ceased CSF leaks on day one, twelve on day two, and two took more than two days to stop the leak. Table 4.

Table 4. Distribution of the two management groups according to the day of leak stop

Group	Day to stop of CSF leak			Total
	One day	Two days	More than two days	
Group 1	7	10	35	52
	13.5%	19.2%	67.3%	100.0%
Group 2	30	12	2	44
	68.2%	27.3%	4.5%	100.0%
Total	37	22	37	96
	38.5%	22.9%	38.5%	100.0%

P-value= 0.0001

In group one, 29 patients developed headache, 13 patients developed photophobia, 17 patients developed nausea, 8 patients developed vomiting, 3 patients meningitis, and 5 patients from them required reparation. Most of the symptoms took several days to resolve after the stop of CSF leak in spite of the use of conservative measures, non-narcotic and narcotic analgesia for headache, and intravenous fluid for photophobia, nausea, and vomiting. Revision surgery was done for 5 patients when CSF leak had not decreased after 5 post-operative days or untreatable complications Table 5.

In group two, 9 patients in the post-operative sand bag pressure group suffered headaches, and 4 individuals had photophobia. Those symptoms vanished as soon as the sand bag pressure was applied. Five patient had nausea. One patient developed drowsiness, repeated vomiting, hypotension in the first post-operative day with stop of CSF leak. His brain CT scan was normal. The patient was given1 litter intravenous normal saline, and his symptoms resolved within eight hours. Two weeks after using the salt bag, one patient developed signs of atypical meningitis. This patient did not have any CSF fluid leaks and was eventually identified with viral meningitis, which recovered without further complications Table 5. All of the patients had great outcomes. As a result of the procedure, no patient experienced a neurological impairment or an increase in lower extremity indications.

Table 5. Distribution of the two management group according to the post operative complications.

Group	Headache	Photophobia	Nausea	Vomiting	Meningitis	Revision surgery
Group 1	29	13	17	8	3	5
	55.8%	25.0%	32.7%	15.4%	5.8%	9.6%
Group 2	9	4	5	1	1	0
	20.5%	9.1%	11.4%	2.3%	2.3%	.0%
P-value	0.001	0.077	0.026	0.036	0.622	0.06

5. DISCUSSION

Following spine surgery, establishing a watertight dura mater closure is crucial, since post-operative CSF leaks can result in medical issues, longer hospital stays, worse quality of life, and greater expenditures. Due to increased hydrostatic pressure induced by gravity while patients are sitting upright, CSF leaks are more likely in the infratentorial and spinal portions of the brain than in the supratentorial area [11,12].

Although a variety of methods were used for the management of CSF leak, including direct suturing, percutaneous injection, drainage therapy, and blood patch, there are still some cases required surgical repair by either meticulous direct primary closure of the dura or augmented closure by means of fat, muscle tissue, or a fascia graft [13-17].

In this study, there were no significant difference in age, sex, and type of surgery between two groups (P-value 0.242, 1.000 and 0.341 respectively), while the application of sand bag pressure to stop CSF leak was found to be highly significant (P-value= 0.0001) in decreasing time of post-operative CSF leak. Like sandbags use to stopping water leak below levees Fig. 2, the sandbag increasing extra dural pressure prevents CSF leak and lead to subsequent healing in a short time with less complication as compared to patients treated without any applying and bag pressure.

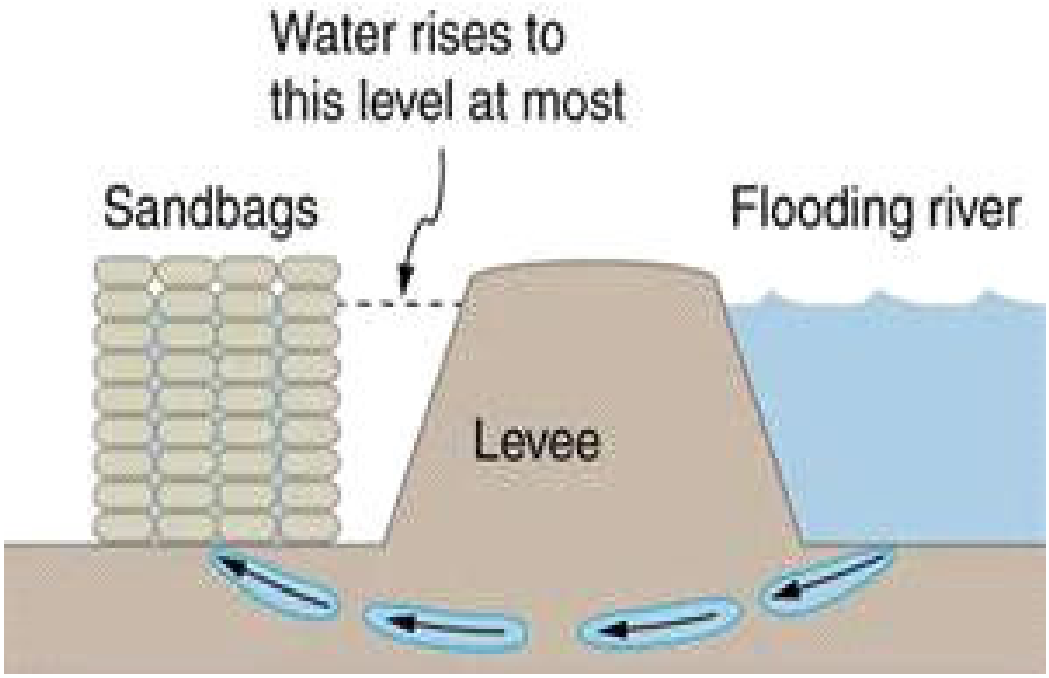

Figure 2. The most success method to stopping water leak below levees is sandbags

Early CSF leak less than 3 days from the enterance of the subfascial drain is usually mild and stopped immediately when was salt bag applied, while delay leak especially after removal of the stitches, was so severe and required more time with salt bag to be stopped.

Regarding the complications following CSF leak, the post operative sand bag pressure was found to be statically significant in decreasing headache, nausea, and vomiting (P-value = 0.001 , 0.026 and 0.036) respectively. Photophobia might be very sensitive to decrease intracranial pressure, so it is not statically significant (P-value = 0.077). In classically treated group, 3 patients developed atypical meningitis and 5 revision surgery, while in post-operative sand bag pressure group, only one patient atypical meningitis and no one required revision surgery, but this was statistically not significant (P-value = 0.622 and0.06). This is probably because of the small number of the patients who developed these two complications.

The long-term prognosis for the forty-four patients in Group 2 was excellent. There were no neurological abnormalities in any of the patients, and none had elevated symptoms in their lower extremities, radiculopathy, or discomfort as a result of the procedure.

The present concept of the squeale and its therapy is based on a few small studies with a small number of individuals. More patients are needed to draw more substantial conclusions concerning the clinical course and final result when a dural rupture occurs after a lumbar spine operation [18,19].

6. CONCLUSIONS

Application of the sand bag pressure was decreases postoperative CSF leaks complications and bed-ridden as sequences of early stopped CSF leaks. It's safe, cheep, can do at home. The long-term prognosis for the forty-four patients in Group 2 was excellent. More patients are needed to draw more substantial conclusions concerning the clinical course. Gender variations were not considered in the present study.

Compliance with Ethical Standards

Conflict of Interests

The authors declare that they have no conflict of interest.

Ethical Approval

Not Applicable

Informed Consent

Not Applicable

Author Contribution The present submissions represent original work. The present work doesn't being considered for publication elsewhere in any other form. Also, the author aware of this submission and they contributed to this work.

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