Impact of Trauma Center Designation on Head and Neck Trauma Outcomes: A National Analysis

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Introduction

Head and neck trauma is a major driver of emergency care in the United States, contributing to over 5.4 million emergency department visits annually. As trauma care becomes increasingly regionalized, patients with complex head and neck trauma are increasingly referred to higher-level trauma centers.

Definitive management of these injuries depends on subspecialty surgical expertise that is unevenly distributed across centers, so patients are often transferred for operative care rather than physiological instability, and a substantial share of transfers for isolated facial injury may be avoidable. Recent national studies found no independent benefit of Level I designation for isolated midface or mandible fractures, but excluded polytrauma, airway management, and neck injury. Head and neck trauma has yet to be analyzed as a distinct body region in the field of this research.

Objective:
To evaluate whether trauma center verification level (I, II, III) is associated with differences in otolaryngologic interventions and clinical outcomes among adults with head and neck trauma.

Methods

Study Design & Data Source
Retrospective cohort study using the 2023 National Trauma Data Bank (NTDB) Participant Use File, a de-identified national registry of trauma encounters.

Study Population
Included: Adults ≥18 years with at least one ICD-10-CM head or neck injury code (S00-S19), treated at an ACS-verified Level I, II, or III trauma center.
Excluded: Age <18, dead on arrival, missing trauma level or Injury Severity Score (ISS), hospital length of stay >30 days, and patients transferred to another hospital from the emergency department.

Exposure
ACS trauma center verification level

Outcome
Airway Intervention: intubation, mechanical ventilation, or surgical airway (ICD-10-PCS)
Otolaryngologic Surgery: Non-airway operative procedures on facial bones, nasal/sinus, ear, larynx, or trachea
Major Complication: AKI, ARDS, cardiac arrest, DVT, PE, stroke, severe sepsis, unplanned intubation, unplanned ICU admission, or unplanned return to OR
In-Hospital Mortality: Death recorded at hospital or ED discharge

Covariates
Age, Sex, ISS, mechanism of injury, injury region (head, neck, mixed), and concomitant intracranial injury (S06).

Statistical Analysis
- Descriptive comparisons by trauma center level (chi-squared, one-way ANOVA, Kruskal-Wallis)
- Multivariable logistic regression for each outcome; results reported as adjusted odds ratios (aORs) with 95% confidence intervals
- Stratified analyses by ISS (<16 or ≥16) and by presence of intracranial injury
- Analyses performed in R 4.3.2

Results

Table 1. Patient Characteristics and Outcomes by Trauma Center Level

Characteristic	Level I N = 219,383[1]	Level II N = 116,936[1]	Level III N = 22,326[1]
Patient characteristics			
Age (years), mean (SD)	54.4 (21.2)	57.5 (21.3)	62.1 (20.8)
Medicare insurance	71,763 (32.7%)	44,132 (37.7%)	10,793 (48.3%)
Interfacility transfer-in	71,934 (32.8%)	25,271 (21.6%)	1,258 (5.6%)
Injury Severity Score, mean (SD)	10.8 (9.0)	10.0 (8.5)	7.5 (7.2)
ISS ≥16	53,808 (24.5%)	24,938 (21.3%)	2,704 (12.1%)
Concomitant intracranial injury	94,776 (43.2%)	53,506 (45.8%)	7,495 (33.6%)
Management and outcomes			
Any airway intervention	21,285 (9.7%)	10,166 (8.7%)	1,051 (4.7%)
Any otolaryngologic surgery	11,424 (5.2%)	4,358 (3.7%)	197 (0.9%)
Facial fracture repair	11,116 (5.1%)	4,209 (3.6%)	177 (0.8%)
Major complication	6,394 (2.9%)	3,351 (2.9%)	419 (1.9%)
In-hospital mortality	11,376 (5.2%)	5,625 (4.8%)	791 (3.5%)
ICU admission	67,843 (30.9%)	39,800 (34.0%)	4,392 (19.7%)
Hospital LOS (days), median (Q1, Q3)	6.5 (3.0, 11.5)	5.5 (3.0, 11.0)	4.7 (1.7, 8.9)

[1]n (%); Mean (SD); Median (Q1, Q3)

[2]All comparisons p<0.001 (Pearson's Chi-squared test; One-way analysis of means; Kruskal-Wallis rank sum test)

ISS = Injury Severity Score; LOS = length of stay. 2023 National Trauma Data Bank, N = 358,645.

Table 1. *Trauma center level per ACS verification (I-III). Intracranial injury = ICD-10 S06.*. Otolaryngologic surgery excludes airway procedures. Major complications = AKI, ARDS, cardiac arrest, DVT/PE, stroke, sepsis, or unplanned intubation, ICU admission, or return to OR. Values are n (%), mean (SD), or median (Q1, Q3). All p<0.001. N = 358,645.*

Table 2. Risk-Adjusted Outcomes by Trauma Center Level (Reference: Level I)

Outcome	Level I	Level II	Level III
Adjusted odds ratio (95% CI)			
Any airway intervention	— (ref)	1.04 (1.01, 1.07)	0.79 (0.74, 0.85)
Any otolaryngologic surgery	— (ref)	0.83 (0.80, 0.87)	0.22 (0.19, 0.26)
Major complication	— (ref)	1.03 (0.99, 1.08)	0.79 (0.71, 0.88)
In-hospital mortality	— (ref)	1.09 (1.05, 1.14)	1.27 (1.17, 1.38)
Unadjusted mortality, stratified by injury severity			
ISS <16 (n = 277,195)	2,188 (1.3%)	1,324 (1.4%)	317 (1.6%)
ISS ≥16 (n = 81,450)	9,188 (17.1%)	4,301 (17.2%)	474 (17.5%)

Multivariable logistic regression adjusted for age, sex, Injury Severity Score, mechanism of injury, injury type (head, neck, mixed), and concomitant intracranial injury. Level I is the reference. All odds ratios p<0.001 except major complication at Level II (p=0.13).

Stratified mortality: Pearson's Chi-squared test, p<0.001 for ISS <16; p=0.7 for ISS ≥16. CI = Confidence Interval; ISS = Injury Severity Score.

Table 2. *Adjusted Ors vs. Level I, controlling for age, sex, ISS, mechanism, injury type, and intracranial injury. All p<0.001 except Level II complications (p=0.13). Stratified mortality is unadjusted n(%); p<0.001 for ISS <16, p=0.7 for ISS >16. CI = Confidence Interval*

Discussion

In this national analysis of 358,645 adults with head and neck trauma, operative otolaryngologic care was concentrated at Level I centers (5.2% vs. 0.9% at Level III; aOR 0.22), with facial fracture repair comprising 97% of procedures, and the gradient persisted among minimally injured patients (ISS <16). This is best read as a structural finding about where subspecialty operative capacity resides rather than an outcome disparity and is compatible with two 2025 NTDB analyses that found no independent Level I benefit within isolated, operatively managed midface and mandible fractures.

Unadjusted mortality was lowest at Level III (3.5% vs. 5.2%), reflecting an older, less severely injured case mix (mean age 62, 48% Medicare, mean ISS 7.5); after adjustment, odds of death were modestly higher at Level II (aOR 1.09) and Level III (aOR 1.27). Absolute differences were small and confined to the ISS <16 stratum (1.6% vs. 1.3%); among ISS ≥16 patients, mortality was similar across levels (17–18%). In older, minimally injured patients, death more likely tracks frailty, comorbidity, and goals-of-care decisions than injury management, and without a comorbidity index this signal should not be read as evidence that transfer would improve survival. Lower recorded complication odds at Level III (aOR 0.79) most likely reflect differential ascertainment rather than a quality difference.

Limitations include the retrospective registry design, restriction to ACS-verified centers, no comorbidity or frailty measure, and administrative coding. Excluding ED transfers-out removes Level III's highest-risk patients, and transfer-in composition differed markedly by level (32.8% vs. 5.6%). These findings support regionalization of operative head and neck trauma care to Level I centers on the basis of where subspecialty capability resides, not a demonstrated survival advantage, and argue for identifying which older, low-ISS patients benefit from transfer rather than uniformly lowering transfer thresholds.

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