Evidence-Based Preoperative Imaging and Outcomes After Open Reduction and Internal Fixation of Tibial Plateau Fractures

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Introduction

Advanced imaging is frequently used in the evaluation of tibial plateau fractures (TPF)[1,2], but its relationship to postoperative outcomes and healthcare utilization is unclear. We hypothesized that preoperative imaging strategy—radiograph alone, radiograph + CT, or radiograph + MRI—would be associated with differences in postoperative complications and resource use following open reduction and internal fixation (ORIF). This study evaluates the impact of imaging selection on patient outcomes and resource utilization, pertaining to the implementation of evidence-based imaging guidelines and Appropriate Use Criteria (AUC) in musculoskeletal (MSK) radiology[3].

Methods

- Design: Retrospective cohort study
- Data source: PearlDiver national administrative database (2010–2022)
- Population: Adults undergoing ORIF for tibial plateau fractures (TPF)
- Imaging groups: Radiograph only, Radiograph + CT, Radiograph + MRI
- Matching: 1:1:1 cohorts (n=751/group) by: age, sex
- Charlson Comorbidity Index (CCI), obesity, tobacco use, and fracture diagnosis code
- Objective: Assess association between imaging strategy and outcomes (proxy for guideline concordance/AUC adherence)
- Primary (90-day composite): surgical site infection, wound disruption, deep vein thrombosis (DVT), pulmonary embolism (PE), acute kidney injury (AKI), pneumonia
- Secondary: emergency department (ED) visits (≤90 days), total healthcare costs (≤90 days), revision ORIF (1 year), conversion to total knee arthroplasty (TKA) (2 years)

Baseline Comorbidities

Comorbidity	X-Ray (n = 6,057)	X-Ray + CT (n = 14,420)	X-Ray + MRI (n = 962)	P-value
DM	14.41%	15.78%	10.08%	<0.001
Obesity	9.86%	12.17%	8.32%	<0.001
Hypertension	34.39%	37.55%	24.84%	<0.001
CKD	3.88%	3.93%	1.35%	<0.001
COPD	5.04%	6.14%	1.87%	<0.001
CAD	5.32%	5.93%	2.60%	<0.001
Anemia	15.29%	16.86%	10.19%	<0.001
EtOH Abuse	3.96%	5.15%	2.08%	<0.001
Depression	14.63%	17.07%	12.58%	<0.001
Liver Disease	2.31%	3.31%	2.18%	<0.001
RA	1.68%	1.32%	1.77%	0.092
Tobacco-Use	7.69%	9.03%	8.73%	0.008

Table 1: *Baseline comorbidities in all cohorts undergoing tibia plateau fracture ORIF.*

Results: Costs

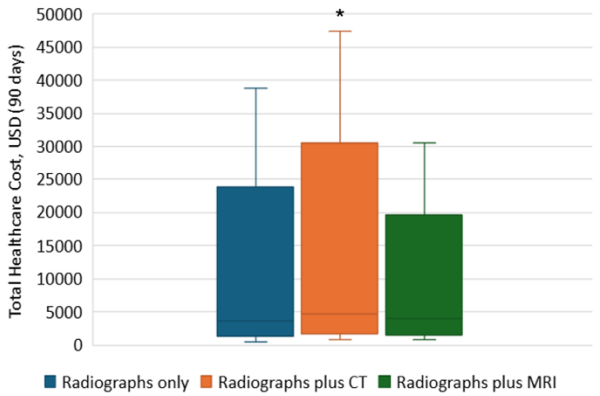

Figure 1: *Healthcare costs within 90 days following open reduction and internal fixation of tibial plateau fractures, stratified by preoperative imaging strategy. *p < 0.05*

Results: Outcomes

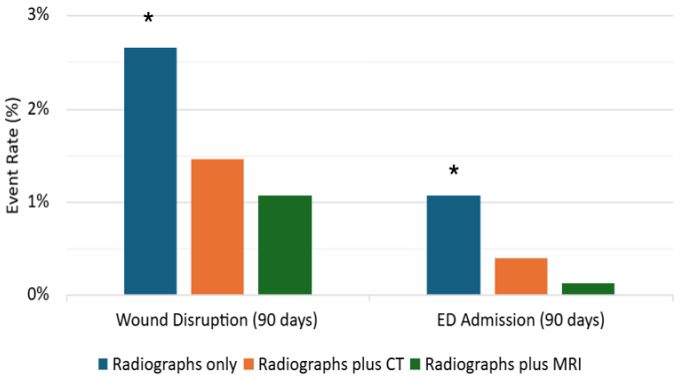

Figure 1: *Rates of wound disruption and ED admission among matched cohorts undergoing radiographs only, radiographs plus CT, or radiographs plus MRI (n = 751 per group). *p < 0.05*

Outcome	X-Ray (n = 751)	X-Ray + CT (n = 751)	X-Ray + MRI (n = 751)	P-value
SSI	3.20%	3.33%	3.46%	0.960
Wound Disruption	**2.66%**	**1.46%**	**1.07%**	**0.047**
DVT	1.07%	1.07%	0.80%	0.832
PE	0.53%	0.80%	0.93%	0.660
AKI	1.33%	2.66%	1.20%	0.055
Pneumonia	2.13%	2.00%	1.20%	0.335
Composite	8.12%	8.52%	6.79%	0.425
ED	9.85%	9.32%	8.79%	0.777
ED Admission	**1.07%**	**0.40%**	**0.13%**	**0.038**
Removal, 1 Year	8.66%	7.72%	9.32%	0.539
rORIF, 1 Year	1.73%	1.46%	0.67%	0.163
TKA, 2 Years	2.53%	0.93%	1.86%	0.062

Table 2: *Postoperative outcomes following tibia plateau fracture ORIF in matched imaging cohorts.*

Discussion and Conclusions

- Preoperative imaging strategy was associated with differences in wound disruptions, ED admission, and healthcare costs.
- Higher adverse event rates in the radiograph-only cohort may reflect unrecognized fracture complexity or soft-tissue injury.
- Selective use of advanced imaging may better identify high-risk injury patterns and improve perioperative planning for ORIF of TPF.
- These results support the implementation of evidence-based imaging guidelines and AUC in MSK radiology, highlighting the impact of guideline-concordant imaging on patient safety and resource utilization.

References

1. Milani, L., & Ferrari, S. (2021). Importance of CT Scan in Predicting the Outcomes of Tibial Plateau Fractures: A Retrospective Study of 216 Patients over 10 Years' Time. Indian journal of orthopaedics, 56(3), 377–385. https://doi.org/10.1007/s43465-021-00512-4
2. Fleming, T. A., Torrie, P. A. G., Murphy, T. A., Dodds, A. L., Engelke, D. M., Curwen, C. H., ... & Pegrum, J. (2023). The influence of pre-operative Computed Tomography (CT) on surgical approach and fixation for fractures of the tibial plateau. Journal of Orthopaedics, 42, 50-53.
3. American College of Radiology. (2026). ACR AC Portal: Acute trauma to the knee (Scenario 3073910). https://gravitas.acr.org/ACPortal/GetDataForOneScenario?senarioId=686