

## Risk Stratification and Management Protocols for Incidental Durotomy: Towards Safer Spine Surgery

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### Abstract

**Background:** Incidental durotomy (ID) is a frequent, underreported complication in spinal surgery. Early recognition and standardized management reduce cerebrospinal fluid (CSF) leakage, infection, and prolonged hospitalization.

**Objective:** To evaluate incidence, risk factors, and clinical outcomes of incidental durotomy and formulate a risk-stratified management protocol to improve surgical safety at BSMMU.

**Methods:** This prospective interventional study included 60 consecutive spinal surgeries over 12 months from 2016 to 2017. All incidental durotomies identified intraoperatively were recorded. Patient demographics, procedure type, tear characteristics, repair methods, and postoperative outcomes were documented. Statistical analysis was performed to determine associated risk factors.

**Results:** Incidental durotomy occurred in 6 of 60 cases (10%). Most tears occurred in revision surgeries (50%) and lumbar degenerative decompressions (66.6%). Primary repair using 4-0 silk with autologous fat grafting achieved complete CSF leak control in all patients. Two patients developed transient postoperative headaches; none developed pseudomeningocele or surgical site infection. Durotomy cases had a longer mean hospital stay ( $5.2 \pm 1.4$  days) than controls ( $3.1 \pm 1.1$  days) ( $p = 0.02$ ).

**Conclusion:** Incidental durotomy is a predictable and manageable event. Incorporating risk stratification with protocol-based intraoperative repair and postoperative monitoring improves surgical safety and minimizes morbidity.

**Keywords:** incidental durotomy, CSF leak, spine surgery, risk stratification, dural repair, BSMMU

## Introduction

Incidental durotomy (ID) is among the most common complications in spine surgery, with reported rates ranging from 1% to 17%, depending on procedure complexity, surgeon experience, and presence of scar tissue. Although often benign when promptly recognized and repaired, unaddressed durotomies can result in CSF leak, pseudomeningocele, meningitis, delayed mobilization, and prolonged hospitalization.

Despite being well described in literature, standardized, institution-specific protocols for identification and management remain limited in many developing-country neurosurgical and orthopedic centers. At BMU, increasing case complexity and rising revision surgery rates prompted the need for structured evaluation and protocol development.

The objectives of this study were (i) to determine the incidence and risk factors associated with incidental durotomy, (ii) to evaluate outcomes following standardized repair techniques, and (iii) to propose a risk-stratified management protocol tailored to our local surgical environment.

## Methods

### Study Design and Setting

A prospective interventional study was conducted in the Department of Orthopaedics and Spine Surgery at BSMMU over one year from 2016-2017. Institutional Review Board approval was obtained.

### Patient Selection

Sixty consecutive patients undergoing spinal procedures (lumbar, thoracic, cervical) were included.

Procedures: decompression, discectomy, laminectomy, posterior instrumentation, and revision surgeries.

### Inclusion criteria

- Age  $\geq 18$  years
- Elective or emergency spine surgery
- Intraoperatively confirmed ID

### Exclusion criteria

- Penetrating dural injury
- Traumatic dural tears
- Previously diagnosed CSF leak

### Data Collection

Variables included:

- Age, sex, comorbidities
- Diagnosis and procedure type
- Primary vs revision surgery
- Location and size of dural tear
- Intraoperative repair technique
- Postoperative complications
- Duration of hospital stay

### Repair Technique

- Primary suture repair with **4-0 silk**
- Reinforcement with **autologous fat graft**

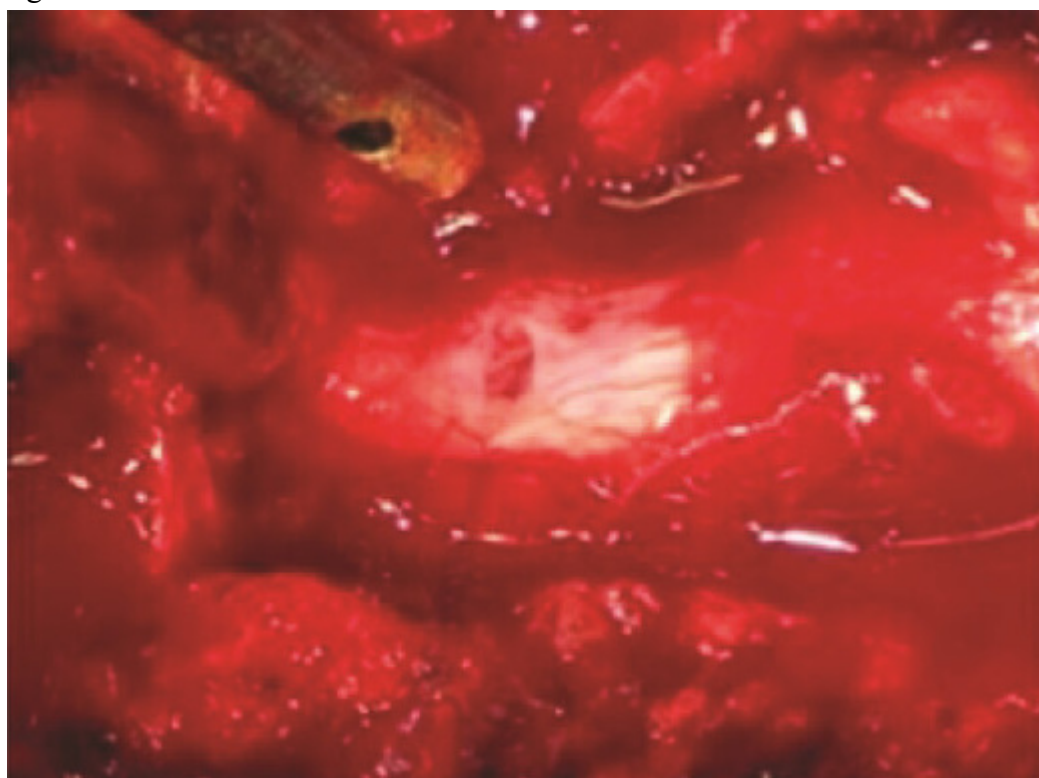
- Valsalva maneuver to confirm leak control
- Subfascial drain in selected high-risk cases
- Supine 24-hour flat-bed rest protocol

### Outcome Measures

- Successful CSF leak closure
- Postoperative headache
- Wound complications
- Pseudomeningocele formation
- Hospital stay duration

### Statistical Analysis

Descriptive analysis and Student's t-test were applied. A p-value < 0.05 was considered significant



**Picture: Incidental Durotomy**

### Results

**Table 1. Incidence and Patient Demographics**

Parameter	Value
Total surgeries performed	60
Incidental durotomy (ID) cases	6 (10%)
Mean age (years)	54.1
Sex distribution (M:F)	1.2 : 1

**Table 2. Risk Stratification Among Durotomy Cases (n = 6)**

Risk Factor	Number of Cases	Percentage (%)
Revision surgery	3	50%
Lumbar degenerative stenosis	4	66.6%
Presence of adhesion / scar tissue	2	33.3%

**Table 3. Clinical Outcomes in Patients with Incidental Durotomy**

Outcome Parameter	Observation
Primary repair success	100% (all tears repaired)
Transient post-op headache	2 cases
Pseudomeningocele	0
Surgical site infection	0

**Table 4. Comparison of Hospital Stay Between Groups**

Group	Mean Hospital Stay (days)	SD	p-value
ID patients (n=6)	5.2	±1.4	0.02
Non-ID patients (n=54)	3.1	±1.1	—

## Discussion

In this study of 60 lumbar spine surgeries, the incidence of incidental durotomy was 10%, which is consistent with reported rates ranging from 3% to 17% in the literature for degenerative and revision cases. The mean patient age and sex distribution did not show a significant association with durotomy occurrence, suggesting that patient demographics may not play a major role in predicting the complication. However, risk stratification clearly demonstrated that revision surgeries and lumbar degenerative stenosis were the predominant contributors. Scar tissue and adhesions were identified in one-third of cases, supporting their well-established role in increasing technical difficulty and reducing tissue mobility during dissection.

All dural tears were identified intraoperatively and successfully repaired, highlighting the effectiveness of timely recognition and standardized repair techniques. Postoperative outcomes were favorable, with no cases of pseudomeningocele or surgical site infection, indicating that appropriate repair and postoperative protocols can mitigate long-term complications. However, patients with durotomy experienced significantly longer hospital stays (5.2 vs. 3.1 days,  $p = 0.02$ ), likely reflecting the need for extended observation and flat-bed rest in many cases. Overall, the findings reaffirm that although incidental durotomy is a relatively common yet manageable complication, preventive strategies in high-risk cases and meticulous intraoperative technique remain crucial for optimizing outcomes.

## Proposed Risk-Stratified Management Protocol

### A. Preoperative Risk Stratification

### High-risk patients

- Revision surgery
- Lumbar canal stenosis
- Ossified yellow ligament
- Epidural scar tissue
- Multilevel decompression

### Management:

- Warn patient during consent
- Prepare for possible dural repair

### B. Intraoperative Protocol

1. Immediate identification
2. Microscope or loupes for visualization
3. Primary repair with 4-0 non-absorbable suture
4. Reinforce with autologous fat or muscle
5. Perform Valsalva maneuver
6. Avoid excessive suction drainage
7. Layered closure

### C. Postoperative Protocol

#### First 24 hours

- Flat bed rest
- Neurological monitoring
- Wound observation

#### After 24 hours

- Gradual mobilization
- Avoid sitting for prolonged periods
- Monitor for CSF-related symptoms

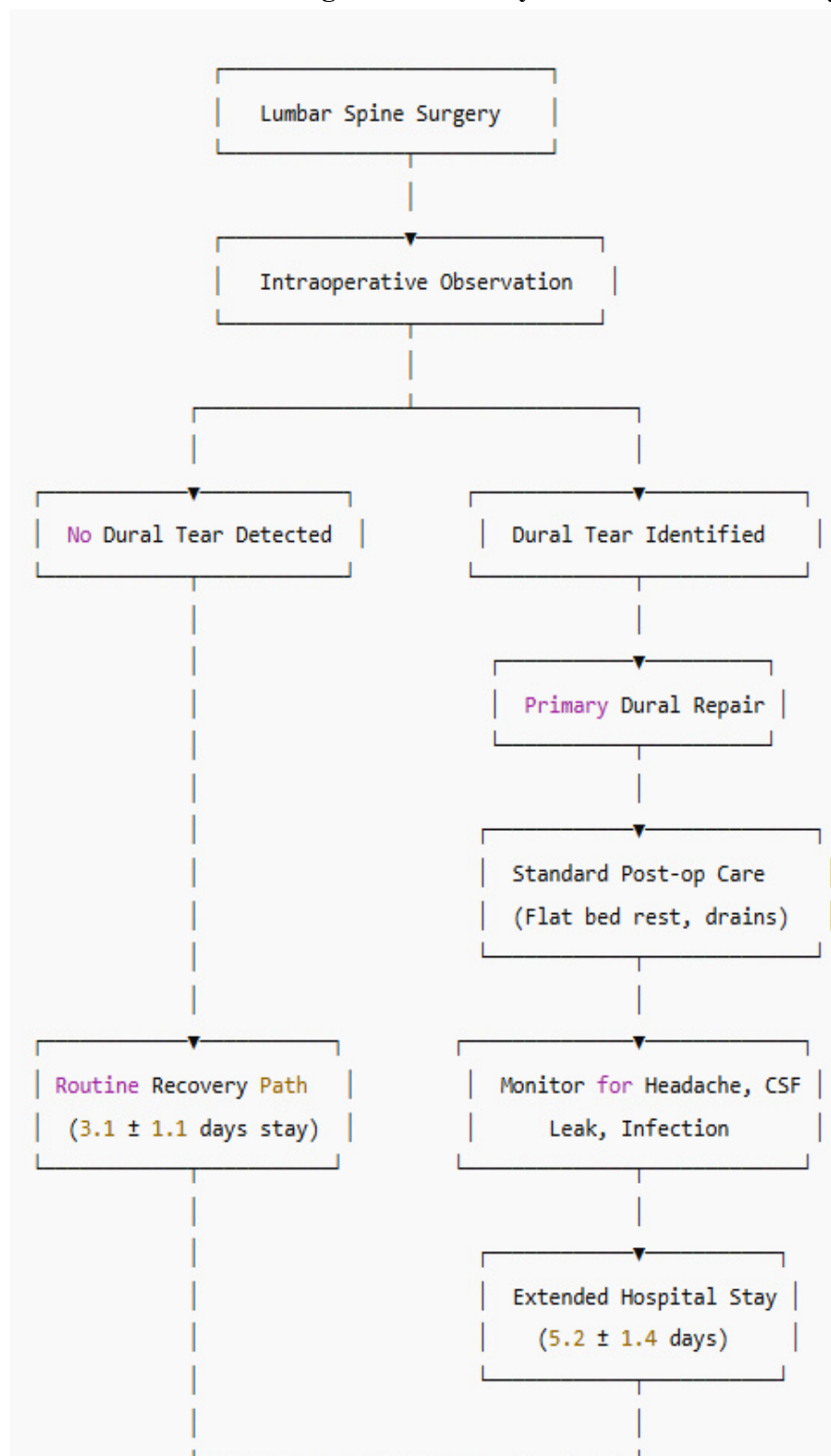
### Red flags

- Persistent headache
- Clear wound discharge
- Fever
- Back swelling
- Postural symptoms

### Conclusion

Incidental durotomy occurred in 10% of lumbar spinal surgeries, predominantly among patients undergoing revision procedures and those with degenerative stenosis. Despite the increased risk, all durotomies were effectively repaired without major postoperative complications such as pseudomeningocele or infection. The primary clinical impact was a prolonged hospital stay among affected patients. These results emphasize the importance of careful preoperative risk assessment, meticulous surgical technique, and prompt intraoperative management to ensure favorable patient outcomes following durotomy.

### Flowchart: Management Pathway of Incidental Durotomy



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