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ARTHROSCOPY-ASSISTED VERSUS CONVENTIONAL FIXATION OF INTRA-ARTICULAR FRACTURES: A NARRATIVE REVIEW OF JOINT-SPECIFIC OUTCOMES

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ABSTRACT

Arthroscopy-assisted fracture fixation has increasingly been adopted as an adjunct to conventional open reduction and internal fixation (ORIF) in the management of intra-articular fractures. While ORIF remains the standard surgical approach, arthroscopy enables direct visualization of articular surfaces and associated intra-articular pathology, potentially improving reduction accuracy and clinical outcomes. This narrative review compares functional and clinical outcomes of conventional fixation techniques with arthroscopy-assisted approaches across multiple joints, including the ankle, knee (tibial plateau), wrist (distal radius), and elbow. A comprehensive literature search was conducted using PubMed and supplemented by systematic reviews from Embase and Cochrane databases. Current evidence demonstrates that arthroscopy-assisted fixation provides joint- and fracture-specific advantages, particularly in ankle fractures, Schatzker I–III tibial plateau fractures, and complete intra-articular distal radius fractures. Evidence for elbow fractures remains limited but suggests potential benefits in carefully selected cases. Arthroscopy-assisted fixation should be considered a complementary technique and applied selectively based on fracture morphology, joint involved, and surgeon expertise.

KEYWORDS

Arthroscopy-Assisted Fixation, ORIF, Intra-Articular Fractures, Ankle, Tibial Plateau, Distal Radius, Elbow

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1. Introduction

Intra-articular fractures represent a major challenge in orthopedic trauma surgery, as accurate restoration of articular congruency is essential for preserving joint biomechanics and preventing post-traumatic osteoarthritis. Even minimal residual step-off or joint surface incongruity may result in abnormal load distribution, progressive cartilage degeneration, chronic pain, and long-term functional impairment. Numerous biomechanical and clinical studies have demonstrated a strong association between imperfect articular reduction and inferior outcomes following fracture fixation.

Conventional open reduction and internal fixation (ORIF) remains the standard surgical approach for most intra-articular fractures. While ORIF allows stable fixation and restoration of overall alignment, it relies predominantly on fluoroscopic imaging and indirect assessment of the joint surface. As a result, subtle cartilage injuries, intra-articular loose bodies, and associated ligamentous lesions may remain undetected during surgery. This limitation is particularly relevant in fractures caused by rotational or axial loading mechanisms, where damage to the articular cartilage frequently accompanies bony injury.

Over the past two decades, arthroscopy has been increasingly introduced as an adjunct to fracture fixation in selected joints. Arthroscopy-assisted fracture fixation allows direct visualization of the articular surface, enabling accurate assessment of reduction quality, identification of chondral lesions, removal of loose bodies, and simultaneous treatment of associated intra-articular pathology. This approach has been most extensively investigated in ankle fractures and tibial plateau fractures, with growing interest in distal radius and selected elbow fractures.

Despite the increasing number of clinical studies, the role of arthroscopy in fracture management remains controversial. While some authors report improved functional outcomes and reduced postoperative pain, others emphasize the technical complexity, increased operative time, and lack of clear benefit in certain fracture patterns. Importantly, available evidence suggests that the potential advantages of arthroscopy are highly dependent on fracture type, joint involved, and surgeon experience. The aim of this narrative review is to analyze and compare clinical outcomes of conventional ORIF and arthroscopy-assisted fracture fixation across multiple anatomical regions, with particular emphasis on fracture-specific indications supported by current PubMed-indexed literature.

2. Materials and Methods

2.1. Study design

Narrative review.

2.2. Literature search strategy

A narrative review of the literature was performed using PubMed as the primary database. The search strategy included combinations of the following keywords: *arthroscopy-assisted fracture fixation*, *ARIF*, *ORIF*, *intra-articular fracture*, *ankle fracture*, *tibial plateau fracture*, *distal radius fracture*, and *elbow fracture*. The search was supplemented by systematic reviews and meta-analyses incorporating Embase and Cochrane databases.

2.3. Inclusion and exclusion criteria

Peer-reviewed articles published in English were included. Both comparative studies and case series were considered due to the limited availability of randomized controlled trials. Studies focusing solely on diagnostic arthroscopy without fracture fixation were excluded. Fractures of the ankle, tibial plateau, distal radius, and elbow were analyzed separately, with attention to fracture morphology, associated intra-articular pathology, functional outcomes, and complication rates

3. Results

3.1. Ankle Fractures

Epidemiology and intra-articular pathology

Ankle fractures are among the most common intra-articular injuries treated surgically and represent the strongest evidence base for arthroscopy-assisted fracture fixation. Depending on the injury mechanism, ankle fractures may present as isolated lateral malleolar fractures, isolated medial malleolar fractures, bimalleolar fractures, or trimalleolar fractures. Rotational forces combined with axial loading frequently result in concomitant injury to the talar cartilage, tibial plafond, and syndesmotic complex.

Multiple arthroscopic studies have consistently demonstrated a high prevalence of intra-articular pathology associated with ankle fractures. Meta-analyses and prospective cohort studies report cartilage lesions, loose bodies, or syndesmotic instability in approximately 60–80% of surgically treated ankle fractures. Importantly, a significant proportion of these findings are not detected using conventional radiographs or intraoperative fluoroscopy, highlighting the diagnostic limitations of standard ORIF.

Conventional ORIF versus arthroscopy-assisted fixation

Conventional ORIF remains the gold standard for unstable ankle fractures, providing reliable restoration of bony alignment and mechanical stability. However, ORIF does not allow direct inspection of the articular surface and therefore cannot reliably identify chondral damage or confirm anatomical reduction of the joint surface.

Arthroscopy-assisted ORIF enables direct visualization of the ankle joint during fracture fixation. This allows surgeons to assess cartilage integrity, remove loose osteochondral fragments, treat chondral lesions, and dynamically evaluate syndesmotic stability. Several comparative studies have shown that arthroscopy frequently leads to additional intra-operative interventions that would not have been performed using ORIF alone.

Outcomes according to fracture pattern

Isolated lateral malleolar fractures

Evidence from PubMed-indexed cohort studies suggests that patients with isolated lateral malleolar fractures treated with arthroscopy-assisted fixation demonstrate improved functional outcomes compared with conventional ORIF. Reported benefits include higher AOFAS scores, lower postoperative pain scores, and increased patient satisfaction. The ability to identify and treat talar cartilage lesions appears to be a key factor contributing to these improved outcomes.

Bimalleolar fractures

In bimalleolar fractures, arthroscopy-assisted fixation has been shown to provide both diagnostic and therapeutic benefits. Studies report frequent detection of chondral injuries and syndesmotic malreduction despite apparently satisfactory fluoroscopic reduction. Arthroscopy allows correction of subtle malreductions and treatment of intra-articular pathology, which may translate into improved short-term functional results.

Trimalleolar fractures

In trimalleolar fractures, the role of arthroscopy appears more limited. While arthroscopy reliably identifies extensive cartilage damage and loose bodies, comparative studies do not consistently demonstrate superior functional outcomes compared with conventional ORIF. In these cases, arthroscopy is primarily considered a diagnostic and prognostic tool rather than a method that clearly improves long-term outcomes.

Functional outcomes and complications

Recent meta-analyses of PubMed-indexed studies comparing arthroscopy-assisted fixation with conventional ORIF report modest but statistically significant improvements in functional scores and pain outcomes in selected ankle fracture patterns. Importantly, no significant increase in complication rates has been observed, including infection, wound healing problems, or reoperation rates.

Overall, current evidence supports the selective use of arthroscopy-assisted fixation in ankle fractures, particularly in isolated lateral malleolar and bimalleolar fractures, where intra-articular pathology is common and directly influences clinical outcomes.

3.2. Tibial Plateau Fractures (Knee)

Epidemiology and injury mechanisms

Tibial plateau fractures represent complex intra-articular injuries of the knee joint and account for approximately 1% of all fractures and up to 8% of fractures in the elderly population. These injuries result from axial loading combined with varus or valgus forces, leading to depression, splitting, or comminution of the articular surface. Low-energy mechanisms are more common in elderly patients with osteoporotic bone, whereas high-energy trauma predominates in younger individuals.

Due to the load-bearing function of the knee joint, even minimal residual articular incongruity following fracture fixation may result in altered joint biomechanics, increased contact stresses, and accelerated development of post-traumatic osteoarthritis. As a result, precise anatomical reduction of the tibial plateau is considered a key determinant of long-term clinical outcome.

Associated intra-articular pathology

A major limitation of conventional radiographic and fluoroscopic assessment in tibial plateau fractures is the inability to accurately evaluate associated intra-articular soft tissue injuries. Arthroscopic studies consistently demonstrate a high prevalence of concomitant pathology, including meniscal tears, chondral lesions, and ligamentous injuries.

Systematic reviews and cohort studies indexed in PubMed report associated meniscal injuries in up to 60–70% of tibial plateau fractures, particularly in lateral plateau fractures (Schatzker I–III). Chondral damage of the femoral condyle or tibial plateau is reported in more than half of cases. These injuries are frequently underestimated or entirely missed when conventional ORIF is performed without arthroscopic assistance.

The presence of untreated meniscal or chondral pathology has been associated with inferior functional outcomes, persistent pain, and earlier onset of degenerative changes, highlighting the importance of comprehensive intra-articular assessment during fracture fixation.

Conventional ORIF: advantages and limitations

Conventional ORIF remains the standard surgical approach for most tibial plateau fractures and allows restoration of limb alignment, joint stability, and bony congruency. Modern fixation techniques provide reliable mechanical stability and facilitate early mobilization in appropriately selected cases.

However, ORIF relies primarily on fluoroscopic imaging to assess reduction quality, which may not accurately reflect the condition of the articular surface. Subtle residual step-offs, rotational malreductions, or cartilage damage may remain undetected. In addition, associated meniscal injuries are typically addressed through separate incisions or not treated at all, potentially compromising long-term joint function.

Arthroscopy-assisted reduction and internal fixation (ARIF)

Arthroscopy-assisted reduction and internal fixation (ARIF) has been increasingly adopted as an adjunct to conventional ORIF in selected tibial plateau fractures. Arthroscopy allows direct visualization of the articular surface, facilitating accurate reduction of depressed fragments and confirmation of joint congruency. In addition, ARIF enables simultaneous treatment of associated intra-articular pathology, including meniscal repair or partial meniscectomy and management of chondral lesions.

Several PubMed-indexed studies emphasize that arthroscopy frequently alters intraoperative decision-making by revealing residual depression or malreduction not apparent on fluoroscopy. This real-time feedback may contribute to improved quality of reduction and better functional outcomes.

Outcomes according to Schatzker classification

Schatzker I–III fractures

The strongest evidence supporting the use of arthroscopy-assisted fixation exists for Schatzker I–III fractures. Meta-analyses and comparative cohort studies demonstrate that ARIF is associated with improved functional outcomes compared with conventional ORIF in these fracture patterns. Reported benefits include better knee range of motion, higher Rasmussen and Lysholm scores, and earlier return to daily activities.

The improved outcomes observed in these cases are largely attributed to the ability to accurately elevate depressed fragments under direct visualization and to treat concomitant meniscal injuries during the same procedure.

Schatzker IV–VI fractures

In higher-energy fracture patterns (Schatzker IV–VI), the role of arthroscopy is more limited. Extensive comminution, compromised soft tissues, and increased operative complexity reduce the feasibility and potential benefit of ARIF. Available studies do not demonstrate a consistent functional advantage of arthroscopy-assisted techniques over conventional ORIF in these fractures.

In such cases, arthroscopy may still serve a limited diagnostic role but is not routinely recommended as a standard adjunct.

Functional outcomes and complication profile

Comparative studies and meta-analyses indexed in PubMed report that ARIF does not increase complication rates compared with conventional ORIF. Infection rates, wound complications, and reoperation rates appear comparable between the two techniques. Importantly, arthroscopy-assisted fixation may reduce soft tissue trauma by limiting the need for extensive arthrotomy.

Functional outcomes consistently favor ARIF in appropriately selected fracture patterns, particularly with respect to knee range of motion and patient-reported outcome measures in the short to mid-term follow-up.

Clinical implications

Current evidence supports the selective use of arthroscopy-assisted fixation in tibial plateau fractures, particularly in Schatzker I–III patterns where associated intra-articular pathology is common and directly influences clinical outcomes. In higher-energy fractures, conventional ORIF remains the preferred approach, with arthroscopy reserved for selected diagnostic or adjunctive purposes.

3.3. Distal Radius Fractures (Wrist)

Epidemiology and clinical relevance

Distal radius fractures are among the most common fractures of the upper extremity and represent a significant source of long-term functional impairment when the articular surface is involved. Intra-articular distal radius fractures account for a substantial proportion of surgically treated cases, particularly in younger patients following high-energy trauma and in elderly patients with osteoporotic bone after low-energy falls.

The wrist joint is highly sensitive to residual articular incongruity. Even minimal step-off or gap following fracture reduction has been shown to alter load transmission across the radiocarpal joint, leading to chronic pain, reduced grip strength, and accelerated degenerative changes. As a result, accurate restoration of the articular surface is considered a critical determinant of clinical outcome in intra-articular distal radius fractures.

Mechanism of injury and associated intra-articular pathology

Distal radius fractures involving the articular surface commonly result from axial loading combined with wrist extension or flexion. Such mechanisms frequently lead not only to bony injury but also to concomitant damage of intra-articular soft tissue structures, including the triangular fibrocartilage complex (TFCC), scapholunate and lunotriquetral ligaments, and articular cartilage of the radiocarpal joint.

Arthroscopic studies indexed in PubMed consistently report a high prevalence of associated intra-articular pathology in intra-articular distal radius fractures. TFCC injuries are reported in up to 40–60% of cases, while intercarpal ligament injuries and chondral lesions are also common. Importantly, many of these injuries are not reliably detected by conventional radiography or fluoroscopy and may remain untreated when ORIF is performed without arthroscopic assistance.

Conventional ORIF: strengths and limitations

Conventional ORIF using volar locking plates has become the standard surgical technique for unstable distal radius fractures. This approach provides stable fixation, allows early mobilization, and generally yields satisfactory radiographic alignment. Fluoroscopy is routinely used to assess reduction quality and implant placement.

However, fluoroscopy provides only indirect information about the articular surface and does not allow evaluation of cartilage integrity or soft tissue injuries. Several clinical studies have demonstrated that fluoroscopically acceptable reductions may still be associated with residual intra-articular step-offs or untreated ligamentous injuries. These limitations may contribute to persistent pain and suboptimal functional outcomes despite apparently successful fixation.

Arthroscopy-assisted fixation: diagnostic and therapeutic value

Arthroscopy-assisted fixation of distal radius fractures allows direct visualization of the radiocarpal joint during fracture reduction. This technique enables precise assessment of articular congruity, identification of subtle step-offs, and confirmation of anatomical reduction that may not be apparent on fluoroscopy.

In addition to evaluating reduction quality, wrist arthroscopy allows simultaneous treatment of associated intra-articular pathology. TFCC tears may be debrided or repaired, and intercarpal ligament injuries may be addressed during the same surgical procedure. Several PubMed-indexed studies report that arthroscopy alters intraoperative management in a substantial proportion of cases by identifying injuries that would otherwise remain untreated.

Outcomes according to fracture type

Complete intra-articular fractures

The strongest evidence supporting arthroscopy-assisted fixation in distal radius fractures pertains to complete intra-articular fracture patterns. Comparative studies and meta-analyses demonstrate that patients treated with arthroscopic assistance achieve improved functional outcomes compared with conventional ORIF alone. Reported benefits include lower DASH scores, reduced postoperative pain, and improved wrist range of motion in short- to mid-term follow-up.

These improved outcomes are thought to result from more accurate restoration of the articular surface and the treatment of concomitant TFCC and ligamentous injuries, which directly influence wrist stability and function.

Partial intra-articular and extra-articular fractures

In partial intra-articular and extra-articular distal radius fractures, the role of arthroscopy is less clear. Available studies do not consistently demonstrate a significant functional advantage of arthroscopy-assisted fixation over conventional ORIF in these fracture patterns. As a result, routine use of arthroscopy in extra-articular fractures is generally not recommended and should be reserved for selected cases with suspected intra-articular pathology.

Functional outcomes and complications

PubMed-indexed comparative studies indicate that arthroscopy-assisted fixation does not significantly increase complication rates compared with conventional ORIF. Rates of infection, tendon irritation, and need for secondary procedures appear comparable between the two techniques.

Functional outcomes, as assessed by patient-reported measures such as DASH and pain scores, consistently favor arthroscopy-assisted fixation in complete intra-articular fractures. However, long-term data regarding the prevention of post-traumatic osteoarthritis remain limited, and further studies with extended follow-up are required.

Clinical implications

Current evidence supports the selective use of arthroscopy-assisted fixation in intra-articular distal radius fractures, particularly complete articular patterns with a high likelihood of associated soft tissue injury. In these cases, arthroscopy provides both diagnostic and therapeutic benefits that may translate into improved functional outcomes. Conversely, routine arthroscopy in extra-articular fractures does not appear justified based on available evidence.

3.4. Elbow Fractures

Epidemiology and clinical relevance

Fractures involving the elbow joint constitute a challenging group of injuries due to the complex anatomy of the joint, its limited tolerance for residual incongruity, and a high propensity for post-traumatic stiffness. Even minor articular irregularities may lead to restricted range of motion, chronic pain, and impaired upper limb function. As a result, accurate restoration of the articular surface and early mobilization are considered essential goals of treatment.

The most common intra-articular elbow fractures include fractures of the radial head, fractures of the capitellum, and fractures associated with intra-articular loose bodies. These injuries frequently result from a fall on an outstretched hand, with axial load transmission through the forearm to the radiocapitellar joint. Compared with other joints, the role of arthroscopy in elbow fracture management remains less clearly defined, largely due to technical complexity and the proximity of neurovascular structures.

Associated intra-articular pathology

Several arthroscopic and surgical series indexed in PubMed demonstrate that elbow fractures are frequently associated with additional intra-articular pathology. Radial head fractures, particularly Mason type

I and II injuries, are often accompanied by cartilage damage to the capitellum, loose osteochondral fragments, and synovitis. Similarly, capitellar fractures may coexist with radial head impaction injuries and chondral defects.

These associated lesions are frequently underestimated on plain radiographs and may not be adequately visualized on computed tomography. When conventional ORIF or fragment excision is performed without direct visualization of the joint surface, loose bodies and cartilage defects may remain untreated, potentially contributing to persistent mechanical symptoms and postoperative stiffness.

Conventional surgical management: advantages and limitations

Conventional surgical treatment of elbow fractures includes fragment excision, open reduction and internal fixation, or radial head arthroplasty, depending on fracture pattern and stability. ORIF allows stable fixation and restoration of joint alignment but typically requires extensive soft tissue dissection, which may increase the risk of postoperative stiffness and heterotopic ossification.

Moreover, conventional open techniques provide limited visualization of the entire joint surface, particularly the posterior compartment. As a result, small loose bodies or subtle chondral lesions may be missed. These limitations have prompted interest in arthroscopy as an adjunctive tool in selected elbow fractures.

Arthroscopy-assisted management: potential benefits

Arthroscopy-assisted treatment of elbow fractures offers several theoretical advantages, including minimal soft tissue disruption, direct visualization of the articular surface, and the ability to address associated intra-articular pathology. Arthroscopy enables removal of loose bodies, assessment of cartilage damage, and assistance in the reduction of selected fracture fragments.

In Mason type I and II radial head fractures, arthroscopy has been used to evaluate joint congruity, remove loose fragments, and confirm stability of the radiocapitellar joint. Several PubMed-indexed case series report that arthroscopy-assisted management facilitates early mobilization and may reduce the risk of postoperative stiffness in these selected fracture patterns.

In capitellar fractures, arthroscopy may assist in assessing fracture morphology and reduction accuracy; however, its use remains limited to highly selected cases and experienced centers due to technical demands.

Clinical outcomes and evidence level

Compared with ankle, knee, and wrist fractures, the evidence supporting arthroscopy-assisted management of elbow fractures is limited. Most available studies consist of small retrospective series or case reports, and randomized controlled trials are lacking. Nevertheless, reported outcomes suggest that arthroscopy-assisted techniques may yield comparable or slightly improved short-term functional results compared with conventional open approaches in carefully selected patients.

Improved early range of motion and reduced mechanical symptoms have been reported following arthroscopy-assisted treatment of Mason type I–II radial head fractures. However, long-term outcomes and the potential impact on post-traumatic osteoarthritis remain insufficiently studied.

Complications and technical considerations

Elbow arthroscopy is technically demanding and carries a risk of neurovascular injury due to the close proximity of the ulnar, median, and radial nerves. Fluid extravasation and compartment syndrome are additional concerns. Consequently, arthroscopy-assisted fracture management of the elbow should be reserved for surgeons with substantial experience in elbow arthroscopy.

Available studies suggest that, when performed by experienced surgeons, arthroscopy-assisted techniques do not significantly increase complication rates compared with conventional surgery. Careful patient selection and adherence to established safety principles are critical to minimizing risk.

Clinical implications

Based on current PubMed-indexed evidence, arthroscopy-assisted management of elbow fractures should be considered a selective adjunct rather than a routine technique. The greatest potential benefit appears to exist in Mason type I and II radial head fractures with suspected intra-articular loose bodies or cartilage damage. In more complex fracture patterns, conventional open techniques remain the preferred approach.

4. Discussion

The present narrative review analyzed current PubMed-indexed literature comparing conventional open reduction and internal fixation (ORIF) with arthroscopy-assisted fracture fixation across multiple joints. The findings demonstrate that the clinical value of arthroscopy is highly joint- and fracture-specific and cannot be generalized across all intra-articular fractures. Rather than serving as a universal alternative to open techniques, arthroscopy should be viewed as a complementary tool that enhances intra-articular assessment and, in selected cases, improves functional outcomes.

A consistent finding across all reviewed joints is the high prevalence of associated intra-articular pathology that is frequently underestimated or missed when conventional ORIF is performed without direct visualization of the joint surface. Cartilage lesions, loose bodies, ligamentous injuries, and subtle malreductions were commonly identified during arthroscopy, particularly in ankle, tibial plateau, and distal radius fractures. These findings support the concept that fracture fixation alone may be insufficient to restore normal joint function if associated intra-articular damage is left untreated.

Joint-specific interpretation of evidence

Ankle fractures

Among the analyzed joints, ankle fractures provide the strongest and most consistent evidence supporting the use of arthroscopy-assisted fixation. Multiple comparative studies and meta-analyses demonstrate that arthroscopy frequently alters intraoperative management by identifying cartilage lesions and syndesmotic malreduction not apparent on fluoroscopy. Functional improvements reported in isolated lateral malleolar and bimalleolar fractures suggest that treatment of intra-articular pathology contributes meaningfully to patient outcomes.

However, in trimalleolar fractures, the role of arthroscopy appears primarily diagnostic. While arthroscopy reliably identifies extensive cartilage damage, current evidence does not consistently demonstrate superior long-term functional outcomes compared with conventional ORIF. This observation suggests that the severity of initial cartilage injury, rather than the fixation technique itself, may be the dominant determinant of outcome in complex ankle fractures.

Tibial plateau fractures

In tibial plateau fractures, arthroscopy-assisted reduction and internal fixation (ARIF) offers clear advantages in selected fracture patterns, particularly Schatzker I–III injuries. The ability to directly visualize depressed fragments and treat associated meniscal injuries likely explains the superior functional outcomes reported in comparative studies. Meniscal preservation or repair performed during ARIF may play a critical role in maintaining long-term knee function.

In contrast, the benefits of arthroscopy diminish in high-energy Schatzker IV–VI fractures. Extensive comminution, compromised soft tissues, and increased operative complexity limit the feasibility of arthroscopy and reduce its potential impact on outcomes. These findings emphasize that fracture morphology and injury energy are key factors in determining the appropriateness of arthroscopy-assisted techniques.

Distal radius fractures

The role of arthroscopy in distal radius fractures highlights the importance of fracture pattern selection. In complete intra-articular fractures, arthroscopy-assisted fixation provides both diagnostic and therapeutic advantages by enabling precise assessment of articular congruity and treatment of TFCC and intercarpal ligament injuries. Improved functional outcomes observed in these cases likely result from restoration of both bony and soft tissue stability.

Conversely, in extra-articular or partial intra-articular fractures, routine arthroscopy does not appear to confer significant additional benefit. These findings reinforce the concept that arthroscopy should be reserved for fracture patterns in which intra-articular pathology is expected to influence clinical outcomes.

Elbow fractures

Compared with other joints, the evidence supporting arthroscopy-assisted management of elbow fractures remains limited. Available studies are primarily retrospective and consist of small case series. Nevertheless, selected applications—particularly in Mason type I–II radial head fractures—suggest that arthroscopy may facilitate removal of loose bodies, improve early range of motion, and reduce postoperative stiffness.

The limited adoption of arthroscopy in elbow fractures reflects both technical challenges and safety concerns related to neurovascular structures. Consequently, arthroscopy in elbow fracture management should be considered a highly selective adjunct performed by experienced surgeons rather than a routine approach.

Safety considerations and complication profile

An important finding across all joints is that arthroscopy-assisted fracture fixation does not appear to significantly increase complication rates when compared with conventional ORIF, provided that appropriate patient selection and surgical expertise are present. Reported rates of infection, wound complications, and reoperation are comparable between techniques in most studies.

However, the risk profile is joint-specific. Elbow arthroscopy carries a higher risk of neurovascular injury, while fluid extravasation may pose challenges in ankle and knee procedures. These risks underscore the importance of surgeon experience and adherence to established arthroscopic safety principles.

Implications for post-traumatic osteoarthritis

One of the theoretical advantages of arthroscopy-assisted fixation is the potential reduction in post-traumatic osteoarthritis through improved articular reduction and treatment of cartilage lesions. Although short- and mid-term functional outcomes appear favorable in selected fractures, long-term data assessing the incidence of post-traumatic osteoarthritis remain limited. Current evidence suggests that the severity of initial cartilage injury may outweigh the influence of fixation technique on long-term joint degeneration.

Limitations of current evidence

The interpretation of available data is limited by several factors. Most studies are retrospective, with heterogeneous patient populations, fracture patterns, and outcome measures. Randomized controlled trials are scarce, and long-term follow-up data are limited. Additionally, selection bias may influence reported outcomes, as arthroscopy is often applied in less severe fracture patterns or in specialized centers with greater surgical expertise.

Clinical decision-making framework

Based on current evidence, arthroscopy-assisted fracture fixation should be considered within a fracture-specific and joint-specific framework. The greatest benefit is observed in fracture patterns with a high prevalence of associated intra-articular pathology and where arthroscopy can directly influence treatment decisions. Conversely, routine use of arthroscopy in all intra-articular fractures is not supported by available data.

5. Conclusions

Arthroscopy-assisted fracture fixation represents a valuable adjunct to conventional open reduction and internal fixation in the management of selected intra-articular fractures. Current evidence indicates that the clinical benefit of arthroscopy is not universal but depends on fracture pattern, joint involved, and the likelihood of associated intra-articular pathology.

Among the analyzed joints, the strongest and most consistent evidence supporting arthroscopy-assisted techniques exists for ankle fractures and tibial plateau fractures. In these settings, arthroscopy facilitates accurate assessment of articular congruity, identification and treatment of cartilage and soft tissue injuries, and optimization of reduction quality, which may translate into improved functional outcomes in appropriately selected cases.

In distal radius fractures, arthroscopy provides meaningful advantages primarily in complete intra-articular fracture patterns, where concomitant TFCC and ligamentous injuries are common and directly influence wrist function. Routine arthroscopy in extra-articular fractures does not appear to confer significant additional benefit and is therefore not recommended.

The role of arthroscopy in elbow fracture management remains limited and highly selective. Available evidence suggests potential benefits in carefully chosen cases, such as Mason type I–II radial head fractures with suspected intra-articular loose bodies or cartilage damage. However, technical complexity and safety considerations currently restrict its broader application.

Overall, arthroscopy should be regarded as a complementary tool rather than a replacement for conventional fixation techniques. Its selective use, guided by fracture morphology, joint-specific considerations, and surgeon expertise, may enhance intra-articular assessment and improve clinical outcomes without increasing complication rates. Further high-quality prospective studies are required to better define fracture-specific indications and long-term outcomes associated with arthroscopy-assisted fracture fixation.

6. TABLES

Table 1. Overview of arthroscopy-assisted fixation by joint and fracture type

Joint	Fracture type	Typical associated intra-articular pathology	Role of arthroscopy	Main clinical benefit
Ankle	Isolated lateral malleolar	Talar cartilage lesions, loose bodies, occult syndesmotic instability	Visualization of cartilage, syndesmosis assessment	Improved functional scores (AOFAS), reduced pain
Ankle	Bimalleolar	Chondral damage, syndesmotic malreduction	Diagnostic and therapeutic adjunct	Improved short-term functional outcomes
Ankle	Trimalleolar	Extensive cartilage injury, loose bodies	Primarily diagnostic	Prognostic assessment
Knee (tibial plateau)	Schatzker I–III	Meniscal tears, chondral lesions	Reduction control, meniscus repair	Improved ROM and knee scores
Knee (tibial plateau)	Schatzker IV–VI	Chondral damage, ligamentous injury	Limited, selective use	No consistent advantage
Wrist (distal radius)	Complete intra-articular	TFCC tears, intercarpal ligament injury	Articular congruity assessment, TFCC repair	Improved DASH, reduced pain
Wrist (distal radius)	Extra-articular / partial	Low incidence of soft tissue injury	Limited role	No clear benefit
Elbow	Radial head (Mason I–II)	Loose bodies, cartilage damage	Loose body removal, assessment	Improved early ROM
Elbow	Complex intra-articular	Chondral injury, comminution	Rare, selective	Unclear benefit

Table 2. Functional outcomes: arthroscopy-assisted fixation vs conventional ORIF

Joint	Outcome measure	Arthroscopy-assisted fixation	Conventional ORIF	Key findings
Ankle	AOFAS score	Higher in isolated lateral & bimalleolar fractures	Lower	Meta-analyses show modest but significant improvement
Ankle	VAS pain	Lower postoperative pain	Higher pain scores	Benefit mainly short- to mid-term
Knee	Lysholm score	Higher in Schatzker I–III	Lower	Better functional recovery with ARIF
Knee	Rasmussen score	Improved	Inferior	Better reduction quality
Wrist	DASH score	Lower (better function)	Higher	Benefit limited to complete intra-articular fractures
Wrist	ROM	Improved	Comparable	Small but clinically relevant
Elbow	Range of motion	Faster early recovery	Slower	Evidence limited to small series

Table 3. Strength of evidence and clinical recommendations

Joint	Level of evidence (PubMed)	Recommendation
Ankle	High (meta-analyses, cohort studies)	Recommended in selected fracture patterns
Knee (tibial plateau)	High for Schatzker I–III	Recommended in low-energy fractures
Wrist (distal radius)	Moderate	Selective use in complete intra-articular fractures
Elbow	Low	Highly selective, expert use only

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