

Contemporary Review of Traumatology and Orthopedics: Evidence, Innovations, and Clinical Priorities in 2024–2026

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Abstract

Traumatology and orthopedics are changing rapidly as clinicians respond simultaneously to aging populations, persistent high-energy trauma, increasing implant complexity, and a stronger demand for data-driven, patient-centered care. Recent literature shows that the field is moving beyond a purely mechanical model toward integrated care pathways that combine optimized timing of surgery, multidisciplinary perioperative management, modern imaging, infection prevention, digital outcomes, and selective adoption of artificial intelligence and patient-specific technologies. This review synthesizes 50 recent and real publications, with emphasis on work published in 2024–2026, to summarize current evidence across fracture care, infection prevention, imaging, risk prediction, mental health, precision orthopedics, and digital transformation. The current literature supports earlier definitive care for selected fragility fractures, standardized multidisciplinary pathways for frail and polytrauma patients, better integration of weightbearing imaging and 3D planning for complex reconstruction, and more critical appraisal of novel algorithms before routine implementation. At the same time, important gaps remain in external validation, equitable reporting, long-term functional outcomes, and implementation science, all of which should shape the next phase of orthopedic trauma research.

Keywords: *Traumatology, orthopedics, orthopedic trauma, fracture fixation, hip fracture, multidisciplinary care, orthogeriatrics, infection prevention.*

Introduction

Trauma and musculoskeletal disease remain major contributors to disability, healthcare utilization, and socioeconomic burden, which keeps traumatology and orthopedics at the center of acute and longitudinal care systems. The specialty now faces a dual challenge: managing classic fracture and soft-tissue injuries while also caring for older patients with fragility fractures, multimorbidity, and revision-related complications such as periprosthetic fracture. Contemporary practice therefore depends not only on operative skill but also on perioperative medicine, rehabilitation, imaging science, implant design, and coordinated multidisciplinary care.

Recent publications highlight several converging trends. First, timing and organization of care matter: accelerated hip fracture pathways and structured multidisciplinary

management appear to reduce adverse outcomes in vulnerable patients. Second, prevention of complications remains a dominant research priority, especially fracture-related infection, deep surgical site infection, venous thromboembolism, and failed fixation. Third, technological adoption has broadened to include weightbearing CT, 3D-printed preoperative models, digital mobility outcomes, and artificial intelligence for diagnosis and prediction. However, innovation is not uniformly mature, and many studies still show methodological weaknesses, limited external validation, and uncertain real-world benefit.

This review aims to provide a concise but comprehensive narrative synthesis for submission-ready academic use. The article focuses on recent evidence relevant to both traumatology and orthopedics, emphasizes clinically actionable themes, and presents a results section containing one summary table and one plot based on the retrieved contemporary literature.

Methods

A narrative review design was used to synthesize current literature relevant to traumatology and orthopedics, prioritizing recent publications indexed in PubMed or published in recognized orthopedic journals between 2024 and 2026. The evidence base was built around 50 real publications cited in this manuscript, including systematic reviews, meta-analyses, randomized trials, consensus statements, guideline-oriented studies, and selected editorials that contextualize current practice. The thematic structure was predefined around six domains: systems of care, fracture fixation strategies, infection and perioperative safety, imaging and planning, digital and precision orthopedics, and patient-centered recovery.

Studies were selected for clinical relevance and recency rather than pooled quantitative comparability, because the retrieved literature spans heterogeneous populations, designs, and outcomes ranging from hip fracture mortality to digital mobility endpoints and machine-learning reporting quality. As a result, the review is interpretive rather than meta-analytic. Nevertheless, the included studies allow a coherent assessment of where evidence is strongest, where adoption is already practice-shaping, and where caution is still warranted.

Systems of care

One of the clearest themes in recent literature is the growing importance of organized pathways for frail and injured patients. A 2025 evaluation of adherence to British Orthopaedic Association Standards for Trauma found substantial variation in multidisciplinary input and concluded that a standardized MDT model is needed to optimize recovery in orthopedic trauma populations. This finding aligns with wider calls for integrated orthogeriatric and perioperative systems, particularly for fragility fractures and complex inpatients with multimorbidity.

Hip fracture care illustrates this systems effect particularly well. The 2025 JBJS “What’s New in Orthopaedic Trauma” summary highlighted a HIP ATTACK substudy showing lower mortality with accelerated care than standard care among patients with

hip fracture and elevated troponin, challenging the older practice of delay in medically complex cases. In practical terms, the modern question is no longer simply whether a patient is “fit” for surgery, but whether coordinated optimization can occur without forfeiting the benefits of earlier fixation.

These system-level changes also reshape outcome measurement. Contemporary orthopedic care increasingly values mobility, return to independence, quality of life, and complication avoidance rather than radiographs alone. This broader frame is especially important in geriatric trauma, where successful treatment may mean preserved autonomy rather than perfect anatomical restoration.

Fracture fixation and reconstruction

Recent trials continue to refine implant and fixation choices rather than support one universal strategy. In distal femur fractures, a multicenter randomized trial comparing far cortical locking with standard locked plating found similar clinical and radiographic healing overall, while suggesting that specific subgroups such as younger patients or those with marked medial comminution may deserve further targeted study. This is a good example of modern trauma evidence: nuance now matters more than broad declarations of superiority.

Other areas show a clearer directional signal. A 2024 systematic review and meta-analysis reported that primary arthrodesis may provide better short- and medium-term outcomes than open reduction and internal fixation for acute Lisfranc injuries, reinforcing the shift toward procedure selection based on injury pattern and longer-term function rather than on historical preference alone. Likewise, evolving literature on acetabular reconstruction suggests that patient-specific planning tools can improve workflow and surgical precision in difficult revision scenarios.

Periprosthetic and revision-related fracture research also reflects the overlap between classic traumatology and reconstructive orthopedics. The 2025 editorial overview from the Journal of Clinical Medicine emphasized a cumulative long-term periprosthetic femoral fracture risk after revision arthroplasty and identified female sex, diabetes, and longer stems as important risk factors. The same theme appears in a 2025 JBJS review noting that postoperative periprosthetic fracture risk after primary total hip arthroplasty depends strongly on stem design rather than a simple cemented-versus-cementless dichotomy. Together, these studies show that implant biomechanics and patient risk profile are becoming inseparable in modern decision-making.

Infection and safety

Complication prevention remains a high-priority research area because postoperative infection can erase otherwise excellent fixation or arthroplasty results. A 2024 meta-analysis of orthopedic trauma surgery identified several important risk factors for deep surgical site infection and addressed a persistent gap in evidence synthesis for trauma-specific infection risk. This work supports more structured preoperative risk assessment and selective intensification of preventive strategies in high-risk patients.

At the trial level, the PREP-IT investigation summarized in JBJS found that iodine povacrylex in alcohol was associated with a lower infection rate than chlorhexidine in alcohol among patients with closed fractures, while the two regimens performed similarly in open fractures. In parallel, the POvIV randomized clinical trial demonstrated that oral antibiotics were noninferior to intravenous antibiotics for fracture-related infection across several clinically relevant outcomes, suggesting that some long-standing assumptions about route of administration may deserve revision. These findings matter not only clinically but also operationally, because they influence line-related complications, hospital stay, and antimicrobial stewardship.

Safety research in orthopedics also extends beyond infection. The 2025 Journal of Clinical Medicine editorial cited evidence that dual-dose tranexamic acid reduced intraoperative blood loss and transfusion requirements without increasing subclinical deep vein thrombosis after hip or knee arthroplasty. Although arthroplasty lies partly outside trauma, these perioperative principles increasingly inform fracture surgery as well, particularly in older or revision-prone patients with limited physiological reserve.

Imaging and planning

Imaging is no longer only confirmatory; it increasingly directs classification, biomechanics, and operative planning. A 2024 systematic review discussed in the 2025 editorial overview found that weightbearing CT offers three-dimensional imaging under physiological load, with especially strong application in foot and ankle disorders and growing relevance for knee and hip assessment. Compared with conventional imaging, this approach may improve recognition of dynamic deformity and better align imaging findings with symptoms and operative targets.

Three-dimensional planning has expanded from novelty to practical adjunct in selected complex cases. The same 2025 overview highlighted prospective evidence that life-sized 3D-printed models improved implant selection and reconstruction strategy during complex acetabular revision procedures. A 2025 meta-analysis of randomized trials further suggested that 3D printing in acetabular fracture surgery can influence operation time, blood loss, reduction quality, and complication-related outcomes, supporting its selective use where anatomy is severely distorted.

These technologies are promising, but they should not be adopted indiscriminately. The current literature still lacks strong cost-effectiveness data, standardized indications, and multicenter implementation studies for many image-guided and model-assisted interventions. As with other orthopedic innovations, the central issue is not whether the technology is impressive, but whether it meaningfully improves patient-important outcomes across diverse settings.

Digital and precision orthopedics

Artificial intelligence has become one of the fastest-growing areas in orthopedic trauma research. A 2025 comprehensive review of 217 studies reported rapid expansion in AI publications, with fracture detection, classification, prediction, and segmentation as the most common applications; the review also noted that many

studies reported diagnostic performance above 90% in selected tasks. However, only a small minority underwent external or prospective clinical validation, which limits confidence in routine deployment.

A 2024 systematic review of machine-learning models in orthopedic trauma reached a similar cautionary conclusion, finding widespread high risk of bias and insufficient reporting transparency despite the apparent clinical potential of prediction tools. This mismatch between technical performance and clinical trustworthiness is now one of the field's most important translational problems. In essence, trauma AI may be advancing faster than the evidentiary standards required for bedside use.

The move toward precision orthopedics extends beyond algorithms. A 2024 review described a broader paradigm shift in which anatomical, biomechanical, molecular, and kinematic characteristics are integrated into individualized decisions about implants, alignment, surgical technique, and rehabilitation. This concept fits naturally with trauma care, where patient heterogeneity, bone quality, comorbidity, and function can strongly modify the best treatment strategy even for the same fracture pattern.

Digital outcomes research is also emerging as a practical frontier. A 2026 scoping review of step count in orthopedics and orthopedic trauma surgery concluded that objective digital mobility parameters are increasingly used, although their exact utility for monitoring recovery remains incompletely defined. Even so, wearable-derived mobility may ultimately bridge the gap between inpatient success and real-life recovery in ways that traditional clinic-based follow-up cannot.

Patient-centered recovery

Modern traumatology increasingly recognizes that orthopedic trauma is not only a skeletal event but also a psychological and social one. A 2024 review of patient mental health in orthopedic trauma emphasized persistent gaps in support systems and argued for stronger collaboration between surgical teams, mental health professionals, and social care structures. This literature is clinically important because depression, anxiety, pain catastrophizing, and post-traumatic stress can alter adherence, rehabilitation, and perceived outcome after otherwise technically successful treatment. Equity and representation are also rising concerns. A 2025 systematic review found inconsistent reporting of sociodemographic characteristics in orthopedic trauma randomized trials, limiting the field's ability to judge generalizability and disparities in treatment response. This problem is not merely academic: without better reporting, precision care risks becoming selective innovation for well-studied groups rather than broadly applicable progress.

Results

The retrieved recent literature clusters into a small number of dominant themes. Systems-of-care studies strongly support standardized MDT involvement and more expedited treatment pathways for vulnerable fracture patients. Technology-focused studies show strong momentum around AI, weightbearing CT, 3D planning, and digital

mobility monitoring, but most authors still call for stronger validation and implementation research before widespread adoption.

Domain	Recent signal from literature	Representative publication(s)
Multidisciplinary trauma care	Variation in specialty input remains substantial; standardized MDT pathways are recommended to reduce disparities and improve recovery.	Ann R Coll Surg Engl 2025.
Hip fracture timing	Accelerated care in selected patients with myocardial injury was associated with lower mortality than standard care.	JBJS/HIP substudy 2024, summarized 2025.
Infection prevention	Skin antisepsis choice and oral antibiotic strategies can alter postoperative management without compromising outcomes in selected settings.	PREP-IT and POvIV trials summarized in 2025.
Fixation strategy	Comparative fixation trials increasingly show subgroup-specific rather than universal superiority.	Distal femur RCT and Lisfranc meta-analysis.
Advanced imaging and planning	WBCT and 3D-printed planning tools improve anatomic assessment and operative planning in complex cases.	J Clin Med 2025 editorial and related studies.
AI and digital outcomes	Research volume is rising rapidly, but external validation and practical integration remain limited.	Systematic reviews in 2024–2026.

The contemporary evidence base can be visualized as a balance between clinical maturity and translational readiness across major themes.

In this qualitative plot, systems-of-care optimization, hip fracture timing, and infection prevention appear closest to direct practice implementation, while AI and digital outcomes remain the most promising but least mature domains for routine adoption.

Discussion

Several practice implications emerge from the reviewed literature. First, organization of care is itself a therapeutic intervention in orthopedic trauma: frail and polytrauma patients benefit when care is standardized, multidisciplinary, and time-sensitive. Second, modern implant and fixation decisions should be individualized according to anatomy, bone quality, comorbidity, and functional goals, because many contemporary comparative studies show conditional rather than absolute superiority.

Third, the field should embrace innovation selectively. Weightbearing CT, 3D modeling, and precision-planning concepts are already useful in chosen scenarios, especially where conventional imaging or templating is insufficient. By contrast, AI in trauma currently offers more conceptual promise than implementation-ready certainty, largely because of bias, weak reporting, and inadequate external validation.

Fourth, future research should move beyond narrow procedural endpoints. Digital mobility outcomes, mental health integration, and sociodemographic reporting all point toward a broader model of recovery that is more aligned with what matters to patients

after injury. For traumatology and orthopedics, the next major advance may therefore be less about inventing another implant and more about integrating surgery, data, rehabilitation, and equity into a unified care pathway.

Conclusion

The recent traumatology and orthopedics literature shows a specialty in productive transition. Stronger evidence now supports expedited and multidisciplinary care for vulnerable fracture patients, improved complication prevention strategies, and selective use of advanced imaging and patient-specific planning. Artificial intelligence, digital mobility assessment, and precision orthopedics are likely to reshape future practice, but their clinical adoption should remain evidence-led rather than technology-led until validation, equity, and long-term outcome reporting become more robust.

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