

Incidental Dural Tear in Lumbar Spine Surgery: A Prospective Study

Pravin P Bande¹, Sourav Garnaik², Rajiv V Kulkarni^{3*}, Sagar Wajekar⁴ and Tejal Kothmire⁵

¹Head of the Department, Department of Orthopaedics, Bhabha Atomic Research Centre (BARC) Hospital–Medical Division, Anushakti Colony, Chembur, Mumbai

²PG Trainee, Department of Orthopaedics, Bhabha Atomic Research Centre (BARC) Hospital–Medical Division, Anushakti Colony, Chembur, Mumbai

³Senior Resident, Department of Orthopaedics, Bhabha Atomic Research Centre (BARC) Hospital–Medical Division, Anushakti Colony, Chembur, Mumbai

⁴Consultant, Department of Orthopaedics, Bhabha Atomic Research Centre (BARC) Hospital–Medical Division, Anushakti Colony, Chembur, Mumbai

⁵Statistician, KJ Somaiya Hospital and Research Centre, Mumbai

*Corresponding author

Rajiv V Kulkarni, Senior Resident, Department of Orthopaedics, Bhabha Atomic Research Centre (BARC) Hospital–Medical Division, Anushakti Colony, Chembur, Mumbai.

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Abstract

Introduction: Incidental dural tear is a complication of spinal surgery characterized by an accidental nick of the spinal dural sheath during operative procedures. The worldwide incidence of dural tear according to previous literature varies widely (1-17%) and in general depends on the type and complexity of the procedure. The present was carried to evaluate the incidence of dural tear in lumbar spine surgery, and to study clinical outcomes in terms of VAS score ODI score and length of hospital stay. **Methods:** This was a prospective, observational and case control study conducted on 40 patients who underwent elective Lumbosacral spine surgery. The incidence of dural tear was evaluated and the patients were divided into with dural tear and without dural tear. The clinical outcome such as visual analogue scale (VAS) score, Oswestry Disability Index (ODI) score and length of hospital stay were evaluated.

Results: The incidence of Dural tear in our study population was found to be 7.5%. The ODI score was significantly higher in dural tear as compared to without dual tear at various postoperative periods. Further, there was no significant difference in the VAS scores with and without dural tear patients. The length of hospital stay was significantly higher in patients with dural tear as compared to without dural tear (11.63±6.19 vs 3.06±1.02 days; $p=0.004$).

Conclusion: Incidental Dural tears if detected and managed accordingly, adverse clinical and postoperative outcomes can be reduced effectively and also increases the quality of life in patients.

Keywords: Lumbar spine surgeries, Incidental dural tear, Oswestry Disability Index, Visual analogue scale

Introduction

Incidental dural tears (IDT) is one of the widespread complication during spine surgery and the incidence ranges from 1.6-10% [1, 2]. The major risk factor for IDT is revision surgery reported in many literatures, but the other clinical and demographic risk factor

such as diabetes, age and sex have not displayed profound association [3]. In addition, anatomical variations (bony protuberances ligamentum flavum ossification), adhesions and fibrosis, surgical method, surgeon's expertise, the decompression intensity, complex interventions are also the risk factors in the progression of IDT [4]. In the case of lumbar decompression surgery, there exists a varying

range of iatrogenic dural tears from 1-17% during varies and ranges from 1 to 17% [5]. The clinical outcome of dural tear encompasses headache, formation of pseudocyst in meningitis, fistulas in dural matter which preludes to arachnoiditis, delayed healing of wounds and infection. Further, the clinical consequences associated with prolonged bed rest during dural tears include pneumonia, pressure ulcers, deep vein thrombosis, pulmonary embolism and aspiration. In this backdrop, the present study was carried out to evaluate the incidence of iatrogenic dural tear in elective lumbar spine surgery and correlated with length of stay. Further, the clinical outcomes in terms of Oswestry Disability Score (ODS), visual analogue scale core at immediate post-operative period, 1 month and 3 months post-operative were also evaluated.

Materials and Methods

Patient Population

This was a prospective, observational and case control study performed on 40 patients who underwent elective Lumbosacral spine surgery for a period of two years between 2018-2020. The study was carried out at Department of Orthopaedics, BARC Hospital, Anushaktinagar, Mumbai. Patients of all age group and gender undergoing elective lumbar spine surgery were included in the study. Patients undergoing cervical and thoracic spine surgeries and previous history of lumbar spine surgery were excluded from the study.

Study Design

Any dural tears which occurred inadvertently during surgery were recorded. Among the study population, those with IDT were designated as the with IDT group. An age- and gender-matched group of randomly selected patients who underwent the same level and type of lumbar spine surgery with similar indications, but did not develop IDT were included as the without IDT group. Intraoperative localization of sites of the dural tear was done along with their classification. Intraoperative modes of management of dural tear were noted. Length of hospital stay was noted for each pa-

tient who underwent lumbar spine surgery. Post-operative ward management was carried out and clinical outcomes measured in terms of Oswestry Disability Index and Visual Analogue Scale at immediate, 1 month and 3 months postoperative.

Statistical analysis

Quantitative variables were compared using unpaired t-test/Mann-Whitney test and qualitative variables were correlated using Chi-square test/Fisher's exact test. A p-value of less than 0.05 was considered significant. The data was entered in MS Excel spreadsheet and statistical analysis was done using Statistical Package for Social Sciences (SPSS) version 23.0.

Results

A total of 40 patients were recruited in this study and among these 65% were males and 35% were females. Male preponderance was observed in the present study. The prevalence of IDT in this study was 7.5%, out of 40 patients only 3 cases of IDT was observed. In patients with IDT no comorbidities were present. In patients with IDT, multiple dural tear was present in 2 patients and single dural tear was present in one patient. Among the different operative procedures, all the dural tears were observed in decompression.

The overall Visual analogue scale core and Oswestry Disability Index score among the patients who underwent lumbar spine surgery at immediate, 1 month and 3 months post-operative period were shown in table 1. The mean VAS score at immediate, 1 month and 3 months post-operative period were found to be 2.4 ± 0.78 , 1.47 ± 0.51 and 1.02 ± 0.16 respectively. The VAS score was significantly decreased in 1 and 3 months as compared to immediate post-operative ($P < 0.0001$). The mean ODI score at immediate, 1 month and 3 months post-operative period were found to be 27.3 ± 6.55 , 18.4 ± 5.13 and 11.22 ± 1.17 respectively. The ODI score was significantly decreased in 1 and 3 months as compared to immediate post-operative ($P < 0.0001$).

Table 1: Comparison of VAS and ODI scores at different post-operative periods.

Overall outcome (n=40) (mean \pm SD)	Post-operative period		
	Immediate	1 month	3 months
VAS score	2.4 ± 0.78	1.47 ± 0.51 ^{Va*}	1.02 ± 0.16 ^{Va*,VbNS}
ODI score	27.3 ± 6.55	18.4 ± 5.13 ^{Oa*}	18.4 ± 5.13 ^{Oa*,Ob*}

V= VAS score, O=ODI score. a- comparison between immediate vs 1 and 3 months postoperative, b- comparison between 1 vs 3 months postoperative. * denotes statistically significant $p < 0.05$, NS-non significant.

In this study, there was no significant difference between mean VAS score in patients with and without Dural Tear at Immediate (2.67 ± 1.53 vs 2.38 ± 0.72 ; $p = 0.56$) and 1-month post-operative period (1.67 ± 0.58 vs 1.46 ± 0.51 ; $p = 0.51$). The results were shown in table 2.

Further there was no significant difference between mean decrease in VAS score from Immediate to 1-month period (1 ± 1 vs 0.92 ± 0.63 ; $p = 0.88$), from Immediate to 3-month period (1.33 ± 1.15 vs 1.38 ± 0.78 ; $p = 0.91$) and from 1-month to 3-month period (0.33 ± 0.58 vs 0.46 ± 0.51 ; $p = 0.69$) in patients with & without Dural Tear.

Table 2: Comparison of VAS scores between with and without dural tear patients at different post-operative periods

Outcome	With Dural tear (n=3)			Without Dural Tear (n=37)		
	Immediate	1 month	3 months	Immediate	1 month	3 months
VAS Score	2.67 ± 1.53 ^{aNS}	1.67±0.58 ^{bNS}	1.33±0.58	2.38±0.72	1.46±0.51	1±0.00

Comparison were made between a- Immediate (with vs without dual tear), b- 1 month (with vs without dual tear). NS-Non significant (Mann–Whitney U test).

The mean ODI score in patients with dual tear was significantly higher as compared to patients without dual tear at immediate postoperative (42.67 ± 4.04 vs 26.05± 4.93; p=0.004) and 1 month postoperative (31 ±6.08 vs 17.38 ±3.49; p=0.005). Meanwhile

there was no significant variation in the ODI score at 3 months post-operative period between with and without dual tear (12±0.00 vs 11.16±1.19). The results were shown in table 3.

Table 3: Comparison of ODI scores between with and without dural tear patients at different post-operative periods

Outcome	With Dural tear (n=3)			Without Dural Tear (n=37)		
	Immediate	1 month	3 months	Immediate	1 month	3 months
ODI Score	42.67 ± 4.04 ^{a*}	31 ±6.08 ^{b*}	12±0.00	26.05±4.93	17.38 ±3.49	11.16±1.19

Comparison were made between a- Immediate (with vs without dual tear), b- 1 month (with vs without dual tear). * Statistically significant (Mann–Whitney U test).

Further there was no significant difference between mean decrease in ODI score from Immediate to 1-month period (11.67±2.08 vs 8.68±4.00; p=0.18), from Immediate to 3-month period (30.67±4.04 vs 14.89±5.08; p=0.004) and from 1-month to 3-month period (19.00±6.08 vs 6.22±3.71; p=0.006) in patients

with & without Dural Tear.

The length of stay was significantly higher in patients with dual tear as compared to patients without dual tear (11.63±6.19 vs 3.06±1.02; p=0.004). The results were shown in table 4.

Table 4: Comparison of mean length of stay between with and without dural tear patients

Outcome	With Dural tear (n=3)	Without Dural Tear (n=37)	P-value
Length of stay (in days)	11.63±6.19	3.06±1.02	0.004

Discussion

The incidence of incidental dural tear in our study in patients undergoing lumbar spine surgery is reported to be 7.5 %. Further, in patients with dural tear the post-operative VAS and ODI score was significantly higher as compared to the patients without dural tear. A previous large cohort study involving degenerative lumbar procedures the incidence of IDT is 7.6% for primary surgery and in the case of revision surgery is 15.9% [6]. In another study encompassing a series of 553 patients for four years who had underwent degenerative lumbar spinal stenosis, traumatic lumbar vertebral fractures, spinal tumors, and lumbar spondylolisthesis the incidence of IDT is 12.66%. [7]. The incidence of dural tear in our study was found to be higher in patients undergoing lumbar decompression with instrument fixation as compared to patients undergoing, microdiscectomy, laminectomy or non -instrumented decompression of spinal canal. In a study done by Tsutsumimoto, et al. the incidence of Dural tears in primary micro endoscopic lumbar decompression was 5.10%, lumbar canal stenosis was 7.53% and in degenerative spondylolisthesis it was 12.50%, which was higher than the overall incidence of tears in this study (5.05%) [8]. The incidence of tears was higher in patients subjected to bilateral decompression (12.86%) as compared to unilateral (3.78%).

In our study, the incidence of dural tear was found to be higher in men than in women. In contrast, in a study done by Takahashi, et al. the incidence of Dural tear was significantly higher in women (5.6%) than in men (3%) [9].

In our study, there was no significant difference in the VAS score among the patients with and without dual tear at different post-operative periods. Similar to our study, Soma et al.[10] also reported that there was no difference in the leg pain VAS at 12 months between patients with and without DT following microendoscopic lumbar surgery. Meanwhile, there was a significant difference in the ODI score among the patients with and without dual tear at different post-operative periods. In a meta-analysis done by Stormiest et al. from a large cohort of patients underwent lumbar stenosis, the final results showed that there was significant difference in the ODI score between the dural tear and without dural tear groups at 12 months [11].

The length of hospital stay is significantly higher in patients with dural tear as compared to the patients without dural tear. The mainstay postoperative management in dural tear is flat bed rest until the posture related headache have reduced [12]. Further, the com-

plication are higher when the patients on bed rest for more than 24 hours as compared to the patients who are limited to bed for less than 24 hours [13]. In another retrospective study conducted by Hodges, et al. reported that bed rest is not essential, but accurate repair of Dural tear during surgery required and, in their study, out of 20 patients 75% did not required bed rest [14]. Studies reported that repair of dural tear reduced the length of hospital stay and hospital expenses [15]. In contrast, various studies had reported the need of bed rest ranging from 2-5days in dural tear patients [16, 17].

DT is serious complications that need to be diagnosed early, since it may cause cerebral haemorrhage when CSF pressure decreases. Following fast and accurate diagnostic tools and delivering the information about the clinical condition to surgeons is highly important. Detection of β -2-transferrin in suspected drainage through electrophoresis elicit accurate and rapid diagnosis [18]. However, MRI is highly sensitive when compared other biochemical methods and immediate interventions can be done before the condition worsens [19].

Conclusion

In our study, the incidence of iatrogenic dural tear in elective lumbar spine surgery is 7.5%. The ODI and VAS scores were significantly improved post operatively at the end of 3 months. There was a significant increase in the ODI score in patients with dural tear as compared to patients without dural tear. Further, there was no significant difference in the VAS score among the patients with and without dural tear. Patients with DT were hospitalized for longer periods than compared to those without DT.

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