

Nationwide Analysis of Cardiopulmonary Outcomes after Multiple Long Bone Fracture Fixation

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INTRODUCTION:

Multiple long bone lower extremity fractures repaired with intramedullary nail (IMN) fixation have been associated with significant cardiopulmonary burden and may result in mortality. These patients are at an increased risk for fat embolism syndrome, pulmonary embolism, acute respiratory distress syndrome (ARDS), and pneumonia. No standardized guidelines exist to guide surgical treatment of these patients. There is minimal data regarding the risk of simultaneous versus staged fixation of multiple long bone fractures that includes both tibial and femoral injuries, as patients with multiple concomitant fractures are often excluded from relevant analyses. We aimed to compare the cardiopulmonary outcomes following simultaneous versus staged IMN fixation.

METHODS:

The American College of Surgeon's Trauma Quality Improvement Program (TQIP) database, containing information from over 875 Level I and Level II trauma centers nationally, was queried to identify patients who sustained multiple long bone lower extremity fractures between January 2016 and December 2019. Patients were split into two cohorts: simultaneous fixation (fixation of all fractures in the same operation/calendar day) and staged fixation (two or more operations each > 24 hours apart). The primary outcome was the frequency of cardiopulmonary complications precipitated by simultaneous versus staged fixation.

RESULTS:

There were 202,777 records of patients with tibial and/or femoral fractures identified in the TQIP database; 3,202 patients met the inclusion criteria. In total, 75.9% underwent simultaneous IMN fixation of two or more long bones and 24.1% received staged fixation. The most common fracture pattern was one femur and one tibia, including ipsilateral and contralateral (48.3%), followed by bilateral femur fractures (36.1%). The groups were similar across multiple variables; the staged fixation group, however, was older (42 vs. 37, $p < 0.0001$) and had a significantly higher rate of ventilator associated pneumonia (VAP), Acute Respiratory Distress Syndrome (ARDS), and acute kidney injury (AKI). The staged group had a longer ICU length of stay (LOS) (7 vs. 5 days, $p < 0.0001$) and total hospital LOS (17 vs. 11 days, $p < 0.0001$).

DISCUSSION AND CONCLUSION:

This is the largest retrospective study to date examining simultaneous versus staged IMN fixation in patients with multiple long bone lower extremity fractures. In our nationwide analysis, simultaneous fixation of multiple long bone lower extremity fractures was not associated with increased cardiopulmonary events and appeared to expedite time to discharge. Staged fixation was associated with an increase in complications, including ARDS, VAP, and acute kidney injury. Given these findings, simultaneous IMN fixation should be considered when feasible because it may decrease cardiopulmonary complications and LOS in high-risk patients.