



# Severe chondrolysis after shoulder arthroscopy: A case series

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**Summary** Chondrolysis of the glenohumeral joint can be a devastating complication of shoulder arthroscopy. It has rarely been reported, and its etiology is unknown. We report 23 cases of glenohumeral chondrolysis after various types of arthroscopic shoulder procedures.

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Chondrolysis is defined as the disappearance of articular cartilage as the result of lysis or dissolution of the cartilage matrix and cells. For our discussion, this definition should be further refined to include the term “rapid” (onset of radiographic loss of joint space within 12 months of documented normal joint during arthroscopy) to describe the dissolution of cartilage matrix and chondrocytes. Because “acute” typically indicates onset within several weeks to a few months and “chronic” implies long-term presence, we chose the term “rapid” to describe the onset of degeneration in cases of chondrolysis to emphasize the difference from other more common reasons for degenerative disease of the shoulder. Historically, chondrolysis was mostly associated with the hip as an idiopathic disorder in the developing hip<sup>5</sup> or associated with slipped capital epiphysis.<sup>16</sup> The etiology remains elusive but may be multifactorial, given the variety of reported associations and presumed causes. Chondrolysis has been reported to occur after both physical and surgical trauma,<sup>11</sup> after

meniscectomy,<sup>1</sup> and with the use of irrigation fluid,<sup>25</sup> thermal devices,<sup>8,10,15,24</sup> or bioabsorbable implants.<sup>23</sup>

Chondrolysis of the glenohumeral joint after arthroscopic surgery appears to be rare, being reported in only a few published studies.<sup>2,8,14,19,22</sup> The reported association of the occurrence of chondrolysis with high-volume intra-articular pain pumps, bioabsorbable labral fixation devices, and thermal probes is most concerning, given the frequency of use of these technologies in modern shoulder arthroscopy. However, the actual cause of even the reported cases has not been confirmed, and the associations are speculative at this juncture. No randomized or prospective studies have been performed. Given the severity of this devastating complication and the young patients affected, published anecdotal observations can be useful.

We report a series of 23 cases of chondrolysis of the glenohumeral joint occurring after shoulder arthroscopy in young patients. The suspected causative associations, presenting characteristics, and our treatment experience are discussed.

## Materials and methods

We reviewed the records of suspected cases of glenohumeral chondrolysis that presented to our office after shoulder

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arthroscopy from 2005 to 2006. This research study was submitted to and approved by the Institutional Review Board of Physiotherapy Associates (Exton, PA) before the review of patient data. This time period was used because we had not been aware of a single case of glenohumeral chondrolysis in our clinic before 2005. A total of 23 cases were identified. Chondrolysis was suspected in those patients who presented with a delayed increase in shoulder pain after arthroscopy (typically 8-12 months after the index procedure) and whose radiographs showed a clear loss of joint space. In all of these cases, radiographs taken before the index surgery were interpreted as normal, that is, no radiographic evidence of loss of joint space, osteophytes, cystic changes, or other findings that could represent early arthritis.

Patients with any known history or diagnosis of arthritis or infection before the index surgery were excluded. All operative reports were reviewed, in addition to any available preoperative imaging studies and intraoperative photographs from the index surgery. A thorough history was obtained and physical examinations performed on all suspected chondrolysis patients. Additional radiographs and magnetic resonance imaging (MRI) scans were obtained in some cases. In addition, because of the concern initially over infection, the first 10 cases encountered had blood work performed, including complete blood count, sedimentation rate, and C-reactive protein level. None had a bone scan or nuclear white cell scan.

Eleven of the cases occurred in patients in whom the index operation was performed by the senior author. The remaining patients had been referred to us for further care and their surgery performed elsewhere. None of the latter had been given the diagnosis of chondrolysis before being evaluated in our clinic. The 11 cases represented less than 1% of the total shoulder surgeries performed during the time when an indwelling pain catheter was used. Although symptoms may have been present, they were not sufficient to warrant a return to our office before 8 months after the index surgery. In addition, these numbers do not account for patients in whom chondrolysis may have developed to a lesser degree and who did not feel the need to return to the clinic for evaluation or those who may have sought opinions elsewhere. We did not attempt to contact all shoulder surgery patients during a specific time period for this study.

We evaluated demographic data, including gender and age, time of onset (as indicated by the patient's history of a rapid change in pain) from the index surgery, and initial pathology. In addition, surgical variables of concern including the use of bioabsorbable fixation devices, intra-articular pain pumps, and thermal probes were documented from the patient history and medical records. Treatment methods are presented but outcomes are not yet available and are not the purpose of this report.

## Results

There were 23 documented cases of chondrolysis of the glenohumeral joint. The details are summarized in Table I. The mean age was 30.5 years (range, 15-47 years). The onset of symptoms occurred at a mean of 9.1 months after the index operation (range, 8-12 months). No patient indicated an intervening injury during the time from index surgery to presentation to our office. Review of all available preoperative and intraoperative data failed to show any

evidence of degenerative arthritis, infection, or inflammatory condition before the index surgery in any patient.

There were 14 cases involving labral repairs with bioabsorbable fixation devices (suture anchors and/or tacks), including 5 Bankart-type tears and 9 superior labrum anterior-posterior tears. There were 7 cases with documented use of a thermal probe for capsular laxity (3 monopolar and 4 bipolar), but the wattage used was not documented in the medical records. Seventeen cases involved the use of an intra-articular high-volume pain pump catheter, with 250 to 300 mL of 0.25% bupivacaine administered over a 48-hour period. One of these catheters was reportedly placed in the subacromial space after a mini-open rotator cuff repair. The remainder had been placed within the glenohumeral joint itself. Epinephrine appeared to have been used in 6 known cases, but not all operative reports reflected the actual concentration or amount. Other records (ie, nursing operative records and anesthesia records) were not available, except in the patients who had their index surgery at our clinic. In addition, there were 4 cases in which there was no recorded use of fixation anchors, thermal probes, or pain pumps. Two of these had only an arthroscopic debridement of a frayed labrum and/or partial rotator cuff tear. However, all 4 did have a documented intra-articular bolus of 20 to 30 mL of 0.25% bupivacaine with 1:200,000 epinephrine at the end of the procedure.

Initially, the first 10 cases were also evaluated for occult infection, despite a lack of constitutional symptoms, including a complete blood count, sedimentation rate, and C-reactive protein level, which were normal in all cases. In addition, 4 of these had a negative joint aspirate with no bacteria seen on Gram stain and no growth after 21 days' incubation (aerobic, anaerobic, and fungal). After these 10 negative infection workups, the remaining patients did not have these tests performed because of the lack of other clinical findings that would lead us to suspect an infectious etiology.

The clinical presentation was similar in all patients. All had initially done well after surgery, with nearly complete resolution of their original symptoms. Most had already completed a rehabilitation program and returned to function. At a mean of 9.1 months, they noticed an increase in pain that rapidly escalated over the next 4 to 6 weeks. Nine patients also had a rapid loss of function and loss of range of motion. The remainder described significant pain but had preserved motion and function.

Radiographic findings were similar as well. Compared with preoperative radiographs, there was a diffuse loss of joint space ranging from 1 mm to complete loss (Figure 1). None had any evidence of substantial bone loss develop on plain radiographs, and osteophytes were not apparent. In some cases, MRI scans were obtained. These showed profound loss of articular cartilage and symmetric subchondral cysts on both sides of the joint (Figure 2).

In all 23 cases, treatment initially consisted of the use of injected and/or oral corticosteroids, nonsteroidal anti-inflammatory medication, and/or physical therapy. This was

**Table I** Summary of chondrolysis cases including demographics, pathology, time of onset, and ultimate treatment

Age (y)	Sex	Original complaint/surgery	Onset	Anchor	Thermal	Pump	Treatment
40	M	Traumatic instability Bankart	9	BIOABS	Monopolar	IA	Arthroplasty
45	F	SLAP (thrower)	10	BIOABS		IA	Debridement
41	F	Traumatic instability Bankart	10	BIOABS		IA	Arthroplasty
47	M	P/O RTC repair	10	Metal		SUB AC	Arthroplasty
22	F	MDI with chondral blisters	12		Bipolar	IA	Debridement
27	M	SLAP (thrower)	9	BIOABS		IA	Arthroplasty
15	F	SLAP (direct blow impact)	8	BIOABS		IA	Debridement/HA
33	M	SLAP (fall)	10	BIOABS		IA	Arthroplasty
26	M	Posterior labrum	9	BIOABS	Bipolar	IA	Debridement/HA
47	F	PASTA/type I SAD	8				Arthroplasty
28	M	SLAP (fall)	10	BIOABS		IA	Debridement
29	M	Traumatic instability Bankart	12	BIOABS		IA	Debridement/HA
27	F	MVA partial bursal cuff	12				Debridement/HA
29	M	SLAP (fall)	7	BIOABS		IA	Arthroplasty
32	M	SLAP (thrower)	8	BIOABS		IA	Arthroplasty
46	F	Idiopathic frozen shoulder	9			IA	Arthroplasty
16	F	MDI (thrower)	9		Monopolar		Debridement/HA
18	M	SLAP (thrower)	8	BIOABS		IA	Debridement/HA
22	M	Bankart	10	BIOABS	Bipolar	IA	Debridement/HA
26	M	Bankart	10	BIOABS	Monopolar	IA	Debridement/HA
24	M	SLAP I/PASTA	9				Debridement/HA
31	F	MDI	8		Bipolar		Debridement/HA
30	M	Interval repair	8				Debridement/HA

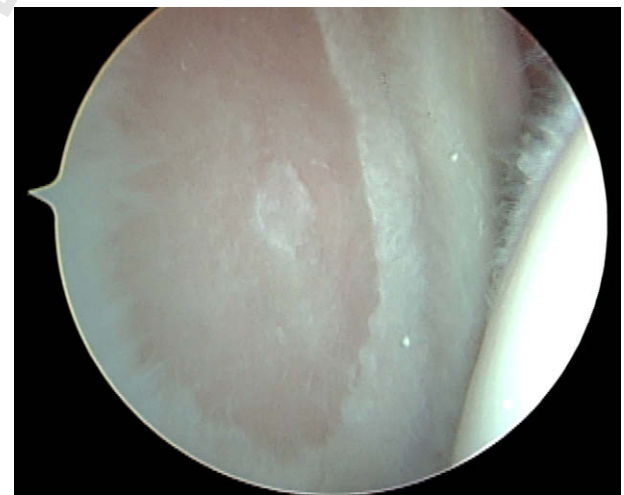
BIOABS, Bioabsorbable anchor; IA, intra-articular pain pump; SLAP, superior labrum anterior-posterior; HA, injection series of hyaluronic acid.

not effective in any case to the point that patients could return to desired activity. Of the cases, 9 (39.1%) ultimately went on to undergo cementless humeral head resurfacing arthroplasty with the Copeland Macrobond Implant (Biomet, Warsaw, IN). These cases had initially presented with severe loss of motion and function and, at the time of surgery, had more diffuse loss of articular cartilage on the humeral head (Figure 3) and a contracted, thickened capsule. In 6 of these cases (26.1%), arthroscopic debridement and capsular release were performed before arthroplasty had not improved their range of motion, and the patients had continued pain. The remainder (14 cases [60.9%]) underwent successful arthroscopic debridement and/or capsular release, with 11 also receiving subsequent hyaluronic acid injections beginning 6 weeks later.

Surgical findings at arthroscopy indicated a paucity of loose bodies, nearly complete dissolution of the articular cartilage on the glenoid, and more central cartilage erosion of the humeral head (Figure 4). None of the cases had evidence of mechanical abrasion by a pain catheter or broken labral fixation device, leading us to conclude that the etiology was biochemical. Furthermore, the surrounding intra-articular soft tissues appeared to be unaffected except in a few cases in which the labral tear may not have healed.

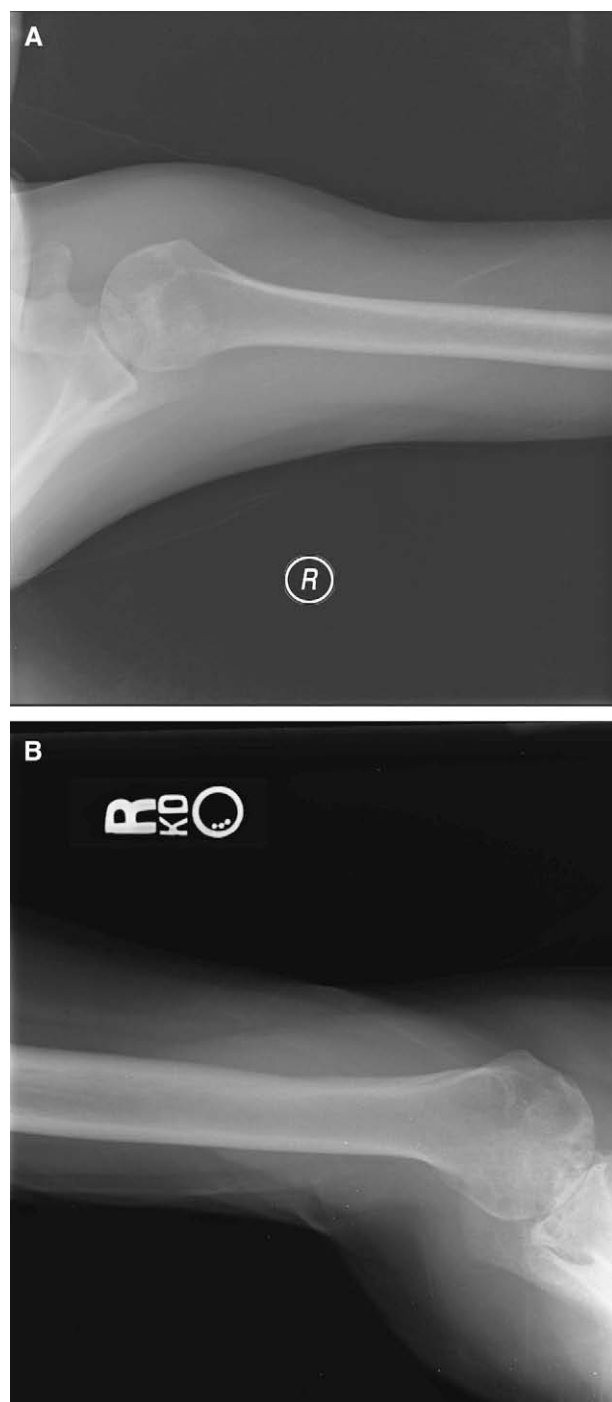
## Discussion

Given the total number of shoulder arthroscopies done each year, the occurrence of chondrolysis still appears to be rare.



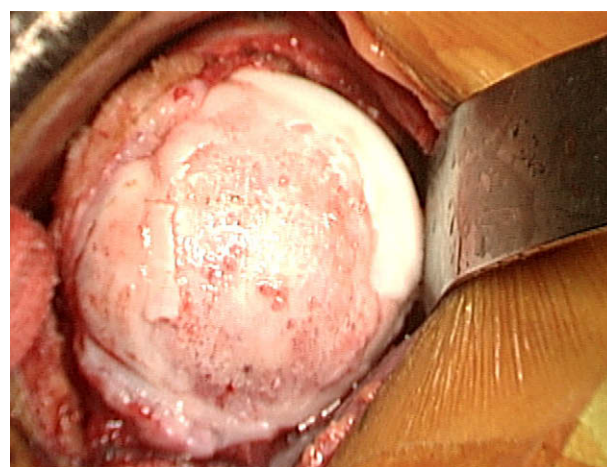
**Figure 1** Glenoid with nearly complete loss of articular cartilage 9 months after suture capsulorrhaphy and use of an intra-articular pain pump in a 17-year-old female athlete. This shoulder had normal articular cartilage at the index surgery.

Of the 3 commonly used modalities implicated by various authors as potential contributors to chondrolysis (pain pumps, thermal devices, and bioabsorbable tissue anchors), devices used for tissue shrinkage initially had the greatest research support as a potential cause for chondrolysis.<sup>8,12,24</sup> The association for both pain pumps and bioabsorbable anchors was initially more tenuous.<sup>4,6</sup> Gobezie et al<sup>6</sup> reported on 687 consecutive patients who had received pain



**Figure 2** Axillary radiographs of same shoulder from **Figure 1** preoperatively (**A**) and at 9 months postoperatively (**B**).

pumps postoperatively with no instances of chondrolysis or other physiologic side effects. Other reports in the literature on the use of continuous infusion of local anesthetics for postoperative pain control in the shoulder would seem to indicate that pain pumps are both safe and efficacious.<sup>3,9,17,18</sup> Conversely, 2 recent animal studies suggest that direct perfusion of articular cartilage with bupivacaine

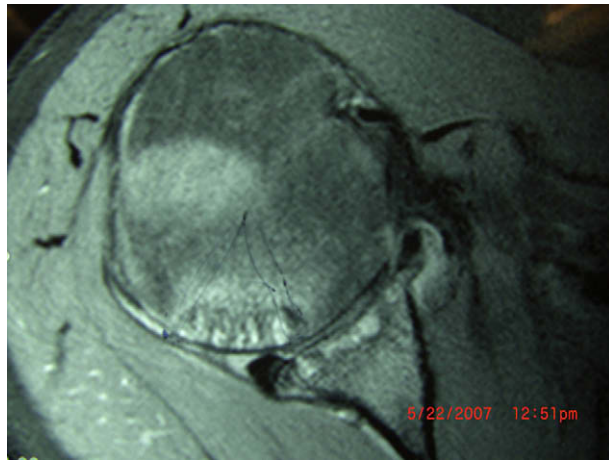


**Figure 3** Intraoperative photograph of humeral head with appearance of “dissolved” articular cartilage.

may have deleterious effects on cartilage metabolism.<sup>4,7</sup> More recently, 0.5% bupivacaine was shown to be significantly more toxic to human chondrocytes than ropivacaine.<sup>20</sup> Whereas the degradation products of bioabsorbable devices have been shown to be chondrotoxic, chondrolysis associated with the use of these devices may more likely be the result of mechanical factors (dislodgement and fragmentation) than a biochemical sequela.<sup>21</sup>

As noted earlier, the available literature on the pathophysiology of chondrolysis after arthroscopic shoulder surgery is sparse. Whereas other authors have correlated the occurrence of chondrolysis with modalities such as pain pumps, bioabsorbable anchors, and thermal devices, the actual etiology would appear to be much more complex and multifactorial. The demographic data of the patients in this series do little to clarify potential etiologies, because they are a fairly representative patient sampling of a typical orthopaedic practice. We were unable to identify a single specific modality that we could implicate in the initiation of postoperative chondrolysis. More likely, we believe that chondrolysis is an unfortunate convergence of multiple factors that may initiate rapid articular cartilage dissolution and degenerative changes. Realistically, these may include not only the modalities mentioned previously but such factors as genetic predisposition of the patient, irrigation fluids used during the procedure (type, temperature, and pressure), the surgical procedure itself, and any medications the patient has or is taking. These factors remain to be defined. Certainly, with the addition of recent laboratory evidence of chondrocyte toxicity of local anesthetics,<sup>4,7,20</sup> caution should be used in considering the use of indwelling pain catheters near hyaline cartilage.

In our series, we identified some common presenting factors that may aid in making the diagnosis of chondrolysis. Most of our patients had surgery elsewhere and presented with advanced disease, that is, the process of chondrolysis was already mature, and extensive damage to the joint surfaces had already occurred. Upon interviewing



**Figure 4** Typical MRI scan showing complete loss of joint space with subchondral cystic changes on both sides of joint, similar in appearance to rheumatoid or other inflammatory arthritis.

the patients, we found that most had initially done well after their procedure, with many indicating nearly complete recovery. However, all noted that they had a sudden change in symptoms, with a rapid increase in their pain that was characterized as different than their original complaints. Most suggested that it began around 8 to 12 months after their original surgery and became severe over a few months' time. This was true for our cases as well, in whom a more defined timeline could be determined. The pain was initially described as a deep, dull ache but progressed to intense pain, particularly in the evening and after activity. Few patients had mechanical symptoms, such as catching, locking, or clicking. Unfortunately, because of the lack of suspicion, very few had early radiographs or MRI scans obtained, and they were often told that they were having pain from overactivity too soon after their procedure. This was particularly true for those who maintained nearly normal range of motion and function. A high index of suspicion should be maintained for those with these symptoms who also had intra-articular exposure to high-volume pain pumps, bioabsorbable anchors or tacks, and/or thermal devices.

Because the findings on plain radiographs were consistently abnormal, we strongly suggest that anyone with an unexplained change in pain have a standard radiographic evaluation of the shoulder. A true anteroposterior view of the glenoid and axillary views are most diagnostic, even if the joint space narrowing is minimal. Comparisons should be made to the original preoperative films to ensure accurate determination of the degree of joint changes. MRI scans were helpful in making the diagnosis, because more extensive damage was more apparent, given that the degree of articular cartilage loss and cystic changes were obvious. In addition, MRI may aid in making treatment decisions because cases with loose bodies or cartilage flaps may be best treated with arthroscopy whereas those without fragmentation might not

require arthroscopy. We did not find nuclear imaging studies helpful, and blood work findings were not abnormal. However, if infection is suspected, these 2 tests should be performed, in conjunction with arthroscopic lavage.

Unfortunately, because of the rarity of this condition, the treatment regimen for postarthroscopy chondrolysis of the shoulder is not defined. Our initial approach to treatment has been conservative/palliative, using intra-articular and oral corticosteroids and nonsteroidal anti-inflammatories. Of the 23 patients in this report, 9 subsequently underwent arthroplasty because of loss of function after failure of conservative management. The remainder responded well to debridement with and without intra-articular injections of hyaluronic acid. Long-term follow-up will be necessary to determine the success of the treatment in this series. A trend seemed to exist in short-term follow-up that suggests that those with severe loss of motion and capsular thickening do not rapidly respond to any form of treatment. Therefore, we would recommend arthroscopic debridement/capsular release and aggressive rehabilitation before performing arthroplasty, even when the joint space appears to be completely lost.

In conclusion, chondrolysis is fortunately a rare sequela of arthroscopic shoulder surgery. However, its long-term consequences can be particularly disabling, especially in the young patient. It is difficult to implicate a single factor as the etiology of this condition. Rather, we believe that this condition results from an unfortunate convergence of multiple factors. These factors are not adequately defined but probably include genetic, traumatic, biomechanical, and biochemical elements. Likewise, treatment options are poorly defined. Whereas some patients have responded favorably to conservative management, arthroplasty has been required to restore function in others. Clearly, more research is indicated to identify the initiating factors in this pathology. A high index of suspicion is needed to make an early diagnosis, and patients with any change in symptoms after arthroscopy of the shoulder should be encouraged to return for prompt evaluation and followed up closely over time.

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