



What are the harms of corticosteroid injections in the management of peripheral musculoskeletal conditions?

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The big question...



Corticosteroids are ubiquitous in musculoskeletal healthcare

98% of orthopaedic surgeons reported using intra-articular CSIs for knee OA

(Blankstein et al, 2021)

19.7% of patients presenting to their GP with RCRSP will receive a subacromial CSI

(Naunton et al, 2020)

Table 4. GP management of RC related shoulder pain by time period (2000–2016).

	2000–2004 N = 1190 (95% CIs)	2004–2008 N = 1347 (95% CIs)	2008–2012 N = 1685 (95% CIs)	2012–2016 N = 2064 (95% CIs)
Management rate (per 1000 encounters)	2.98 (2.78–3.19)	3.50 (3.26–3.73)	4.28 (4.03–5.52)	5.30 (5.02–5.57)
Medication	57.1 (54.0–60.1)	47.9 (44.9–50.8)	51.0 (48.5–53.6)	54.3 (52.0–56.6)
NSAID	33.6 (30.7–36.5)	22.9 (20.4–25.3)	20.5 (18.4–22.5)	18.4 (16.7–20.1)
Steroid–Injection	9.8 (7.9–11.8)	10.3 (8.3–12.3)	15.8 (13.9–17.8)	19.7 (17.8–21.6)
Opioid	6.6 (5.2–8.1)	6.9 (5.5–8.3)	7.5 (6.2–8.8)	8.1 (6.9–9.3)
Panadol	7.1 (5.6–8.6)	6.7 (5.3–8.1)	7.0 (5.8–8.2)	7.4 (6.1–8.6)
Steroid–oral	0.2 (-0.1–0.4)	0.4 (-0.0–0.8)	0.1 (-0.0–0.3)	0.5 (0.2–0.8)

Short term benefit, long term harm?

Intra-articular Corticosteroid Injections in the Hip and Knee: Perhaps Not as Safe as We Thought?

*Andrew J. Kompel, MD • Frank W. Roemer, MD • Akira M. Murakami, MD • Luis E. Diaz, MD •
Michel D. Crema, MD • Ali Guermazi, MD, PhD*

Osteoarthritis and Cartilage



Commentary

Pay attention to the evidence: in the longer term, intraarticular corticosteroid injections offer only harm for knee osteoarthritis

J.W. Orchard ^a



TIM COOK, MSc, MCSP¹ • JEREMY LEWIS, PhD, FCSP^{2,3}

Rotator Cuff-Related Shoulder Pain: To Inject or Not to Inject?

J Orthop Sports Phys Ther 2019;49(5):289-293. doi:10.2519/jospt.2019.0607

How do corticosteroids affect cartilage?

The Effect of Intra-articular Corticosteroids on Articular Cartilage Wernecke, Braun and Dragoo, 2015

Number of studies	40, 39 basic science studies, 1 clinical trial
Type of study	In vivo and in vitro, animal and human cartilage
Corticosteroids investigated	Hydrocortisone, Methylprednisolone, Triamcinolone, Dexamethasone, Betamethasone, Prednisolone
Findings	<p>Low doses: protective effect on cartilage thickness and chondrocyte density</p> <p>Higher doses: chondrocyte apoptosis, reduced collagen synthesis, extracellular matrix breakdown, cartilage thinning</p>
Limitations	<p>Mostly animal in vivo or human in vitro</p> <p>1 low-quality human clinical trial</p> <p>Most studies on healthy or surgically-damaged cartilage</p> <p>Threshold for harm unknown</p>

Increased risk of cartilage loss?

JAMA | **Original Investigation**

Effect of Intra-articular Triamcinolone vs Saline on Knee Cartilage Volume and Pain in Patients With Knee Osteoarthritis A Randomized Clinical Trial

Design

- Double Blind RCT
- 140 participants with knee OA

Interventions

- 1mL 40mg Triamcinolone vs. 1mL saline (placebo)
- Injections every 3 months for 2 years

Outcome Measures

- MRI used to image cartilage volume at yearly intervals
- VAS, WOMAC, 20m timed walk, 5 x STS measured

Increased risk of cartilage volume loss?

Findings

- Greater cartilage loss in steroid group vs. saline group
- No change in pain, stiffness or function in either group

Implications


- 0.21mm loss vs. 0.1mm loss
- Uncertain if clinically relevant

Limitations

- Injection schedule does not reflect clinical practice

Increased risk of radiographic progression?

Subjects with KL Grade II or III knee OA from OAI Database
No previous steroid injection

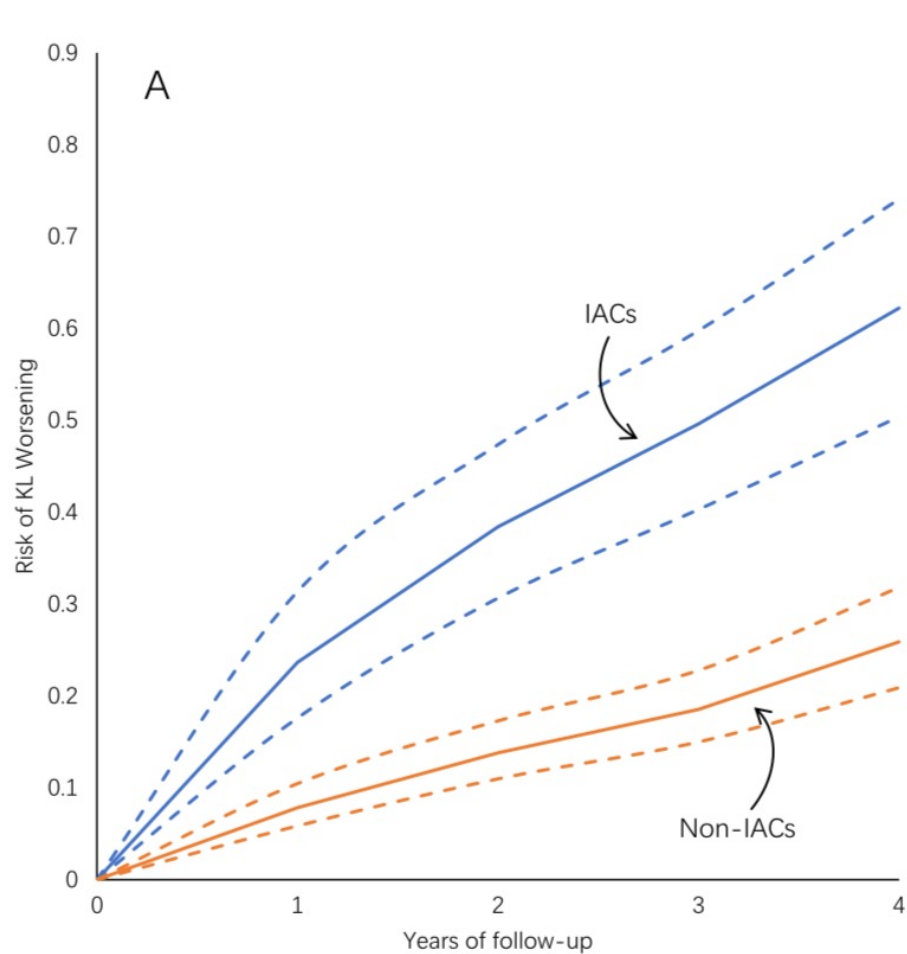


Yearly knee x-rays and screening questions
Index visit = first visit after steroid injection

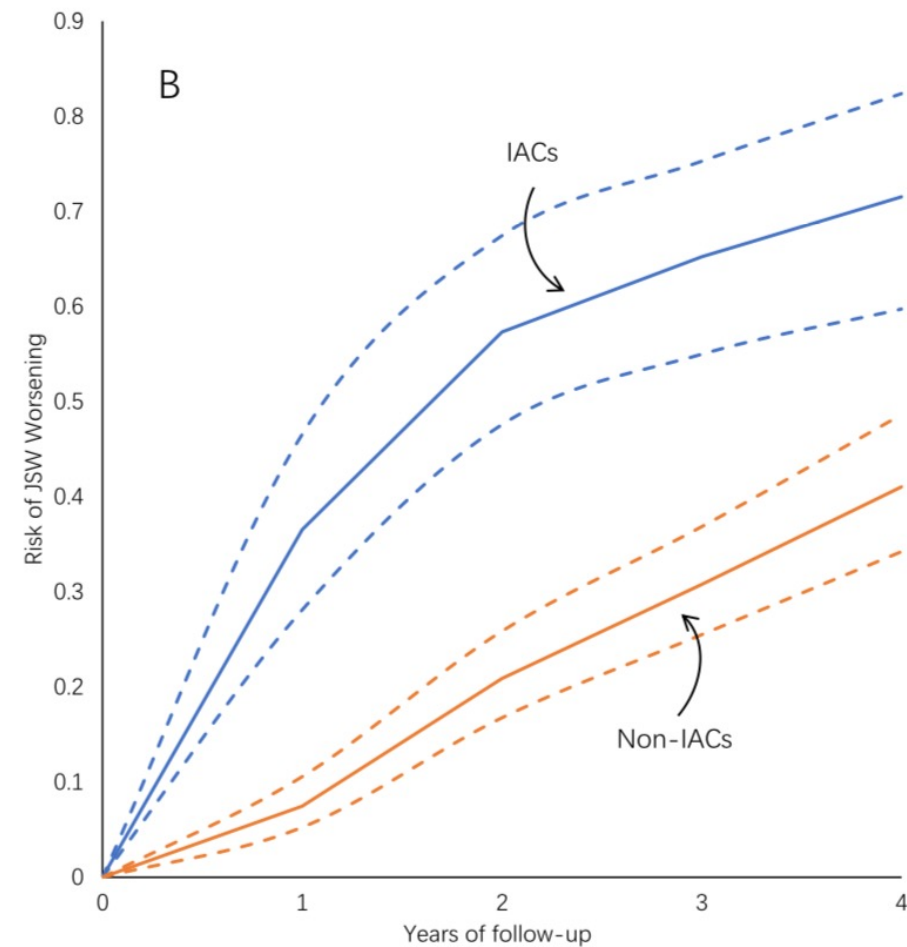


Progression monitored for up to 5 years
Compared against propensity matched cohort without injection

Increased risk of radiographic progression?



KL grade worsening hazard ratio = 3.02



Joint space narrowing hazard ratio = 2.92

Increased risk of arthroplasty?

Retrospective audit

Data from the Osteoarthritis Initiative Database

10 year follow up period

	Total Number	Number progressed to TKR	Percentage
Corticosteroid Injection	749	249	31.3%
No Corticosteroid Injection	3026	152	5%

Increased risk of arthroplasty?

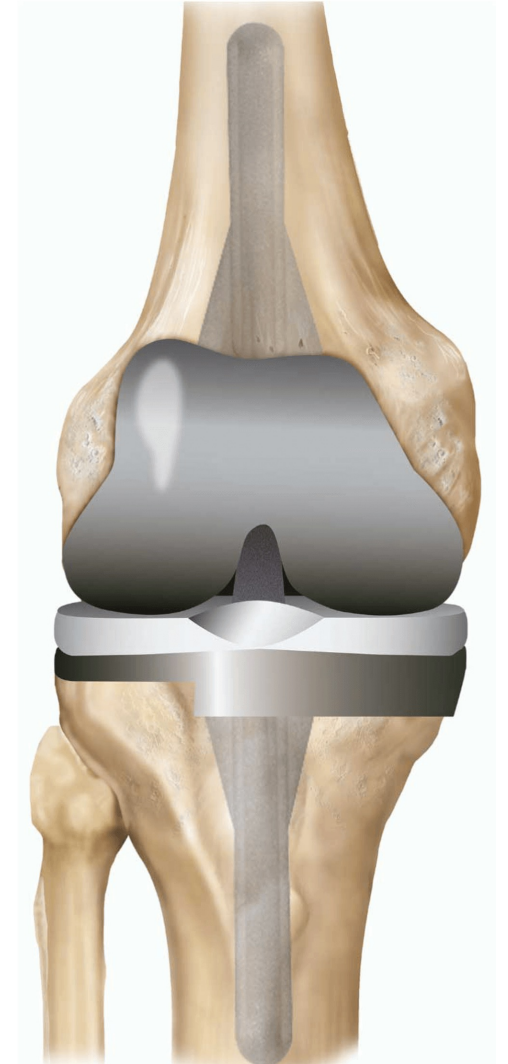
Absolute risk = 9.4%

- Regardless of established or at risk of developing knee OA

Cumulative risk increases by 9.4% with each injection

Limitations: if more willing to receive injection, then:

- Worse symptoms?
- More willing to undergo arthroplasty?



How do corticosteroid affect tendons?

Adverse Impact of Corticosteroids on Rotator Cuff Tendon Health and Repair: A Systematic Review Puzzitiello et al, 2020

Number of studies	16 basic science studies, no clinical trials
Type of study	In vivo and in vitro, animal and human cartilage
Corticosteroids investigated	Methylprednisolone, Triamcinolone, Dexamethasone, Betamethasone
Findings	<p>Decreased tenocyte proliferation and increased apoptosis</p> <p>Increased collagen necrosis and decreased collagen synthesis</p> <p>Disruption of normal balance of matrix enzymes/cytokines</p> <p>Reduced stiffness and ultimate load to failure</p> <p>Effects last up to 4 weeks</p>
Limitations	<p>Mix of in vitro and in vivo studies</p> <p>Different types and dosages of steroid</p> <p>Human and animal studies</p>

What is the mechanism for long term harm?

Glucocorticoid-induced senescence

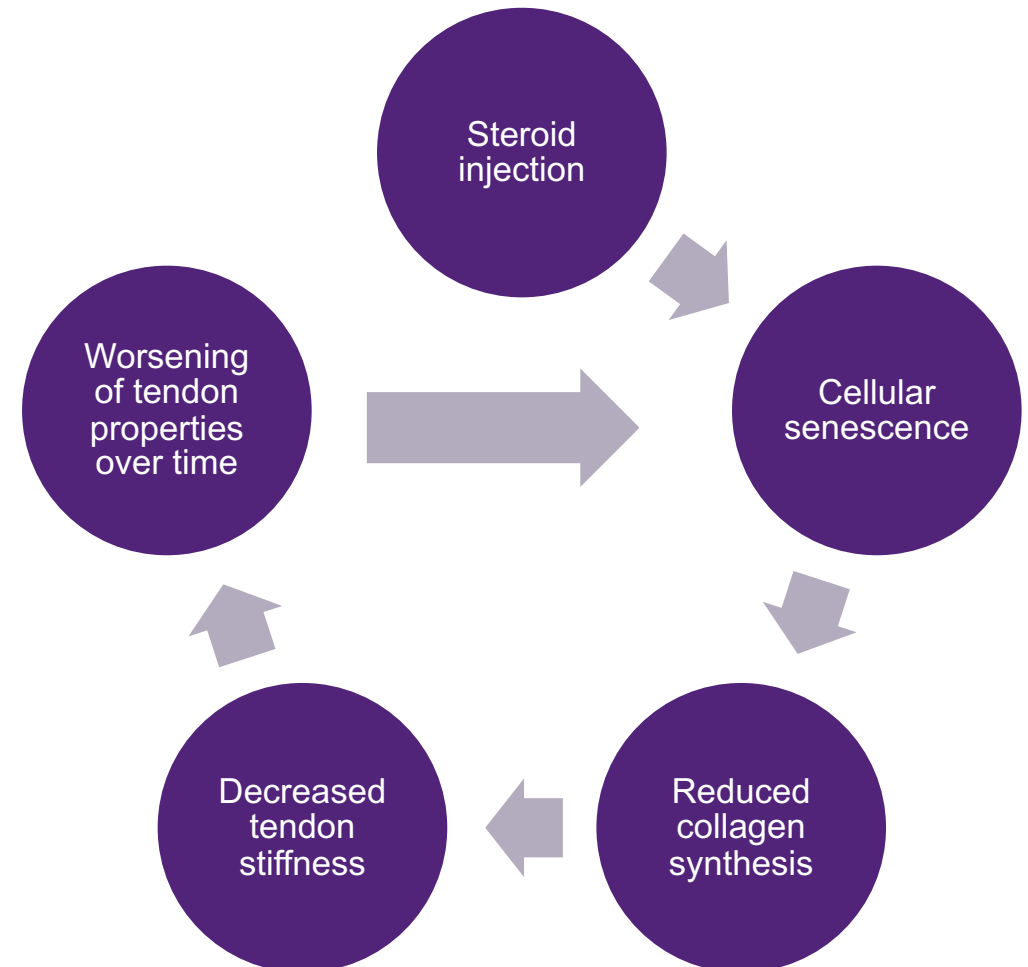
(Dean et al, 2014)

Senescence is an irreversible change in normal cellular activity

(Poulsen et al, 2014)

Deterioration of tendon mechanical properties over time



May aggravate the pathology it was intended to treat



Increased risk of rotator cuff tear?

Article

A Positive Correlation between Steroid Injections and Cuff Tendon Tears: A Cohort Study Using a Clinical Database

Ching-Yueh Lin ^{1,2} , Shih-Chung Huang ^{3,4,5,6}, Shioh-Jyu Tzou ^{4,5}, Chun-Hao Yin ^{7,8}, Jin-Shuen Chen ⁹, Yao-Shen Chen ⁹ and Shin-Tsu Chang ^{2,10,*} 

Retrospective audit of patients with shoulder pain in Taiwan

Followed for ~4 years

205 patients received injection, matched to 820 controls without injection

Increased risk of rotator cuff tear?

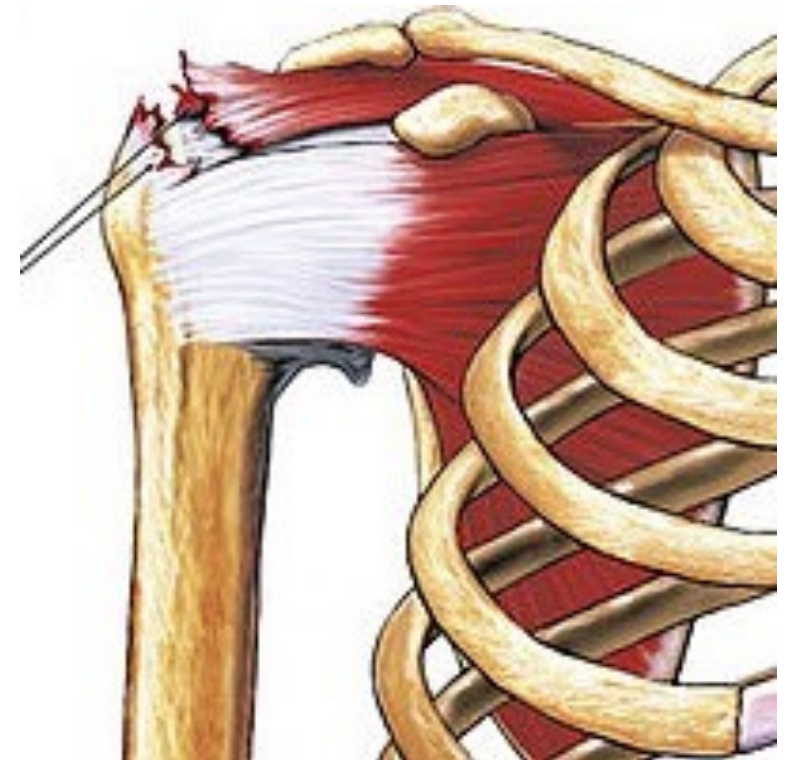
9.8% developed cuff tear in steroid group (20 / 205)

1.2% developed cuff tear in control group (10 / 820)

7.44 times greater risk in steroid group

Limitations:

- Retrospective design, lack of generalisability
- Initial presenting complaint, baseline characteristics and injection specifics not well defined



Incidence of rotator cuff tear

- Small prospective study, n = 53, mean age 60
- No full thickness tear at baseline ultrasound
- All received 1ml / 40mg of triamcinolone into subacromial space
- Small control group (n = 7), received local anaesthetic only
- Followed up ultrasound at 12 weeks

Incidence of rotator cuff tear

- 9 / 53 (17%) had FT tear on 12 week ultrasound
- 6 / 9 (25% of total group) had PT tear at initial ultrasound
- No FT tears in control group

Limitations:

- Small sample size
- No blinding, randomisation or proper control group
- Significance of observations uncertain

Evidence from the elbow: poorer long term outcomes?

“Effect of Corticosteroid Injection, Physiotherapy, or Both on Clinical Outcomes in Patients With Unilateral Lateral Epicondylalgia”

Double blind RCT, 2x2 factorial design, n = 163 (~40 per group), 1 year follow up

Corticosteroid injection vs. placebo (saline) injection, +/- physiotherapy

Lower recovery in steroid group (84%) vs. saline group (93%)

- Addition of physiotherapy – no difference (82% vs 100%)

Higher recurrence in steroid group (55%) vs. saline group (20%)

- NNH = 2.4
- Addition of physiotherapy – no difference in steroid group (55%), reduced recurrence in saline group (5%)

Summary

- Corticosteroids are not benign!
- Increased risk of knee OA progression
- ?Increased incidence of rotator cuff tear
- ?Lowered likelihood of recovery and increased recurrence
 - Evidence only in the elbow

Implications for clinical practice

Opinion is divided in the knee OA literature...

“The best time to have stopped using intra-articular corticosteroid injections was years ago, and the second-best time to stop using them (and stop recommending them) is today.”

(Orchard, 2023)

Intra-articular corticosteroids can be used to obtain short-term analgesia in painful flare ups.

(Richette and Latourte, 2023)



Implications for clinical practice

RCRSP literature less clear

- If severe pain, loss of function or sleep loss

(Lee and Diver, 2020)



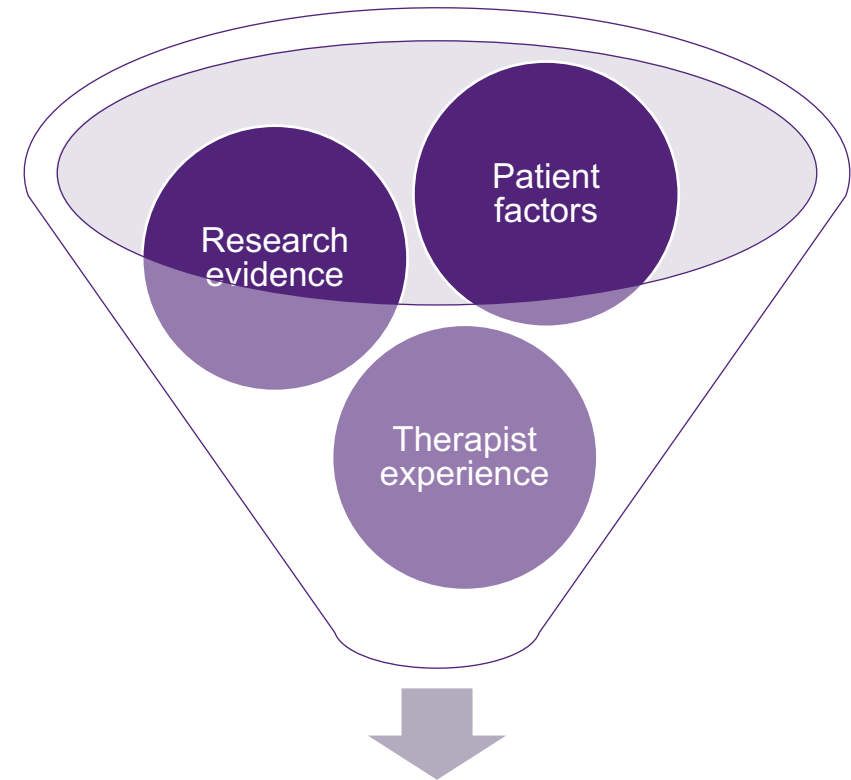
Clinical Decision Making

Depends on many factors

Discuss likely benefits and harms

Collaborative approach

Informed decision making



Informed decision making



“It seems contradictory to treat a condition that is defined by a lack of capacity, with a treatment that is known to cause structural changes that may reduce tissue capacity.”



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CREATE CHANGE

Thank you!

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