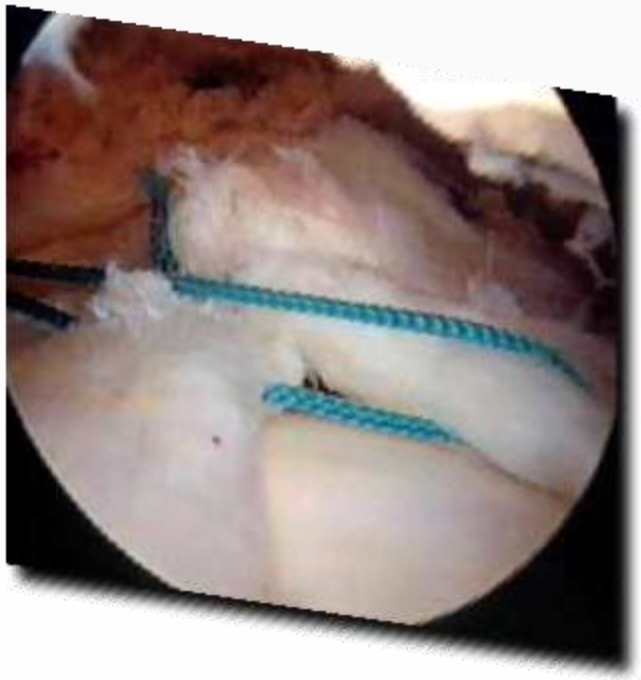
Natural History of Rotator Cuff Tears



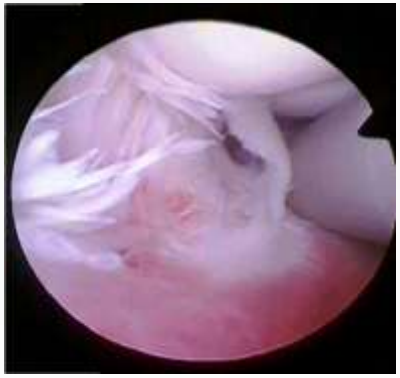
Andreas Panagopoulos, MD, PhD
Assistant Professor in Orthopaedics
University Hospital of Patras

Key points

- Prevalence and risk factors for rotator cuff tearing
- Natural history of asymptomatic and symptomatic tears
- Potential for healing after rotator cuff repair
- Indications-timing of operative and conservative treatment
- The role of arthroscopic treatment

Prevalence – Cadaveric studies

- Cadaver and autopsy dissections 5% to 40%
- **Nee**r full-thickness tears **5%** in 500 cadavers
- **Lehman** full-thickness tears **17%** in 235 cadavers
- **Yamanaka** supraspinatus full-thickness **7%**
  partial-thickness **13%** in 249 cadavers



Bursal sided (2.4%)

intratendinous (7.2%)

articular sided (3.6%)

Neer CS, Clin Orthop 1983
Lehman C, Cuomo F, Kummer FJ, et al. Bull Hosp Jt Dis 1995.
Yamanaka K, Fukada H. Takagishi N, editor. The Shoulder. Tokyo: Professional Postgraduate Services; 1987. p. 220–4.

Prevalence – MRI & US studies

MRI

- Sher et all **34%** overall prevalence in **asymptomatic** pt
  (15% full thickness and 20% partial thickness)

Ultrasound

- Tempelhof et al **23%** prevalence of full-thickness tears in **asymptomatic** individuals (51% > 80 years)

Sher JS, Uribe JW, Posada A, et al. Abnormal findings on magnetic resonance images of asymptomatic shoulders. J Bone Joint Surg Am 1995;77:10–5.
Tempelhof S, Rupp S, Seil R. Age-related prevalence of rotator cuff tears in asymptomatic shoulders. J Shoulder Elbow Surg 1999;8:296–9..

The Demographic and Morphological Features of Rotator Cuff Disease

A Comparison of Asymptomatic and Symptomatic Shoulders

By Ken Yamaguchi, MD, Konstantinos Ditsios, MD, William D. Middleton, MD, Charles F. Hildebolt, PhD, Leesa M. Galatz, MD, and Sharlene A. Teefey, MD

- Cuff tearing increased with age

- Bilateral intact cuffs 48
  Unilateral cuff tear 58
  Bilateral cuff tear 67

- Prevalence of tear from 35% to 50% in pt > 66 years

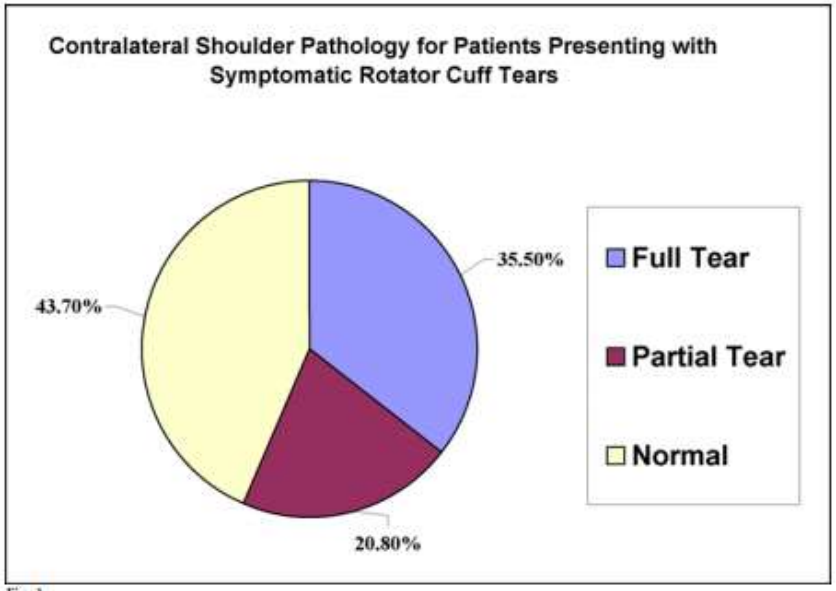


Fig. 1

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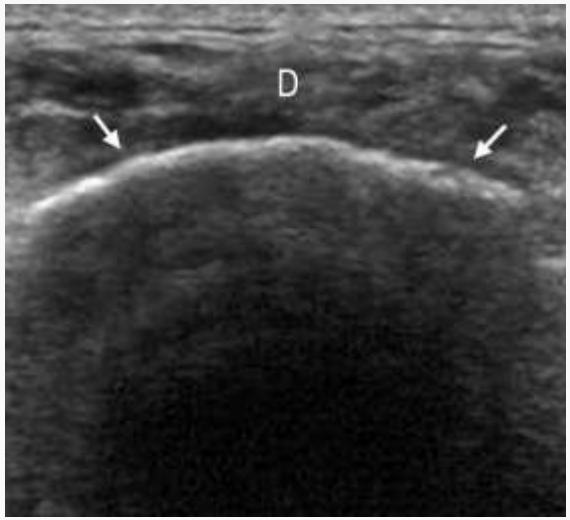
European Journal of Radiology 51 (2004) 263–268

EJR

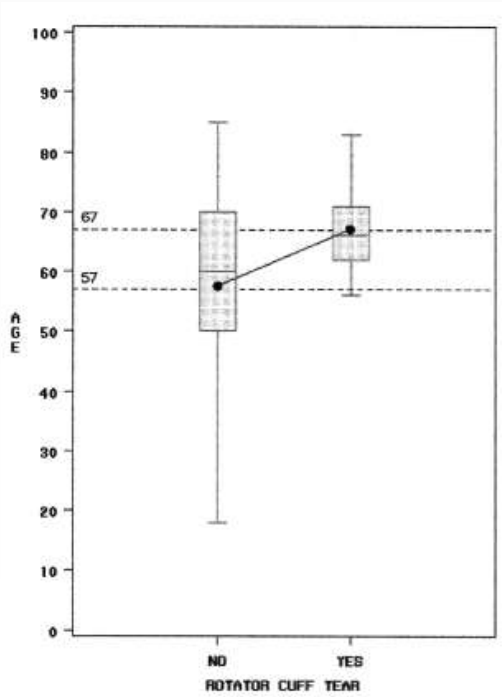
www.elsevier.com/locate/ejrad

Rotator cuff tears in asymptomatic individuals: a clinical and ultrasonographic screening study

N. Schibany [a,*], H. Zehetgruber [b], F. Kainberger [a], C. Wurnig [b], A. Ba-Ssalamah [a], A.M. Herneth [a], T. Lang [c], D. Gruber [c], M.J. Breitenseher [a]



- 212 asymptomatic individuals (18-85 years)
- **6%** complete rupture of SSP (mean: 67 years)
- All patients reported no functional deficits, although strength was significantly lower in the tear group.



J Shoulder Elbow Surg (2011) 20, 1133-1137

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Journal of Shoulder and Elbow Surgery

www.elsevier.com/locate/ymse

Factors involved in the presence of symptoms associated with rotator cuff tears: a comparison of asymptomatic and symptomatic rotator cuff tears in the general population

Atsushi Yamamoto, MD, PhD[a,*], Kenji Takagishi, MD, PhD[a], Tsutomu Kobayashi, MD, PhD[a], Hitoshi Shitara, MD, PhD[a], Toshihisa Osawa, MD, PhD[b]

RC tears were present in **20.7%** / 683 pt

36% tear in symptomatic pt
16.9% in asymptomatic

RC tearing associated with increasing age (25.6% in their 60s ⟶ up to 50% in their 80s)

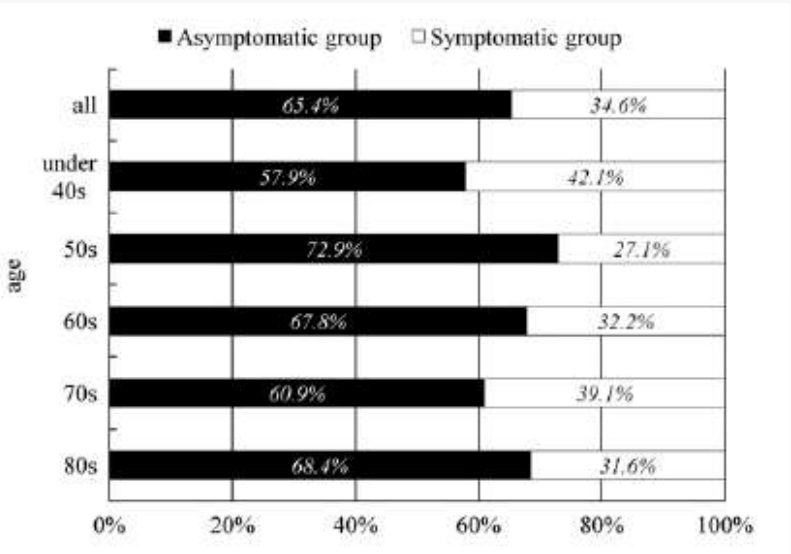

Table III Results of logistic regression analysis

	Odds ratio	95% CI
Age	0.99	0.96-1.02
Sex	0.55	0.30-1.02
Dominant arm*	2.99	1.57-5.71
Heaviness of labor	0.82	0.50-1.36
History of trauma	1.09	0.37-3.16
Impingement sign*	10.18	4.57-22.69
Active forward elevation	0.99	0.97-1.01
Weakness in abduction	1.51	0.60-3.79
Weakness in external rotation*	3.10	1.21-7.95

CI, confidence interval.
* $P < .05$

J Shoulder Elbow Surg (2010) 19, 1191-1198

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Journal of Shoulder and Elbow Surgery

www.elsevier.com/locate/ymse

SHOULDER

Asymptomatic rotator cuff tears: Patient demographics and baseline shoulder function

Jay D. Keener, MD[a,*], Karen Steger-May, MA[b], Georgia Stobbs, RN[a], Ken Yamaguchi, MD[a]

An asymptomatic rotator cuff tear is associated with a clinically insignificant loss of shoulder function.

Clinically detectable differences in shoulder function may indicate an **"at-risk"** asymptomatic tear.

Hand dominance appears to be an important risk factor for pain.

Risk factors

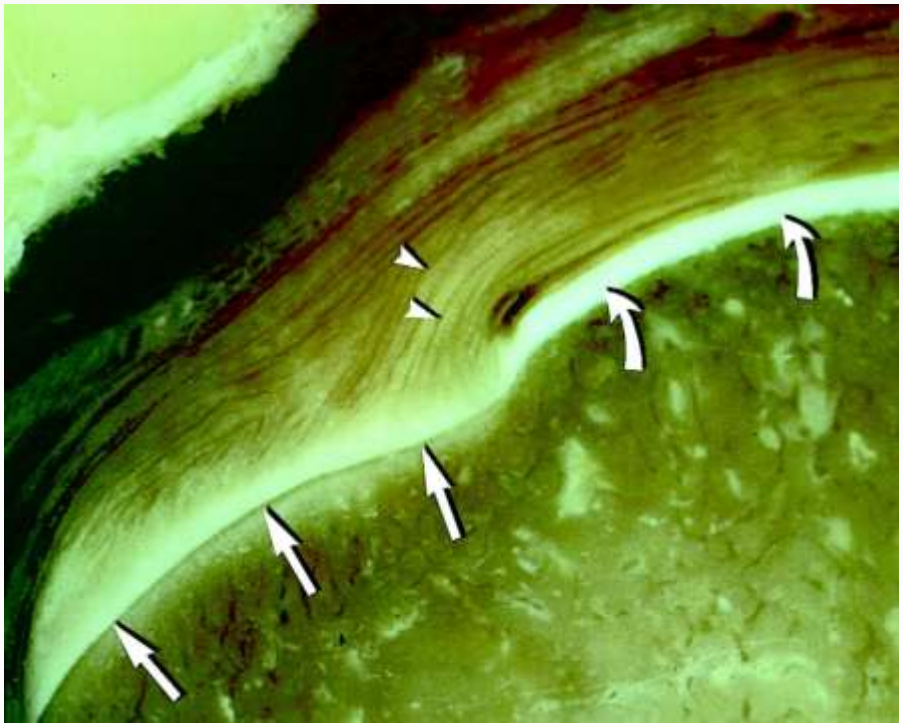
Increasing patient age

Smoking

Hypertension

Hypercholesterolemia

Family history



Smoking

Smoking has not only been shown to increase the risk for rotator cuff tearing but also:

- ❑ increased tear size
- ❑ limited healing ability after repair
- ❑ poorer clinical outcomes after surgical repair

J Shoulder Elbow Surg (2012) 21, 56-60

ELSEVIER

Journal of Shoulder and Elbow Surgery

www.elsevier.com/locate/ymse

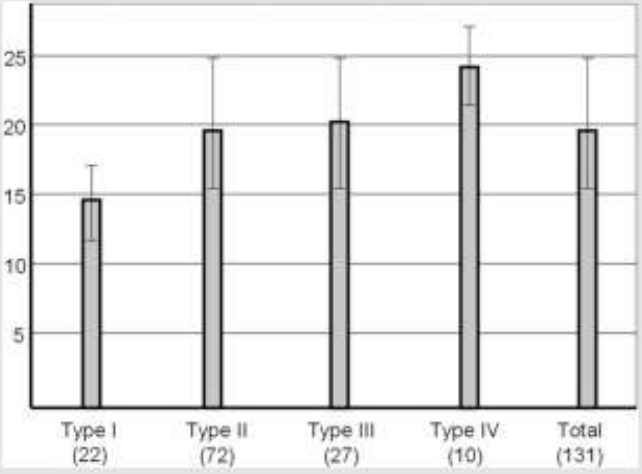
The impact of preoperative smoking habit on rotator cuff tear: cigarette smoking influences rotator cuff tear sizes

Stefano Carbone, MD[a,*], Stefano Gumina, MD, PhD[a], Valerio Arceri, MD[a], Vincenzo Campagna, MD[b], Corrado Fagnani, MD[c], Franco Postacchini, MD, PhD[a]

Type of tear	Average	Standard deviation	Number
Type I	14.63	5.55	22
Type II	19.88	9.03	72
Type III	20.32	10.94	27
Type IV	23.88	6.85	10
Total	19.40	9.07	131

Table I Distribution of different types of rotator cuff tear between smoking and nonsmoking patients

Variable	Type of tear				Total
	Type I	Type II	Type III	Type IV	
Nonsmokers					
No.	73	142	47	15	277
% of total	17.9	34.8	11.5	3.7	67.9
Smokers					
No.	22	72	27	10	131
% of total	5.4	17.6	6.6	2.5	32.1
Total					
No.	95	214	74	25	408
% of total	23.5	52.5	18.1	6.1	100



Hypertension

J Shoulder Elbow Surg (2012) ■, 1–4

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JOURNAL OF SHOULDER AND ELBOW SURGERY

www.elsevier.com/locate/ymse

The association between arterial hypertension and rotator cuff tear: the influence on rotator cuff tear sizes

Stefano Gumina, MD, PhD[a], Valerio Arceri, MD[a], Stefano Carbone, MD[a,*], Paolo Albino, MD[a], Daniele Passaretti, MD[a], Vincenzo Campagna, MD[b], Corrado Fagnani[c], Franco Postacchini, MD, PhD[a]

- Hypertension was associated with a **2-fold higher risk** of tear occurrence
- 2 times more likely to experience large tear and 4 times massive tear
- Mean duration of antihypertensive therapy significantly increased from small tear (1.08 years) to large tear (3.20 years) to massive tear (6.34 years)

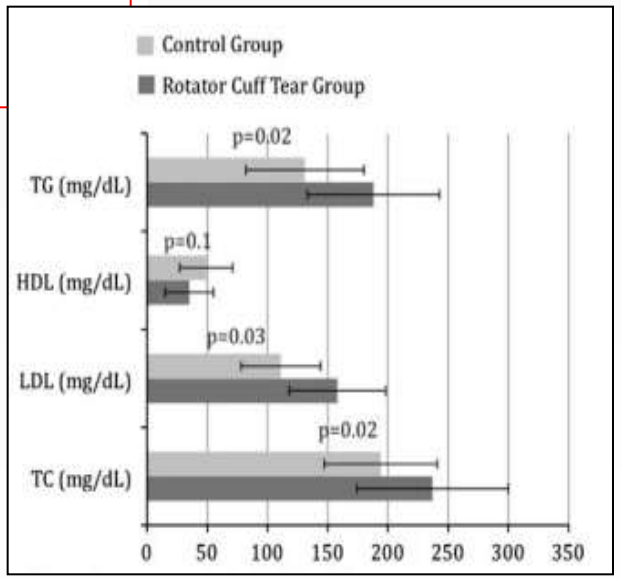
Hypercholisterolemia

Clin Orthop Relat Res (2010) 468:1493Ð1497
DOI 10.1007/s11999-009-1151-9

SYMPOSIUM: CURRENT CONCEPTS IN ROTATOR CUFF DISEASE AND TREATMENT

The Effect of Hypercholesterolemia on Rotator Cuff Disease

Joseph A. Abboud MD, Jae S. Kim MS



Lipid profiles in 80 patients with full-thickness RC tears and 80 controls with shoulder pain but normal RC

Total cholesterol, triglycerides, and LDL concentrations of patients with RC tears were all significantly higher

64% of patients with a tear had an elevated serum cholesterol (> 240 mg/dL) compared with 28% in the control group.

Genetics

129 siblings were retrospectively evaluated in a cohort of 205 patients diagnosed as having full-thickness RC tears by ultrasound.

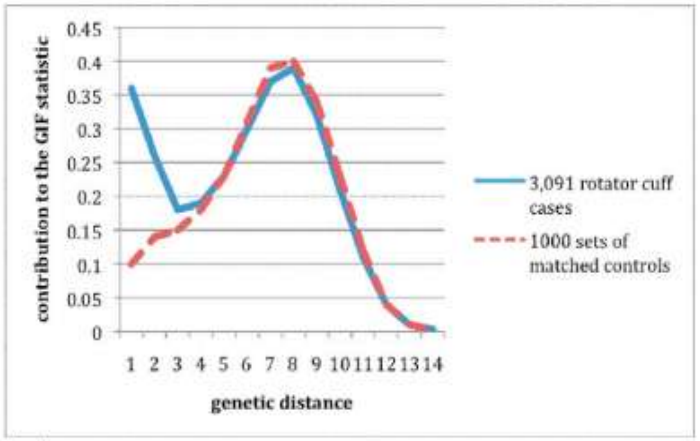
Using the spouses of the patients as a control group, the relative risk of full-thickness tears in siblings compared with controls was **2.42**

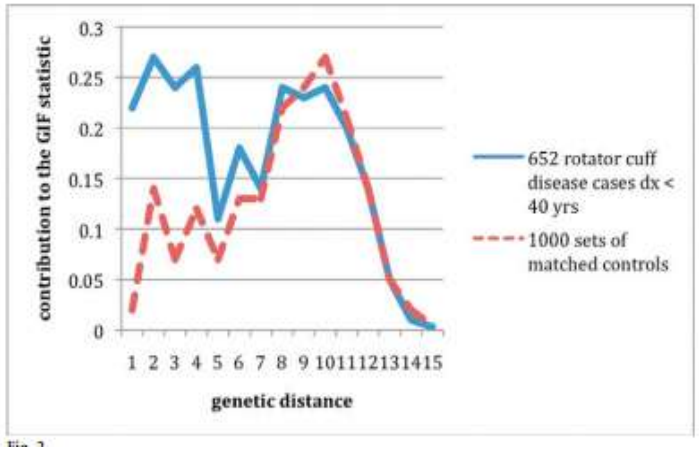
Evaluation of the same population 5 years later showed that siblings were more likely to have had a **progression of tear size** (62.9% in siblings vs 22.1% in controls)

Evidence for an Inherited Predisposition Contributing to the Risk for Rotator Cuff Disease

By Robert Z. Tashjian, MD, James M. Farnham, MS, Frederick S. Albright, PhD, Craig C. Teerlink, MS, and Lisa A. Cannon-Albright, PhD

In a group of **3091 patients**, the relative risk of rotator cuff disease in the relatives of patients diagnosed with cuff disease before age 40 years was significantly elevated for both 2nd degree and 3rd degree relatives.





Natural History - Asymptomatic Full-Thickness Tears

Natural history of asymptomatic rotator cuff tears: A longitudinal analysis of asymptomatic tears detected sonographically

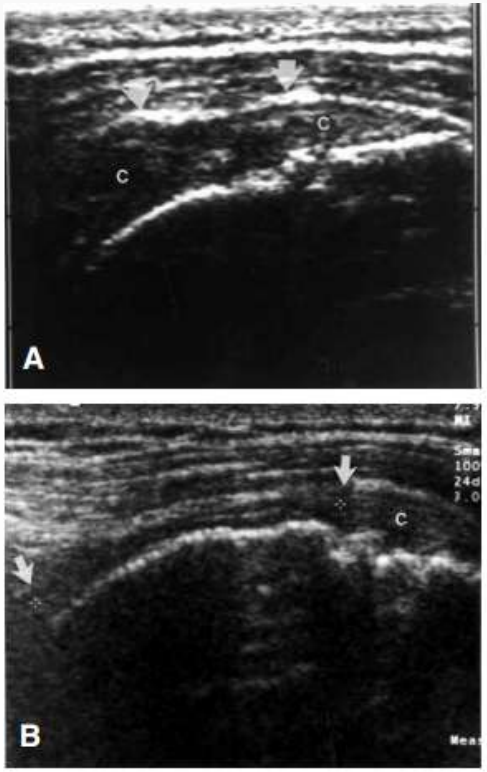
Ken Yamaguchi, MD,[a] A. Marc Tetro, MD, FRCS(C),[a] Oren Blam, MD,[a] Bradley A. Evanoff, MD,[b] Sharlene A. Teefey, MD,[c] and William D. Middleton, MD,[c] *St Louis, Mo*

J Shoulder Elbow Surg
May/June 2001

51% of the patients with a previously asymptomatic tear developed symptoms over an average of 2.8 years

50% of the newly symptomatic tears progressed in size whereas only 20% of the tears that remained asymptomatic progressed in size.

There was no evidence of tendon healing or decrease in tear size.



Symptomatic Progression of Asymptomatic Rotator Cuff Tears

A Prospective Study of Clinical and Sonographic Variables

By Nathan A. Mall, MD, H. Mike Kim, MD, Jay D. Keener, MD, Karen Steger-May, MA, Sharlene A. Teefey, MD, William D. Middleton, MD, Georgia Stobbs, RN, and Ken Yamaguchi, MD

They compared 34 patients who became symptomatic (~ 2 years after the initial evaluation) to 35 patients who remained asymptomatic.

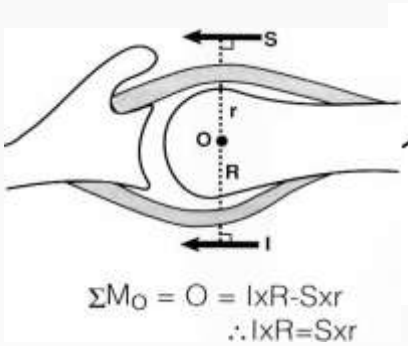
RC tears in the symptom development group were significantly larger than those in the group that remained asymptomatic

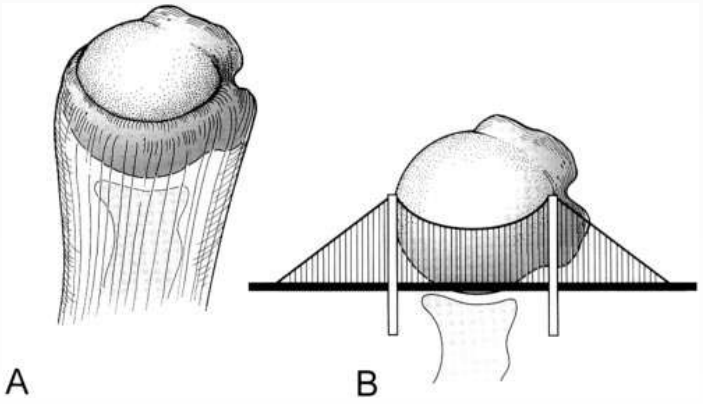
Also, tear enlargement was more common in the group that became symptomatic (23%) compared with those who remained asymptomatic (4%).

Why some tears become symptomatic?

Burkhart proposed the theory that normal glenohumeral kinematics can be preserved in the setting of a rotator cuff tear as long as the cuff's force couples are maintained.

Tear size is less important than tear location in terms of force couple and kinematic preservation.

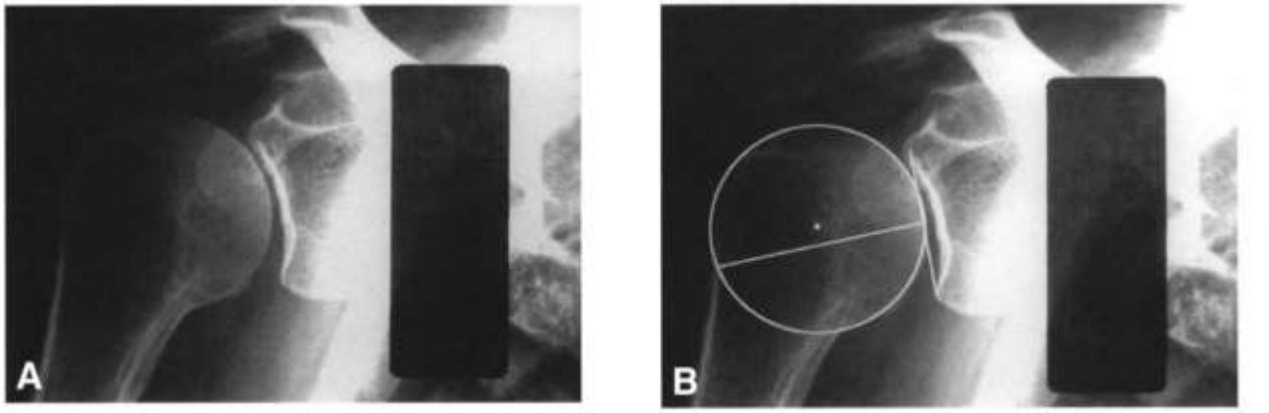




Burkhart SS. Clin Orthop Relat Res 1992;284:144–52.

Glenohumeral motion in patients with rotator cuff tears: A comparison of asymptomatic and symptomatic shoulders

Ken Yamaguchi, MD, Jerry S. Sher, MD, William K. Andersen, MD, Ralph Garretson, MD, John W. Uribe, MD, Keith Hechtman, MD, and Robert J. Neviaser, MD, *St Louis, Mo; Coral Gables and Miami, Fla; and Washington, DC*



The symptomatic and asymptomatic groups showed progressive superior translation of the humeral head on the glenoid with increasing arm elevation. The normal group, in contrast, maintained a constant center of rotation along the geometric center of the glenoid.

Proximal Humeral Migration in Shoulders with Symptomatic and Asymptomatic Rotator Cuff Tears

By Jay D. Keener, MD, Anthony S. Wei, MD, H. Mike Kim, MD, Karen Steger-May, MA, and Ken Yamaguchi, MD

Proximal humeral migration correlates with RC tear size. Tears extending into the infraspinatus tendon are associated with greater humeral migration than is seen with isolated supraspinatus tears.

For full-thickness symptomatic tears of > 175 mm^2 , both pain and tear area were found to have a significant effect on migration.

Multivariate analysis showed that tear size was the strongest predictor of migration in symptomatic shoulders

Differential patterns of muscle activation in patients with symptomatic and asymptomatic rotator cuff tears

Bryan T. Kelly, MD, Riley J. Williams, MD, Frank A. Cordasco, MD, Sherry I. Backus, MA, PT, James C. Otis, PhD, Daniel E. Weiland, MD, David W. Altchek, MD, Edward V. Craig, MD, Thomas L. Wickiewicz, MD, and Russell F. Warren, MD, *New York, NY*

Patients with asymptomatic RC tears had significantly greater **subscapularis** activity during internal rotation activities and less upper trapezius activation during carrying activities than symptomatic patients.

Also, symptomatic patients had significantly greater supraspinatus, infraspinatus, and upper trapezius muscle activation with shoulder elevation tasks than asymptomatic patients

Why some tears become symptomatic?

- Larger tears are more likely to develop symptoms and that development of pain correlates with tear enlargement.
- Abnormal glenohumeral kinematic function cannot independently explain the presence of symptoms and altered kinematics is probably most influenced by tear size.
- Patients with symptomatic tears continue to fire the torn muscles and attempt to overcompensate with scapular stabilizers compared with asymptomatic patients who use the remainder of the intact cuff

Natural History - Symptomatic Full-Thickness Tears

Author	Patients	Average Fup	Improvement
Golberg et al	46	2.5 years	59%
Bokor et al	53	7.6 years	74% (56% good UCLA scale)
Hawkins et al	33	3.8 years	58%

Although non-operative treatment can be effective, information regarding who fails conservative treatment and who likely benefits from surgical repair is required to maximize outcomes.

Goldberg BA, Clin Orthop Relat Res 2001;382: 99–107
Bokor DJ, Clin Orthop Relat Res 1993;294:103–10.
Hawkins RH, Clin Orthop Relat Res 1995;321:178–88.

Natural History - Symptomatic Large Full-Thickness Tears

Author	Patients	Average Fup	Size progression
Maman et al	33	24 months	52% (tear progression > 18 months/ age> 60 and fatty infiltration tear progression)
Safran et al	51(<60)	29 months	50% (> 5mm), pain was correlated with tear progression

… there is a significant risk for tear progression in non-operatively treated **symptomatic** large full-thickness tears with approximately 50% progressing at an average of 2 years.

Early surgical treatment can be considered in young patients

If tears are to be monitored, then imaging should be performed at 1.5 years or if the shoulder becomes increasingly painful

Evolution of Nonoperatively Treated Symptomatic Isolated Full-Thickness Supraspinatus Tears

Sandro F. Fucentese, MD, Andreas L. von Roll, MD, Christian W.A. Pfirrmann, MD, Christian Gerber, MD, and Bernhard Jost, MD

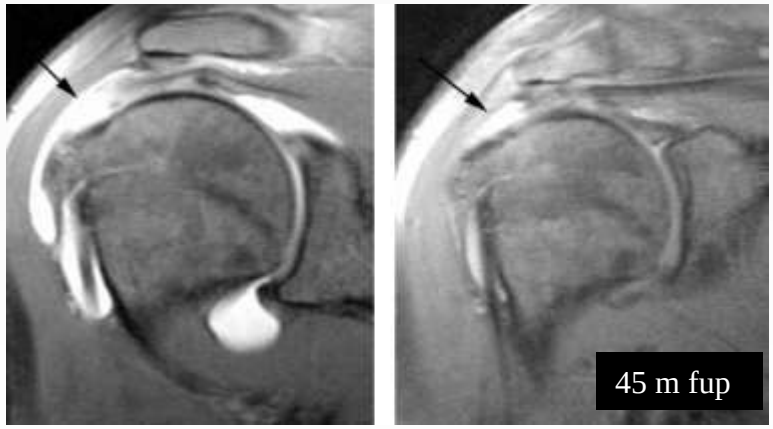
24 patients (~ 54 years old)

isolated full-thickness SSP tears

initial tear size was 1.6 cm

3.5 years' average follow-up

25% had tear progression



no increase in fatty degeneration of the SSP beyond stage 2

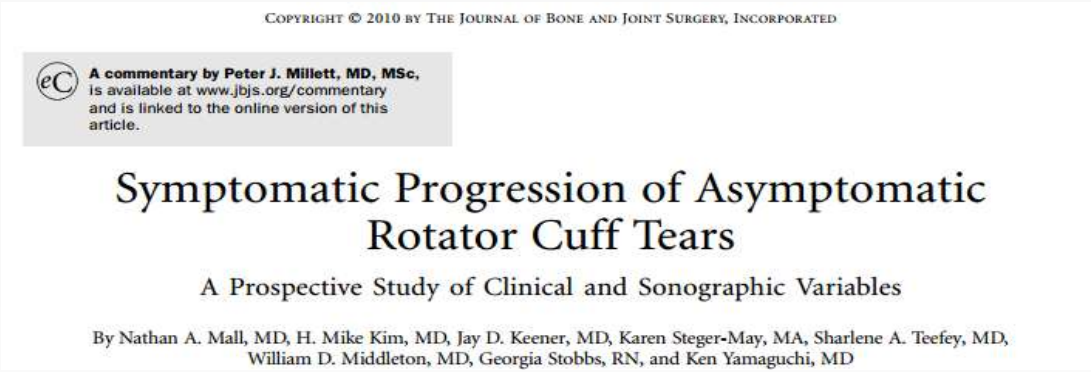
tear progression did not affect the reparability of these tears

Natural History - Symptomatic Full-Thickness Tears

In small (<1–1.5 cm) full-thickness tears, initial observation is reasonable even in young patients, due to a low risk for tear progression (25%)

In larger tears, as shown by Maman et al and Safran et al, there is a higher risk (approximately 50%) for tear enlargement.

Natural History - Asymptomatic Partial-Thickness Tears



eC **A commentary by Peter J. Millett, MD, MSc,** is available at www.jbjs.org/commentary and is linked to the online version of this article.

Symptomatic Progression of Asymptomatic Rotator Cuff Tears

A Prospective Study of Clinical and Sonographic Variables

By Nathan A. Mall, MD, H. Mike Kim, MD, Jay D. Keener, MD, Karen Steger-May, MA, Sharlene A. Teefey, MD, William D. Middleton, MD, Georgia Stobbs, RN, and Ken Yamaguchi, MD

30 asymptomatic partial-thickness tears.

2-years' follow-up

10/30 became symptomatic.

40% of symptomatic progressed to a full-thickness tear

Pain was highly correlated with tear progression

Natural History - Symptomatic Partial-Thickness Tears

Outcome of Nonoperative Treatment of Symptomatic Rotator Cuff Tears Monitored by Magnetic Resonance Imaging

Eran Maman, Craig Harris, Lawrence White, George Tomlinson, Misra Shashank and Erin Boynton
J Bone Joint Surg Am. 2009;91:1898-1906. doi:10.2106/JBJS.G.01335

30 patients with symptomatic partial-thickness tear

24 months follow up with an MRI

10% of progressed in size (>5 mm),

(which is significantly less than the 50% progression reported in the same study for symptomatic full-thickness tears)

Tear location had no affect on tear progression.

Initial non-operative treatment is reasonable due to a decreased risk for tear progression

Spontaneous Tendon Healing – Animal models

There is limited if any spontaneous rotator cuff healing in animal models.

Hirose K, Kondo S, Choi H, et al. Spontaneous healing process of a supraspinatus tendon tear in rabbits. Arch Orthop Trauma Surg 2004;124:374–7.

Carpenter JE, Thomopoulos S, Flanagan CL, et al. Rotator cuff defect healing: a biomechanical and histologic analysis in an animal model. J Shoulder Elbow Surg 1998;7:599–605.

Gimbel JA, Mehta S, Van Kleunen JP, et al. The tension required at repair to reappose the supraspinatus tendon to bone rapidly increases after injury. Clin Orthop 2004;426:258–65..

Spontaneous Tendon Healing – clinical cases

Arthroscopic or open debridement of tears and acromioplasty will not result in spontaneous tendon healing

Weber SC: none of pt treated with arthroscopic debridement and acromioplasty for partial-thickness tears had evidence of healing at **2nd look scope**

Kartus et al: no evidence of tendon healing **(by US)** at 101 m postoperatively in 26 patients treated with arthroscopic acromioplasty for partial thickness rotator cuff tears. (35% progressed to full tears)

Massoud et al: no patients who underwent **revision surgery** at an 13.7 months after open decompression for small and medium-sized tears had evidence of healing and 40% progressed to full tears

Tendon Healing After Repair—Animal models

In a rat supraspinatus tendon repair model, repair sites revealed a **poor healing response** with only partial recreation of the original tendon insertion site by 8 weeks.

Biomechanical properties of repaired supraspinatus rat tendons were **inferior at 8 weeks after repair** compared with uninjured tendon sites.

Thomopoulos S, Hattersley G, Rosen V, et al. J Orthop Res 2002;20:454–63.
Galatz LM, Sandell LJ, Rothermich SY, et al. J Orthop Res 2006;24:541–50.
Thomopoulos S, Williams GR, Gimbel JA, et al.. J Orthop Res 2003;21:413–9.

Tendon Healing After Repair—clinical studies

Galatz LM, Griggs S, Cameron BD, et al. J Bone Joint Surg Am 2001;83:1052–6. Prospective longitudinal analysis of postoperative shoulder function: a ten-year follow-up study of full-thickness rotator cuff tears.

The results of open rotator cuff repair for chronic tears do not deteriorate with time (ten year)

ORIGINAL ARTICLES

Mini-incision rotator cuff repair: A longitudinal assessment with no deterioration of result up to nine years

Homan Zandi, FRACS,[a,b] Jennifer A. Coghlan, BA, FRCNA,[b] and Simon N. Bell, FRACS[a,b] *Melbourne and Brighton, Australia*

J Shoulder Elbow Surg
March/April 2006

there is no deterioration in the results of mini-incision cuff repair in up to 9 years' follow-up

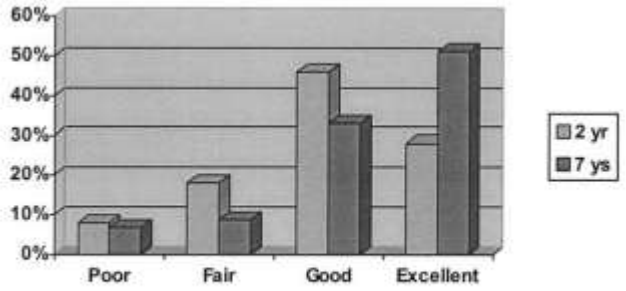


Figure 1 Longitudinal classification of patients based on modified UCLA score.

Tendon Healing After Repair—clinical studies

Single-tendon and 2-tendon re-tear rates have been reported as **29%** and up to **94%**, respectively, despite excellent clinical outcomes.

Failure of tendon healing does not preclude an excellent result, although improved results have been correlated with intact repairs.

Boileau P, et alJ Bone Joint Surg Am 2005;87:1229–40.
Galatz LM, et al. J Bone Joint Surg Am 2004;86:219–24.
Harryman DT, et al. J Bone Joint Surg Am 1991;73:982–9.

Biologic & patient related factors affecting healing

Patient age	> 60
Tear size	> tears
Tear chronicity	> 24 m
Muscle atrophy	> grade 2

Patient age

Boileau et al reported **43%** healing in patients over 65 as opposed to **86%** healing under age 65 in single tendon tears fixed arthroscopically.

Tashjian et al determined the average age of unhealed repairs after double-row repair was in the early **60s** compared with those that healed was in the mid-50s.

Boileau P, et al. Arthroscopic repair of full-thickness tears of the supraspinatus: does the tendon really heal? J Bone Joint Surg Am 2005;87:1229–40.

Tashjian RZ, Hollins AM, Kim HM, et al. Factors affecting healing rates after arthroscopic double-row rotator cuff repair. Am J Sports Med 2010;38:2435–42.

Tear size

J Shoulder Elbow Surg (2011) 20, 941-946

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JOURNAL OF SHOULDER AND ELBOW SURGERY

www.elsevier.com/locate/ymse

Prospective evaluation of arthroscopic rotator cuff repairs at 5 years: part II—prognostic factors for clinical and radiographic outcomes

Lawrence V. Gulotta, MD*, Shane J. Nho, MD, Christopher C. Dodson, MD, Ronald S. Adler, MD, PhD, David W. Altchek, MD, John D. MacGillivray, MD, for the HSS Arthroscopic Rotator Cuff Registry

…..those who were satisfied at earlier time points continued to have excellent functional scores at 5 years.

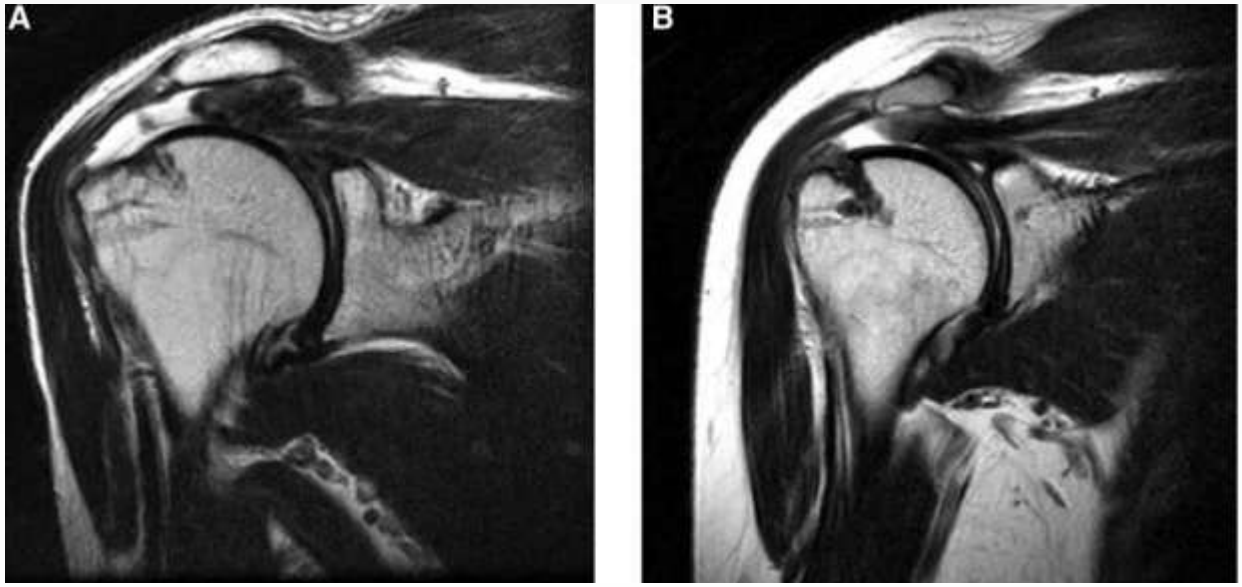
The presence of a radiographic defect at the repair site at 5 years was predicted by older age, **increasing tear size**, concomitant biceps, and AC joint procedures

Tear chronicity

Arthroscopic Rotator Cuff Repair Using a Suture Bridge Technique : Is the Repair Integrity Actually Maintained?

Nam Su Cho, Bong Gun Lee and Yong Girl Rhee

Am J Sports Med 2011 39: 2108 originally published online February 24, 2011
DOI: 10.1177/0363546510397171



The factors affecting tendon healing were the patient's age, the size and extent of the tear, and the presence of **fatty degeneration** in the rotator cuff muscle.

Atrophy & fatty infiltration

Magnetic Resonance Imaging of Arthroscopic Supraspinatus Tendon Repair

By Dennis Liem, MD, Sven Lichtenberg, MD, Petra Magosch, MD, and Peter Habermeyer, MD

TABLE III Fatty Infiltration and Supraspinatus Atrophy

	Preop.	Postop.	P Value*
Fatty infiltration of supraspinatus *(Stage)*			
Retear group	1.30	2.23	0.014
Intact-tendon group	1.00	1.15	0.225
Overall	1.06	1.42	0.015
Fatty infiltration of infraspinatus *(Stage)*			
Retear group	0.50	1.69	0.016
Intact-tendon group	0.40	0.88	0.001
Overall	0.42	1.07	0.001
Fatty infiltration of subscapularis *(Stage)*			
Retear group	0.10	0.69	0.059
Intact-tendon group	0.31	0.35	0.366
Overall	0.27	0.43	0.059
Atrophy of supraspinatus *(Grade)*			
Retear group	1.50	2.38	0.011
Intact-tendon group	1.14	1.12	0.655
Overall	1.22	1.43	0.071

* Level of significance, $p < 0.05$.

Higher degrees of muscular atrophy and fatty infiltration preoperatively are associated with recurrence of the tear as well as progression of fatty infiltration and muscular atrophy and an inferior clinical result

Inter-Rater Agreement of the Goutallier, Patte, and Warner Classification Scores Using Preoperative Magnetic Resonance Imaging in Patients With Rotator Cuff Tears

Julienne Lippe, M.D., Jeffrey T. Spang, M.D., Robin R. Leger, R.N., Ph.D., Robert A. Arciero, M.D., Augustus D. Mazzocca, M.D., and Kevin P. Shea, M.D.

TABLE 2. *Interobserver Agreement for Full-Thickness Rotator Cuff Tears*

Classification System	κ Value
Tendon retraction in frontal plane (Patte)	0.58
Supraspinatus fatty infiltration, dichotomized (Goutallier)	0.53
Supraspinatus fatty infiltration, nondichotomized (Goutallier)	0.41
Supraspinatus atrophy	0.25
Infraspinatus atrophy	<0.37

NOTE. The κ statistic is a measure of interobserver reliability. Further description is given in the Methods section.

Indications & timing of surgical repair

The natural history of rotator cuff disease has demonstrated that there are several potential significant risks associated with **non-operative** treatment.

These **risks** include:

- a relative lack of spontaneous healing,
- tear progression over time,
- muscle fatty degeneration,
- tendon retraction,
- difficulty with tendon mobilization and
- potential for arthritis

Epidemiology, Natural History, and Indications for Treatment of Rotator Cuff Tears

Clin Sports Med 31 (2012) 589–604

Robert Z. Tashjian, MD*

Box 1
Treatment algorithm for rotator cuff disease

- Group I—initial nonoperative treatment
  - Tendonitis
  - Partial-thickness tears (except maybe larger bursal-sided tears)
  - Maybe small (<1 cm) full-thickness tears
- Group II—consider early surgical repair
  - All acute tears full-thickness (except maybe small [<1 cm] tears)
  - All chronic full-thickness tears in a young (<65) age group (except maybe small [<1 cm] tears)
- Group III—initial nonoperative treatment
  - All chronic full-thickness tears in an older (>65 or 70) age group
  - Irreparable tears (based on tear size, retraction, muscle quality, and migration)

Group I—Rotator Cuff Tendonitis, Partial-Thickness Tears (Except Larger Bursal-Sided Tears), and Small (<1–1.5 cm) Full-Thickness Tears

Prolonged physical therapy and nonoperative treatment should be considered in group I.

There is limited risk for the development of irreversible, chronic changes, such as fatty infiltration, tendon retraction, or glenohumeral arthritis with this treatment regimen

J Shoulder Elbow Surg (2009) 18, 138-160

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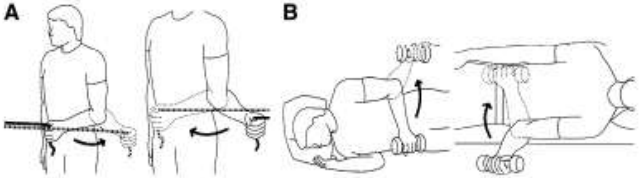
REVIEW ARTICLES

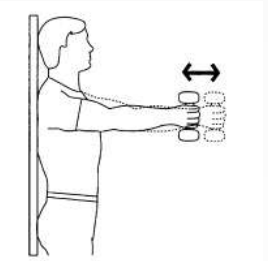
Exercise in the treatment of rotator cuff impingement: A systematic review and a synthesized evidence-based rehabilitation protocol

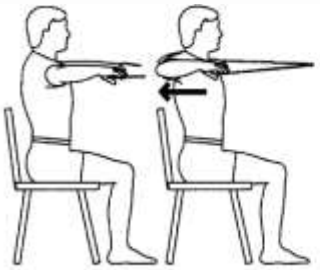
John E. Kuhn, MD*

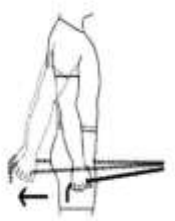


11 randomized, controlled trials (level 1 and 2) evaluating the effect of exercise in the treatment of impingement were identified.

… the data demonstrate that exercise has statistically and clinically significant effects on **pain reduction** and **improving function**, but not on range of motion or strength.







Arthroscopic surgery versus supervised exercises in patients with rotator cuff disease (stage II impingement syndrome): A prospective, randomized, controlled study in 125 patients with a $2^{1}/_{2}$-year follow-up

Jens Ivar Brox, MD, PhD, Erling Gjengedal, MD, Gisle Uppheim, MD, Audhild Skagseth Bøhmer, PT, John Ivar Brevik, Anne Elisabeth Ljunggren, and Peer H. Staff, MD, *Oslo and Bergen, Norway*

	Arthroscopic surgery (n = 38*)	Placebo laser (n =28*‡)	Supervised exercises (n = 45†‡)
Pain on activity	23 (19)	7 (6)	22 (19)
Pain at rest	24 (22)	6 (6)	22 (21)
Pain at night	24 (22)	6 (6)	23 (20)
Disability carry 5 kg at the side	23 (20)	5 (5)	21 (20)
Disability take down something from a wall cupboard	25 (24)	7 (6)	20 (19)

We conclude that after 2,5 years of follow-up, both arthroscopic surgery and supervised exercises are better treatments than placebo. The difference between the 2 active treatments was not significant.

EXTENDED REPORT

Exercises versus arthroscopic decompression in patients with subacromial impingement: a randomised, controlled study in 90 cases with a one year follow up

J P Haahr, S Østergaard, J Dalsgaard, K Norup, P Frost, S Lausen, E A Holm, J H Andersen

Ann Rheum Dis 2005;**64**:760–764. doi: 10.1136/ard.2004.021188

Then who should be operated on?

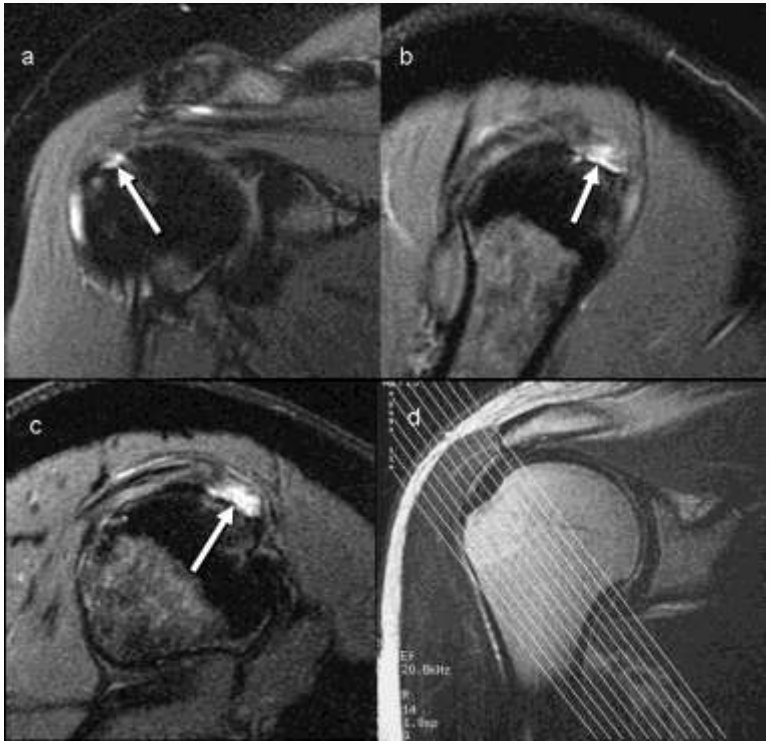
In view of our findings, we are now more reluctant to recommend surgery in cases with **stage II** impingement.

There is a need for larger scale studies with sufficient numbers of participants

Group I—Rotator Cuff Tendonitis, **Partial-Thickness Tears (Except Larger Bursal-Sided Tears),** and Small (<1–1.5 cm) Full-Thickness Tears

Although healing has not been shown to occur without repair, significant improvements in functional outcomes have been shown with conservative treatment.

Similarly, there has been shown to be a slow, small risk for tear progression.



Kartus J, Arthroscopy 2006;22:44–9
Yamanaka K, Clin Orthop 1994;304:68–73.

0363-5465/102/3030-0257$02.00/0
THE AMERICAN JOURNAL OF SPORTS MEDICINE, Vol. 30, No. 2

The Partial-Thickness Rotator Cuff Tear: Is Acromioplasty Without Repair Sufficient?

Frank A. Cordasco,* MD, Marianne Backer, MD, Edward V. Craig, MD, Dana Klein, and Russell F. Warren, MD

The clinical outcome among patients with partial-thickness RC tear (>50% of the tendon, grade 1 and 2) is not significantly different from that among patients without partial-thickness rotator cuff tears.

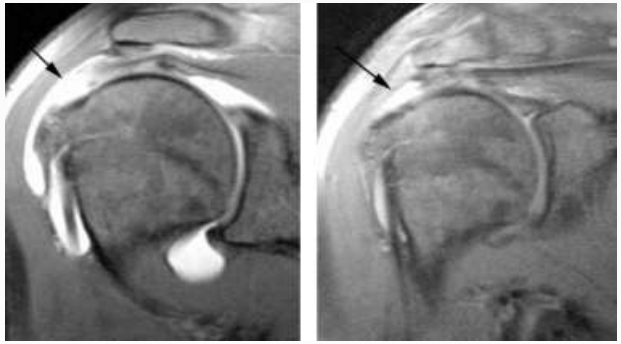
Patients with grade 2B **(bursal-side)** partial-thickness tears had a higher failure rate **(38%)** than did patients with grade 2A (articular-side) partial-thickness tears (5%).

Evolution of Nonoperatively Treated Symptomatic Isolated Full-Thickness Supraspinatus Tears

Sandro F. Fucentese, MD, Andreas L. von Roll, MD, Christian W.A. Pfirrmann, MD, Christian Gerber, MD, and Bernhard Jost, MD

Low rate of tear progression for small (<1 cm–1.5 cm) full-thickness tears.

If observation is performed, then an MRI should be performed at 12 to 18 months from evaluation or if symptoms progress to monitor for tear progression.



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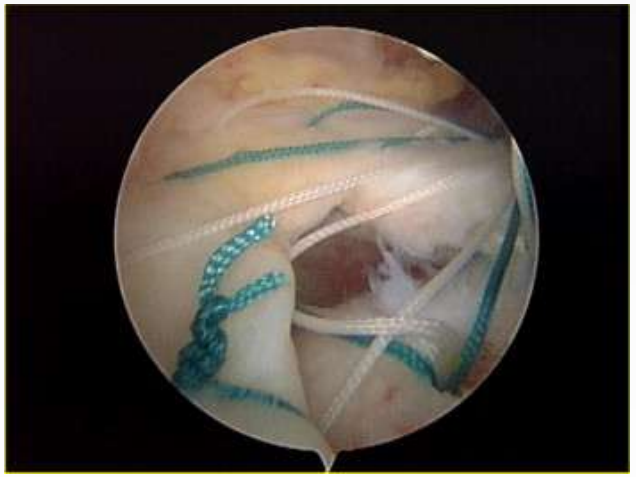
Group II - Any Acute **Full-Thickness Tear** or Any Chronic Full-Thickness Tear in a Young (<65-Year-Old) Age Group (Except Possibly Small [<1–1.5 cm] Full-Thickness Tears)

Early surgical intervention is warranted in this category due to significant risks for irreversible changes with non-operative treatment and a high likelihood of healing if repair is performed.



Early operative fixation?

Patients younger than 50 years old with acute rotator cuff tears should undergo early operative fixation or at least within 3 weeks for maximal restoration of shoulder function, specifically improved shoulder abduction.

Wirth MA et al. Orthop Clin North Am 1997;28:59–67.
Bassett RW, Cofield RH. Clin Orthop 1983;175:18–24.

Acta Orthopaedica 2011; 82 (2): 187–192

The influence of age, delay of repair, and tendon involvement in acute rotator cuff tears

Structural and clinical outcomes after repair of 42 shoulders

Hanna C Björnsson[1], Rolf Norlin[2], Kajsa Johansson[3], and Lars E Adolfsson[1]

no significant differences in tendon healing, pain, shoulder elevation, or functional outcomes occur if an acute tear was fixed within **3 months** of injury compared with within 3 weeks

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J Shoulder Elbow Surg (2011) 20, 62-68

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The timing of rotator cuff repair for the restoration of function

Steve A. Petersen, MD*, Todd P. Murphy, MD

patients with acute tears fixed after **4 months** had worse American Shoulder and Elbow Surgeons scores, active forward elevation, and satisfaction than if fixed before 4 months.

Group II - Any Acute Full-Thickness Tear or Any **Chronic Full-Thickness Tear** in a Young (<65-Year-Old) Age Group (Except Possibly Small [<1–1.5 cm] Full-Thickness Tears)

All young (<65 years old) patients with substantial (>1–1.5 cm) full-thickness tears without significant muscle deterioration can also be considered for early surgical repair.

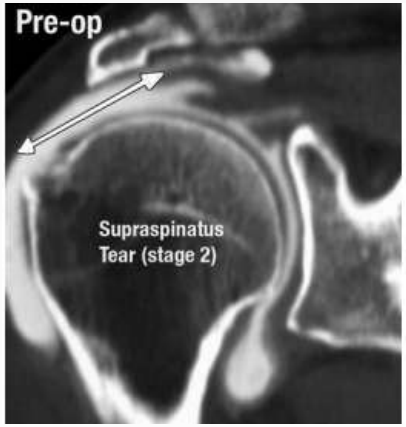
Based on natural history[1,2] there is a significant risk tear progression in this group (tear extension, fatty changes and tendon retraction)

1. Maman E et al. J Bone Joint Surg Am 2009;91(8):1898–906.
2. Safran O, et al. Am J Sports Med 2011;39(4):710–4.

Group III - **Chronic Full-thickness Tears** in Older Patients (>65 or 70) or Irreparable Tears with Significant Irreversible Changes Present

ARTHROSCOPIC REPAIR OF FULL-THICKNESS TEARS OF THE SUPRASPINATUS: DOES THE TENDON REALLY HEAL?

BY PASCAL BOILEAU, MD, NICOLAS BRASSART, MD, DUNCAN J. WATKINSON, FRCS, MICHEL CARLES, MD, ARMODIOS M. HATZIDAKIS, MD, AND SUMANT G. KRISHNAN, MD



Only **43%** of patients over age 65 treated with arthroscopic rotator cuff repair of a full thickness supraspinatus tear had evidence of healing at 18 months postoperatively compared with **86%** of patients under age 65.

Group III - **Chronic Full-thickness Tears** in Older Patients (>65 or 70) or Irreparable Tears with Significant Irreversible Changes Present

Arthroscopic Rotator Cuff Repair Using a Suture Bridge Technique : Is the Repair Integrity Actually Maintained?

Nam Su Cho, Bong Gun Lee and Yong Girl Rhee

Am J Sports Med 2011 39: 2108 originally published online February 24, 2011

High rate of recurrent defects

Mean 25-month follow-up demonstrated excellent pain relief and improvement in the ability to perform the activities of daily living, despite the structural failures.

Group III - Chronic Full-thickness Tears in Older Patients (>65 or 70) or **Irreparable Tears with Significant Irreversible Changes Present**

In the setting of large or massive tears with chronic irreversible changes to the rotator cuff muscle, the risks of non-operative treatment are small because most of these injuries are irreparable.

Several factors have been identified on imaging studies that correlate with irreparability

Prediction of primary reparability of massive tears of the rotator cuff on preoperative magnetic resonance imaging

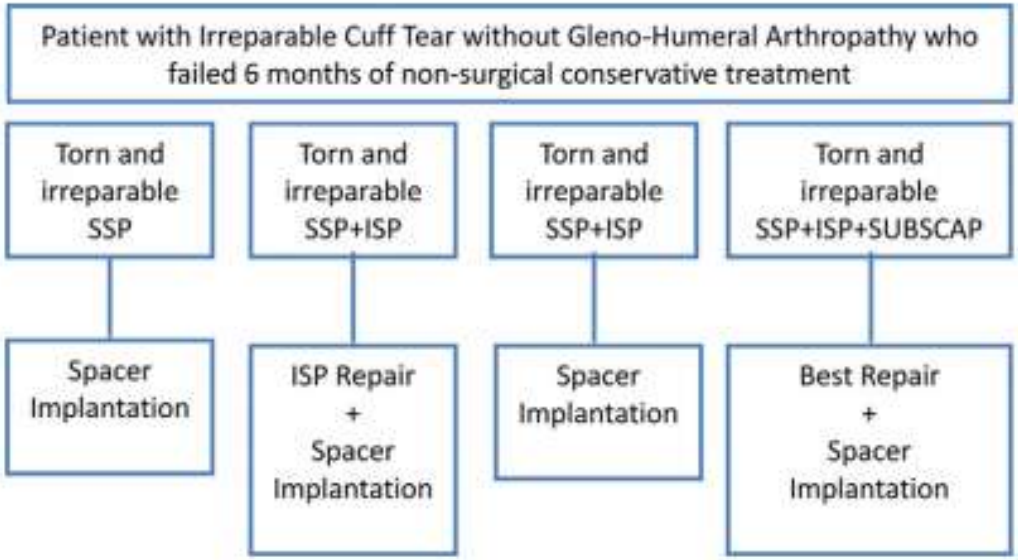
(J Shoulder Elbow Surg 2003;12:222-5.)

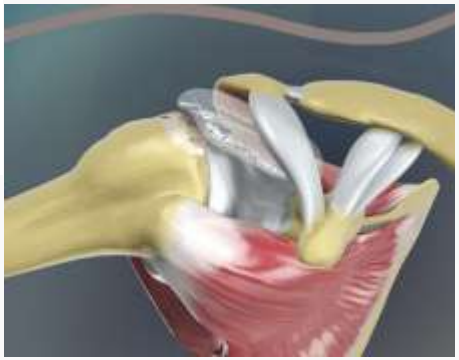
Takayuki Sugihara, MD,[a] Teruhiko Nakagawa, MD,[b] Masamitsu Tsuchiya, MD,[b] and Masafumi Ishizuki, MD,[a]
Tokyo, Japan

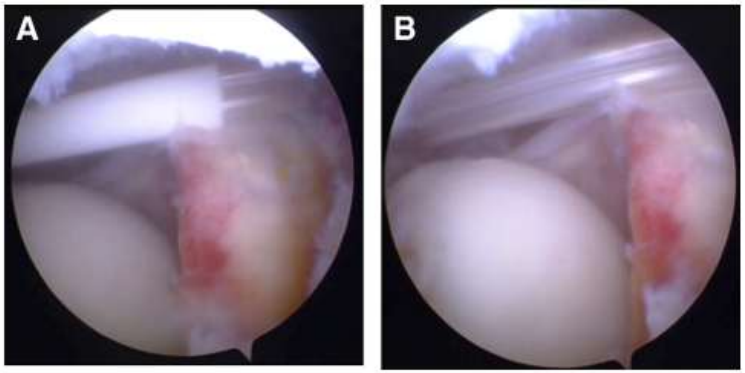
- ❑ Tears greater than 4 cm in width and length
- ❑ severe fatty infiltration of the SSP (grade 3 or 4) and IFS
- ❑ Static superior humeral head migration on plain radiographs
- ❑ reduced acromiohumeral index

New Solution for Massive, Irreparable Rotator Cuff Tears: The Subacromial "Biodegradable Spacer"

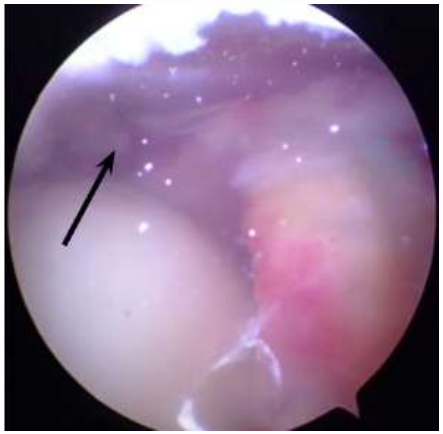
Eugenio Savarese, M.D., Ph.D., and Rocco Romeo, M.D.







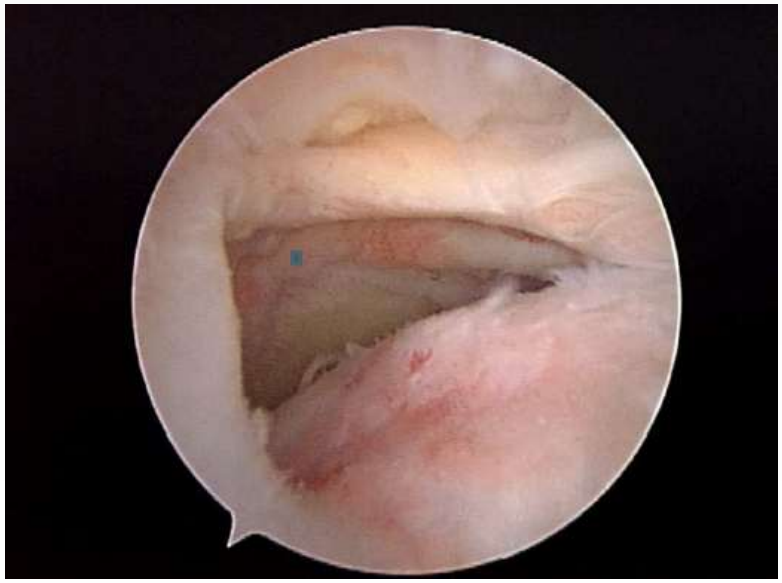
The rotator cuff normally provides stability by compression of the humeral head into the glenoid, whereas rotator cuff disruption compromises concavity compression and alters glenohumeral load structure and direction

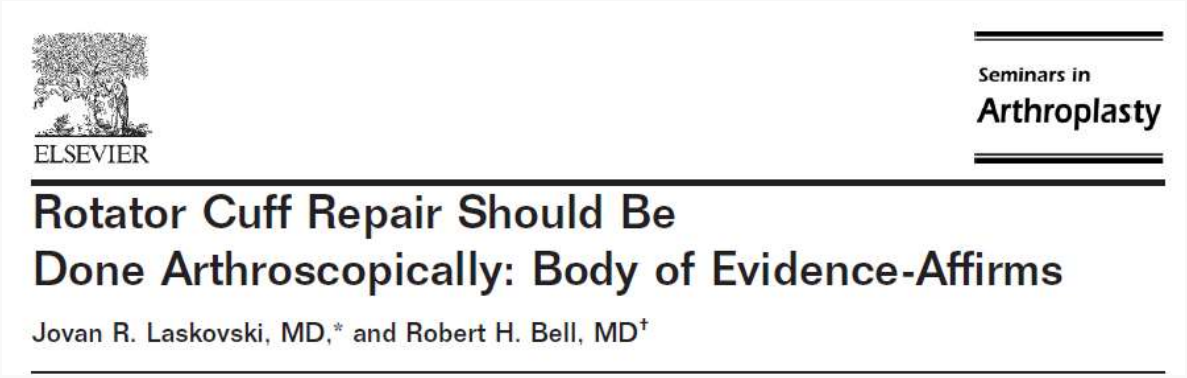


Rotator Cuff Repair Should Be Done Open: *Seein' is Believin'!—In Opposition*

Sumant G. Krishnan and Wayne Z. Burkhead

"Seein' is believin'!" and arthroscopy allows direct visualization of the entire rotator cuff from anterior subscapularis to posterior teres minor in one single "view"





- decreased surgical morbidity,
- improved rehabilitation,
- ability to identify and treat associated pathology
- allows visualization of the tear size, retraction, and tissue quality
- releases can also rbe performed, facilitating low-tension repairs.

The final factor in the argument for an arthroscopic approach is that of patient preference

Initial nonoperative care can be safely undertaken in:

- in older patients (>70 years old) with chronic tears
- patients with irreparable rotator cuff tears with irreversible changes,
- patients of any age with small (<1 cm) full-thickness tears or in
- patients with partial-thickness tears

Early surgical treatment can be considered in

significant (>1 cm–1.5 cm) acute tears or young patients with full-thickness tears who have a significant risk for the development of irreparable rotator cuff changes.