# Traumatic spinal cord injury prognosis

Traumatic spinal cord injury (TSCI) induces a powerful inflammatory response that can significantly exacerbate the extent and severity of neural damage (termed as "secondary injury"). Thus, the suppression of inflammation is crucial for reducing neurological dysfunction following TSCI. However, the conventional anti-inflammatory drugs show limited efficacy because of poor penetration and release kinetics at the injury site [1].

Acute traumatic spinal cord injury (SCI) is a devastating event with far-reaching physical, emotional, and economic consequences for patients, families, and society at large. Timely delivery of specialized care has reduced mortality; however, long-term neurological recovery continues to be limited.

Patients with traumatic SCI admitted to a Level I center were more likely to have surgery, particularly if they were directly admitted to a Level I center [2].

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A literature search in MEDLINE and EMBASE was performed, and studies reporting follow-up changes in American Spinal Injury Association (ASIA) Impairment Scale (AIS) or Frankel or ASIA motor score (AMS) scales were included in the meta-analysis. The proportion of patients with at least 1 grade of AIS/Frankel improvement, and point changes in AMS were calculated using pooled random effects model. The potential effect of severity, level and mechanism of injury, type of treatment, time and country of study, and follow-up duration were evaluated using meta-regression analysis.

A total of 114 studies were included, reporting AIS/Frankel changes in 19,913 patients and AMS changes in 6920 patients. Overall, the quality of evidence was poor. The AIS/Frankel conversion rate was 19.3% (95% CI 16.2-22.6) for patients with grade A, 73.8% (95% CI 69.0-78.4) for those with grade B, 87.3% (95% CI 77.9-94.8) for those with grade C, and 46.5% (95% CI 38.2-54.9) for those with grade D. Neurological recovery was significantly different between all grades of SCI severity in the following order: C > B > D > A. Level of injury was a significant predictor of recovery; recovery rates followed this pattern: lumbar > cervical and thoracolumbar > thoracic. Thoracic SCI and penetrating SCI were significantly more likely to result in complete injury. Penetrating TSCI had a significantly lower recovery rate compared to blunt injury (OR 0.76, 95% CI 0.62-0.92; p = 0.006). Recovery rate was positively correlated with longer follow-up duration (p = 0.001). Studies with follow-up durations of approximately 6 months or less reported significantly lower recovery rates for incomplete SCI compared to studies with long-term (3-5 years) follow-ups.

This meta-analysis provides an overall quantitative description of neurological outcomes associated with TSCI. Moreover, they demonstrated how neurological recovery after TSCI is significantly dependent on injury factors (i.e., severity, level, and mechanism of injury), but is not associated with type of treatment or country of origin. Based on these results, a minimum follow-up of 12 months is recommended for TSCI studies that include patients with neurologically incomplete injury [3].

# Trials

A number of neuroprotective and regenerative strategies have emerged and have come under active investigation in clinical trials, and several more are coming down the translational pipeline. Among

ongoing trials are RISCIS (riluzole), INSPIRE (Neuro-Spinal Scaffold), MASC (minocycline), and SPRING (VX-210). Microstructural MRI techniques have improved our ability to image the injured spinal cord at high resolution. This innovation, combined with serum and cerebrospinal fluid (CSF) analysis, holds the promise of providing a quantitative biomarker readout of spinal cord neural tissue injury, which may improve prognostication and facilitate stratification of patients for enrollment into clinical trials. Given evidence of the effectiveness of early surgical decompression and growing recognition of the concept that “time is spine,” infrastructural changes at a systems level are being implemented in many regions around the world to provide a streamlined process for transfer of patients with acute SCI to a specialized unit. With the continued aging of the population, central cord syndrome is soon expected to become the most common form of acute traumatic SCI; characterization of the pathophysiology, natural history, and optimal treatment of these injuries is hence a key public health priority. Collaborative international efforts have led to the development of clinical practice guidelines for traumatic SCI based on robust evaluation of current evidence. The current article provides an in-depth review of progress in SCI, covering the above areas [4].

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# Study Summary

In a multicenter retrospective cohort study Benedict et al. from the Washington University (St. Louis), University of Utah (Salt Lake City), UAB (Birmingham), Johns Hopkins (Baltimore), University of Miami (Miami), UPenn (Philadelphia), Houston Methodist (Houston), University of Calgary (Calgary), Stanford (Stanford) published in the Neurosurgery Journal to quantify sex-related differences in 1-year functional and neurological outcomes after traumatic spinal cord injury (SCI) Though female patients show similar or greater motor recovery, male patients have significantly better functional independence (FIM) at 1 year, especially in bladder management and transfers [5].

# Critical Review

### Strengths

- **Large cohort:** 3,924 patients from the SCI Model Systems database spanning 24 years (1992–2016).
- **Robust methodology:** Propensity score–weighted multivariable regression adjusted for key confounders (age, injury severity, baseline function).
- **Comprehensive outcomes:** Assessed both global (FIM total) and item-level functional independence (e.g., bladder management, transfers).

### Limitations

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1. **Retrospective design:** Causal inference is limited; variability in
rehabilitation protocols and data fidelity across centers and time likely
introduced bias.
2. **Temporal scope:** One-year follow-up offers no insight into long-term
functional trajectories or sustained recovery patterns.
3. **Sex disparity:** With females comprising only 20% of the cohort, sex-
specific analyses are underpowered and generalizability is constrained.
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4. **Unmeasured variables:** Socioeconomic status, caregiver support, and
rehabilitation quality were not captured, leaving residual confounding
unaddressed.
5. **Marginal clinical significance:** The 3.1-point FIM difference, while
statistically significant, lacks anchoring to a defined MCID, weakening its
real-world applicability.
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## Verdict (0–10)

- **Score:** 6.5/10
- **Reasoning:** Robust dataset and analytical approach, but retrospective design, female under-representation, and potential unmeasured confounders limit strength. Functional significance of results is unclear without MCID context.

## Takeaway for Neurosurgeons

- Despite comparable motor recovery, female SCI patients exhibit lower functional independence at 1 year—especially in transfers and bladder care.
- Rehabilitation programs should consider sex-specific barriers: ergonomic coaching, adaptive equipment training, and psychosocial support may be needed to help female patients catch up in activities of daily living.

## Bottom Line

Male SCI patients regain more functional independence than females at 1 year post-injury, despite similar neurological recovery. Tailoring rehab for women—especially around bladder and transfers—may improve outcomes.

## Metadata

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category: Spinal_Cord_Injury, Rehabilitation, Sex_Differences
tags: SCI, Functional_Independence_Measure, ASIA,
Sex-Specific_Rehabilitation
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1)

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2)

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3)

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5)

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