

Review Paper

Postarthroscopic Glenohumeral Chondrolysis: A Clinical Review



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ABSTRACT

Postarthroscopic glenohumeral chondrolysis (PAGCL) is a rare but catastrophic complication following shoulder arthroscopy, characterized by rapid and irreversible degeneration of articular cartilage, leading to persistent pain, stiffness, and severe functional impairment. Although its incidence is low, PAGCL predominantly affects young and active patients and often results in early joint failure requiring surgical intervention. The condition has been increasingly associated with potentially modifiable iatrogenic factors, particularly the intra-articular use of local anesthetics. Due to its devastating consequences and lack of standardized management guidelines, early recognition and prevention are of paramount importance. This mini-review summarized the current evidence regarding the epidemiology, proposed pathophysiological mechanisms, clinical presentation, diagnostic considerations, and available treatment strategies for PAGCL, with an emphasis on prevention and clinical decision-making.

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Introduction

Postarthroscopic glenohumeral chondrolysis (PAGCL) refers to the rapid degeneration of the articular cartilage of the glenohumeral joint following arthroscopic procedures. Unlike gradual osteoarthritis, PAGCL typically presents after routine shoulder arthroscopy with progressive shoulder pain, stiffness, and functional loss. The exact pathogenic mechanism remains incompletely understood, and treatment is challenging due to the limited cartilage repair potential [1].

Although rare, PAGCL is clinically significant due to its disproportionate impact on young and otherwise healthy patients, frequently leading to early joint degeneration and the need for salvage procedures, such as shoulder arthroplasty. PAGCL is a rare but devastating complication that most often strikes young patients and results in rapid articular cartilage loss after shoulder arthroscopy [2].

The exact pathophysiological mechanisms underlying PAGCL remain incompletely understood; however, accumulating evidence suggests a multifactorial etiology involving chemical toxicity, mechanical insult, and thermal injury to articular cartilage. The development of PAGCL appears to involve multiple interacting factors, including mechanical, thermal, and chemical events that lead to cartilage injury and degeneration [3].

Among these, intra-articular administration of local anesthetics via postoperative pain pumps has emerged as a major potentially preventable risk factor. Intra-articular infusion of local anesthetics, particularly bupivacaine, has been strongly associated with the development of glenohumeral chondrolysis; these agents are toxic to cartilage, and intra-articular pain pumps confer a higher risk than single injections [4].

Given the increasing use of shoulder arthroscopy worldwide and the absence of clear diagnostic and therapeutic guidelines for PAGCL, a concise synthesis of existing evidence is warranted. Current literature reviews emphasize that despite its rarity, the serious nature of PAGCL and its poorly understood etiology justify a comprehensive synthesis of the evidence to guide diagnosis, prevention, and management [5].

PAGCL predominantly affects younger patients (often in their 20s–30s) and can develop within months after the index arthroscopic surgery. Common symptoms include deep shoulder pain and progressive range-of-motion loss [2].

A systematic literature review of 100 cases found that most patients were young, with symptoms developing soon after arthroscopy. Instability repairs and labral procedures are arthroscopic procedures linked to PAGCL [5]. PAGCL should be considered in cases who present with unexplained persistent pain and loss of motion after otherwise uncomplicated arthroscopy. Clinical examination and imaging, such as MRI aid assessment; however, the diagnosis is mainly based on clinical course and excluding other causes [2].

This mini-review aimed to provide an updated overview of the current understanding of PAGCL, focusing on its etiology, clinical presentation, diagnostic challenges, and management options, while highlighting key considerations for prevention in clinical practice.

Local anesthetic toxicity and mechanical and surgical factors

Intra-articular infusions of local anesthetics, like bupivacaine, lidocaine, have been considered an important risk factor. They are toxic to articular cartilage, especially when delivered continuously through pain pumps [2, 4, 6]. Most reported cases involved local anesthetic postoperative infusion, which suggests a strong correlation with PAGCL development [5]. Besides chemical toxicity, surgical and mechanical factors are involved in the pathogenesis of PAGCL. Although there is no identified single mechanism, mechanical trauma from instrumentation, thermal damage, and implanted materials, like suture anchors can initiate or exacerbate cartilage injury.

Thermal damage

Thermal devices used during arthroscopic procedures — including radiofrequency probes and electrocautery instruments — can generate temperatures sufficient to cause chondrocyte death and matrix degeneration. Experimental data and clinical observations have documented that prolonged or improperly managed use of thermal energy can lead to localized cartilage damage and predispose the joint to chondrolysis. Case reports have linked procedures, such as thermal capsulorrhaphy and extensive synovectomy involving heat sources to subsequent chondrolysis [7].

Mechanical trauma

Mechanical injury to the cartilage surface during arthroscopy can occur from instrument manipulation, cannula placement, or repetitive abrasion against articular surfaces. Prominently placed suture anchors or metallic/

bioabsorbable implants may produce chondral scuffing, or local stress concentrations that initiate cartilage breakdown. Laboratory studies in animal models have demonstrated that wear particles from orthopedic materials can stimulate inflammatory responses and the expression of chondrolytic enzymes, suggesting a biological pathway through which mechanical factors may contribute to chondrolysis [8].

Interaction of factors

A systematic review of PAGCL cases found that the majority of patients had exposure to one or more potential mechanical or surgical triggers, including suture anchors, thermal devices, and local anesthetic pumps. While chemical toxicity remains a prominent risk factor, these mechanical and thermal exposures often co-occur and may act synergistically with chemical insults to initiate a cascade of cartilage injury and degenerative change [8].

Together, these findings support a multifactorial model of PAGCL pathogenesis, in which surgical technique, the choice and handling of instruments and implants, and the intraoperative environment all interact with biological cartilage vulnerability to determine clinical outcomes.

General considerations

PAGCL is a rare but devastating complication that frequently affects younger patients and progresses rapidly, often resulting in significant cartilage loss and functional disability [2].

Non-surgical management

There is no definitive curative treatment for PAGCL. Conservative approaches are primarily supportive and aim to reduce symptoms rather than modify disease progression. These may include activity modification, nonsteroidal anti-inflammatory drugs (NSAIDs), physical therapy to preserve motion, and short-term use of corticosteroid injections. However, existing evidence suggests that non-surgical treatment rarely alters the natural history of PAGCL, and most patients experience progression despite conservative care [2].

Surgical options

In advanced cases with severe functional impairment, surgical intervention is often necessary. The principal surgical option reported in the literature is shoulder arthroplasty, which aims to relieve pain and improve function once the cartilage damage is irreversible. In a clinical

series of patients undergoing shoulder arthroplasty for chondrolysis, pain scores improved significantly after arthroplasty, range of motion (abduction, rotation) improved in many patients. Some shoulders required reoperation (e.g. glenoid loosening, infection, stiffness); patient satisfaction varied, and overall outcomes were less predictable compared with arthroplasty for primary osteoarthritis. Another case series found that most patients underwent arthroplasty within approximately 1–3 years after symptom onset, reflecting the aggressive progression of cartilage loss despite other treatments [9, 10].

Prevention

Because effective treatments are limited and progression is often inevitable, prevention remains the most important strategy in managing PAGCL. Multiple studies point to specific preventable iatrogenic factors.

Avoid intra-articular continuous local anesthetic infusion

A systematic review of the clinical literature confirms that continuous intra-articular infusions of local anesthetics (e.g. bupivacaine, lidocaine) are strongly associated with cartilage toxicity and the development of chondrolysis after arthroscopy. Intra-articular pain pumps significantly increase the risk compared with single injections [4].

Judicious use of pain management modalities

Alternative pain management strategies, such as peripheral nerve blocks or subacromial pain pumps (when clearly outside the joint) may reduce the risk of exposing articular cartilage to toxic concentrations of anesthetics [6].

Minimizing mechanical and thermal injury

Although the evidence is more limited, surgical factors, such as excessive use of thermal devices and improper placement of suture anchors, have been reported in association with PAGCL cases and may contribute to chondrocyte injury through mechanical or thermal stress [8].

Conclusion

PAGCL is a rare but serious complication of shoulder arthroscopy with a poorly understood etiology. Evidence points to a multifactorial pathogenesis involving local anesthetic toxicity and mechanical factors. Diagnosis relies on clinical suspicion in the context of progressive symptoms after arthroscopy. Management remains challenging, and prevention through cautious surgical practice is paramount.

Ethical Considerations

Compliance with ethical guidelines

There were no ethical considerations to be considered in this research.

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Authors' contributions

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Conflict of interest

The authors declared no conflict of interest.

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