

Early Thigh Symptoms After Lateral Lumbar Interbody Fusion

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A focused narrative review of neurological patterns, recovery, and selective investigation

Abstract: ***Background:** Ipsilateral thigh pain, altered sensation, and hip flexion weakness are common after transposas lateral lumbar interbody fusion (LLIF). A much smaller group has a clinically important femoral or lumbar plexus injury. Early triage requires a reproducible examination and attention to changing symptoms rather than a single label of approach-related neuropraxia. **Methods:** This focused narrative review examines primary cohorts published through September 2026, including longitudinal motor assessments, a recent 545-patient neurological complication series, a multicenter retractor-time study, and a report of postoperative psoas hematoma. It separates symptoms, strength grades, anatomy, and time points; it is not a systematic review or pooled incidence estimate. **Results:** In a recent 1,000-patient stand-alone LLIF series, 17.2% of the later-era cohort had at least one grade of iliopsoas and/or quadriceps loss at discharge; 74% of affected patients recovered fully by six weeks and 97.1% by one year. L4/5 involvement and longer operative time predicted weakness at six weeks. A separate 545-patient series reported acute thigh paraesthesia in 14.4%, transient motor weakness in 13.2%, femoral palsy in 1.3%, and psoas hematoma in 1.4%. Rates vary markedly with definitions and ascertainment. A multicenter study found that retraction beyond 20 minutes did not reliably identify quadriceps palsy. **Conclusion:** Mild, nonprogressive approach-side sensory change or hip flexion discomfort can be followed with a documented serial examination. New or worsening quadriceps weakness, knee buckling, severe or expanding pain, contralateral symptoms, falling hemoglobin, or hemodynamic change calls for prompt assessment and imaging tailored to the suspected neural, implant, or retroperitoneal cause. The published cohorts describe prognosis; they have not validated a rigid observation or imaging algorithm.*

Keywords: lateral lumbar interbody fusion; thigh pain; lumbar plexus; femoral neuropathy; hip flexor weakness; psoas hematoma

1. Introduction

A transposas approach enters a muscle that contains the lumbar plexus and passes near sensory branches supplying the thigh. The same patient may report groin discomfort from muscle dissection, anterolateral thigh dysesthesia from a sensory nerve, difficulty raising the thigh from psoas injury, or failure of knee extension from femoral nerve dysfunction. These findings have different functional consequences. A reassuring population average should not replace an individual examination when a patient cannot extend the knee or develops a new deficit after initially normal recovery.

This review addresses the first hours through the first postoperative year after lateral transposas fusion, particularly L4/5. Oblique anterior-to-psoas procedures have different trajectories and should not be pooled uncritically with transposas cases. The main clinical question is how to distinguish a stable expected approach effect from a complication that warrants immediate imaging or intervention.

2. Scope and Evidence Identification

We examined accessible indexed primary reports and full text where available through 30 September 2026 [1–8]. The review prioritizes cohorts that define motor findings by muscle group and follow-up interval, and treats the 2026 publication as preliminary evidence requiring independent appraisal. This targeted search did not use a registered protocol, duplicate screening, formal risk-of-bias grading, or

meta-analysis. Incidence estimates are descriptive within their study populations and should not be combined as if ascertainment and procedure were identical.

Patterns and denominators

The timing, location, and examination separate overlapping mechanisms. Ipsilateral anterior thigh or groin pain and limited active hip flexion immediately after surgery can reflect psoas trauma, retraction, or plexus irritation. Altered cutaneous sensation alone may occur without objective motor loss. Quadriceps weakness, reduced patellar reflex, and knee buckling suggest femoral nerve or upper lumbar root involvement; the entire pattern should be interpreted alongside preoperative deficits and pain-limited effort. New contralateral radicular pain or distal weakness is less easily attributed to routine approach-side psoas irritation and should prompt assessment for foraminal, cage, or posterior pathology.

The definition of a deficit matters. One grade of Medical Research Council (MRC) strength loss is sensitive to change but may include examination variability and pain limitation. At grade 3/5 the quadriceps can extend the knee against gravity but cannot resist examiner force; grades below 3 cannot complete that movement against gravity. Studies that count any transient sensory complaint will report far higher rates than registries restricted to deficits lasting three months. Compare like outcomes at like time points before counseling a patient.

Longitudinal motor recovery

Burkhard and colleagues reviewed 1,000 stand-alone LLIF procedures across two eras [1]. Among 605 patients

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operated on during 2016–2024, 104 (17.2%) had at least one MRC grade of iliopsoas and/or quadriceps loss at discharge. Seventy-seven of those 104 (74.0%) regained full strength by six weeks, and the reported cumulative recovery by one year was 97.1% (three still had weakness). At discharge, 18 of 605 (3.0%) had a loss of at least two grades. One patient had a persistent deficit of at least two grades at one year and improved to MRC grade 4 by two years. This is a selected high-volume single-center stand-alone cohort, not a guarantee of recovery in every construct or surgical setting.

L4/5 involvement was associated with more weakness. In the later era, quadriceps weakness at discharge affected 8.7% of cases involving L4/5 and 2.0% of those without it; corresponding one-year rates in the L4/5 group were 0.8%. In adjusted models, L4/5 surgery and longer operative time predicted iliopsoas and quadriceps loss at six weeks [1]. The observational design cannot establish that shortening a particular portion of the operation would prevent a deficit. Earlier 235-patient data also described marked decline in sensory and motor findings over twelve months, but persistent plexus-related motor findings in 2.9% [2].

A 127-patient series by Zheng and colleagues reported sensory or motor plexopathy in 48 patients (37.8%) and persistent symptoms beyond 90 days in a substantial minority [3]. Ipsilateral sensory symptoms persisted in 24 of 127 (18.9%) and weakness in 20 (15.7%) using that study's definitions. Nonresolution of an intraoperative motor evoked potential alert was associated with later plexopathy. These higher figures compared with other cohorts illustrate different capture, case mix, and definitions; persistence beyond 90 days should not be equated to permanent disability.

Cohort	Clinical endpoint	Selected finding	Interpretive limit
Burkhard 2026 [1]	1,000 stand-alone cases; serial MRC strength	17.2% any motor loss at discharge in later era; 97.1% recovered at one year	Single center; later era n=605
Hulliel 2026 [4]	545 transpsoas cases; documented neurological events	14.4% acute paresthesia; 1.3% femoral palsy	Retrospective labels and follow-up
Zheng 2023 [3]	127 patients; ipsilateral plexopathy >90 days	18.9% sensory, 15.7% weakness persistent	Definitions differ from severe motor palsy
Patel 2025 [5]	658 cases; quadriceps grade $\leq 3/5$	12 palsies (1.8%); 20-minute threshold poorly predictive	Rare event; threshold test, not all exposure effects

Recent complication reporting

Hulliel and colleagues reviewed 545 transpsoas cases performed during 2016–2023 and reported at least one neurological event in 167 (30.6%) [4]. Acute thigh paraesthesia affected 14.4%, transient motor weakness 13.2%, named hip flexion weakness 2.1%, femoral palsy 1.3%, and psoas hematoma 1.4%. The categories can overlap and should not be summed. The relatively recent

publication adds granularity but still relies on retrospective documentation and should not be read as a validated prediction model. The finding that hematoma and femoral palsy are uncommon does not make them safe to miss in a symptomatic patient.

In a carefully selected L4/5 cohort, Buckland and colleagues reported six femoral neuropraxias (1.2%), four considered LLIF-related (0.8%), and two patients (0.4%) with persistent symptoms at one year [6]. Selection, anatomy, and a standardized technique likely affect transportability. Together the cohorts support counseling that approach-side symptoms are common, but severe or lasting motor impairment is less frequent and nonzero. The clinical task remains to identify the particular patient whose deficit is progressive or caused by a structural or bleeding event.

Retraction time and mechanism

Time under retraction is a plausible exposure but is not a stand-alone diagnostic test. In a retrospective multicenter study of 658 patients, 12 (1.8%) developed quadriceps strength of 3/5 or less [5]. A threshold beyond 20 minutes had 50% sensitivity and 73.8% specificity; the authors found no significant association between crossing that threshold and palsy. This does not prove that duration is harmless. Total operative time, corridor position, direct contact, patient anatomy, and monitoring signals may each contribute, and a single dichotomous threshold loses exposure detail. No postoperative deficit should be dismissed simply because retraction lasted less than 20 minutes.

A 2026 event-based neuromonitoring study linked losses of transabdominal muscle action potential signals to specific operative steps and argued that direct mechanical trauma may be important in femoral nerve injury [7]. Its observational and technique-specific findings do not establish one mechanism in every case or demonstrate that one monitoring protocol prevents clinical palsy. The operative record, signal changes, level, side, and sequence of postoperative examination remain useful context for interpretation.

A practical assessment after surgery

Document preoperative and immediate postoperative findings side by side: hip flexion and knee extension by MRC grade, ankle dorsiflexion and plantar flexion, patellar reflex where assessable, mapped sensory change, gait and knee stability, and pain-limited versus true weakness. Recheck after analgesia or anesthetic effects subside and again if the symptom changes. Record whether a deficit was present on awakening or appeared later. For a stable, mild sensory complaint with preserved quadriceps strength and otherwise expected recovery, serial examination and clear return precautions are a reasonable clinical approach, though no cohort validates an exact reassessment interval.

A new grade 3/5 or weaker quadriceps, rapidly worsening strength, knee buckling, severe or expanding thigh or flank pain, unexplained tachycardia or hypotension, falling hemoglobin, or a delayed deterioration warrants urgent senior surgical assessment. CT of the abdomen and pelvis, with vascular phase when active bleeding is suspected, can identify retroperitoneal or psoas hematoma; CT of the

operated spine assesses cage and hardware position; MRI with appropriate metal-artifact reduction addresses neural compression when clinically suspected. Choice and sequence depend on hemodynamic status, examination, and operative details. Imaging and emergency management should proceed together in an unstable patient.

A reported patient developed flank pain, falling hemoglobin, and femoral palsy on day four after staged lateral and posterior surgery; CT demonstrated a large psoas hematoma [8]. A case report cannot estimate frequency or prescribe drainage, but shows why delayed worsening should not be labeled routine neurapraxia. Decisions about observation, embolization, drainage, or exploration depend on instability, active bleeding, expanding collection, and neurological trajectory, in consultation with the relevant teams.

Follow-up and rehabilitation

For a nonprogressive deficit without a treatable structural lesion, explain the likely recovery trajectory without promising full recovery. Serial strength grading and gait safety matter more than an isolated pain score. Provide fall precautions and an appropriate assistive device or therapy for knee buckling. Persistent objective weakness, an atypical distribution, or recovery that stalls should prompt renewed examination and targeted investigation. Electrodiagnostic testing can help localize and characterize a persistent lesion after an appropriate interval, but cannot replace prompt early imaging when compression or bleeding is plausible. Sensory discomfort may outlast motor improvement and warrants separate recording.

3. Research Agenda and Conclusion

A multicenter prospective registry should capture preoperative motor grades, standardized postoperative examinations at discharge and fixed intervals, detailed sensory maps, level and technique, retractor location and duration, monitoring events, imaging indications, and patient-reported function. It should distinguish pain-limited hip flexion from objective quadriceps weakness and adjudicate hematoma or structural lesions. A decision study could then assess whether a specified examination pattern safely selects patients for immediate imaging, rather than assuming that all thigh symptoms are interchangeable.

Most approach-side thigh symptoms after LLIF improve, but the extent and speed of recovery depend on the outcome definition and patient cohort. Careful serial examination identifies the small but important group with severe or progressive motor loss or signs of bleeding. Imaging should answer a specific concern urgently when those features arise. Current observational evidence supports this cautious distinction, not a universal timetable or a validated triage score.

Declarations for author completion

Add author names, affiliations, contributions, funding, conflicts of interest, and journal-specific disclosures after clinical author review. No patient-level data were collected for this narrative review.

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