### Ramazzini Presentation

THE TEMPORAL RELATIONSHIP BETWEEN SUPRASPINATUS TENDON RUPTURE AND FATTY INFILTRATION OF THE SUPRASPINATUS MUSCLE

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#### Shoulder injuries in QLD 2014-51



26 Statutory claim payments by injury type 2014-15 and 2015-16

1. The State of Queensland 2016, Queensland workers' compensation scheme statistics, 2015-6. Office of Industrial Relations.

#### Rotator Cuff Tears



- 1. Shen P, et al .Long-term functional outcomes after repair of rotator cuff tears correlated with atrophy of the Supraspinatus muscles on magnetic resonance images. *Journal of Shoulder And Elbow Surgery*, January 2008
- 2. Kim H, et al. Relationship of tear size and location to fatty degeneration of the rotator cuff. Journal of Bone & Joint Surgery, American Volume April 2010



To assess the relationship of a traumatic tear to the Supraspinatus tendon and the time required for varying levels of development of fatty degeneration in the Supraspinatus muscle.

#### Prevalence of Supraspinatus Injuries

Age	Percentage
All ages <sup>1</sup>	5-39%
<50yrs <sup>2</sup>	0%
51-60yrs	10.70%
61-70	15.20%
71-80	26.50%
>80	36.60%

- 1. Yamamoto A, et al. Prevalence and risk factors of a rotator cuff tear in the general population. *Journal Of Shoulder And Elbow Surgery* January 2010
- 2. Minagawa H, Itoi E. Clinical relevance of the rotator cuff in the shoulder with pain and dysfunction. *Kansetsugeka* 2006

#### Proposed Pathology of Fatty Infiltration of the Supraspinatus Muscle

- Loss of traction on the muscle and resultant loss of permutation angle and;
  Figure 1
- Loss neurological input



- Kuzel B, et al Fatty infiltration and rotator cuff atrophy. The Journal Of The American Academy Of Orthopaedic Surgeons October 2013
- Nakagaki K, et al Fatty degeneration in the supraspinatus muscle after rotator cuff tear. *Journal Of Shoulder And Elbow Surgery*, May 1996

#### Rate of Fatty Infiltration Progression

#### Melis *et al* showed that fatty infiltration can be found at an average of 3 years from traumatic injury.

- Melis *et al* had no description of size of tendon tears
- ► This research looked at large tendon tears (Patte Classification Stage 3)
- Animal studies suggest that the rate of fatty infiltration can be much faster
- Melis B, et al. Natural history of fatty infiltration and atrophy of the Supraspinatus muscle in rotator cuff tears. *Clinical Orthopaedics & Related Research* June 2010

#### Study Design/Process

- This is a correlation study
- Patients under the care of two co-located surgeons
- Imaging completed at Brisbane Private Hospital Imaging
- The retraction of the Supraspinatus tendon was assessed as greater than stage 3 Patte classification.
- The Goutallier grade of fatty infiltration was noted
- The patients file was examined for a date of injury
- The time from the injury to the MRI was calculated
- The time from injury to MRI was compared to the grade of fatty infiltration for correlation

## Study Inclusions

Inclusion criteria were established to assess participant eligibility.

- The patient must be over the age of 18 years;
- Provide consent;
- Had an MRI completed at the Medical Imaging Practice with in the years 2011 and 2016; and,
- Retraction greater Patte Stage 3 as assessed by the medical imaging practice radiologists;

# Study Exclusions

Patients were excluded from the study for the following reasons:

- Retraction less than Stage 3 as measured by the medical imaging practice radiologists on MRI;
- ▶ No date of injury recorded in the patient records; and,
- Patient had undergone previous surgery or had a significant previous injury as noted in patient records

#### Degree of retraction of the Supraspinatus Tendon



1. Patte D. Classification of rotator cuff lesions. Clinical Orthopaedics And Related Research [serial online]. May 1990

#### Goutallier Stages of Fatty Infiltration



1. Goutallier D, Le Guilloux P, Postel J-M, Gleyze P. La degenerescence musculaire graisseuse. Rev Chir Orthop 1999

#### Data Collection

244 Reports identified

102 had less than Stage 3 retraction

33 had no date of injury

30 had previous surgery

79 reports meet criteria



Age Groups	Number of Patients	Male	Female	Average Fl	Range of Fl	Average Time Elapsed (Days)	Range of Time
< 55years	23	19	4	1.3	0-3	104.3	7-459
55-70 years	40	34	6	1.6	0-3.5	119.5	7-459
> 70 years	16	9	7	2.1	0-4	106.9	7-756
All ages	79	62	17	1.6	0-4	112.5	6-380

FI = Fatty Infiltration



Ages	Correlation	p value	Number of Participants
All ages	0.18	0.11	79
<55years	0.24	0.26	23
55-70 years	0.29	0.07	40
>70 years	-0.31	0.24	16



- The aim of this study was to investigate if there was a correlation between fatty infiltration and time elapsed from the time of injury to time of imaging
  - The correlation was negligible
  - The p value did not reach significance



- The rate of pre existing fatty infiltration in the community<sup>1</sup>
- ▶ The presence of pre existing asymptomatic supraspinatus tendon tears in the community<sup>2</sup>
- ▶ The length of time from when the injury occurred to the time of imaging being too short<sup>3</sup>
- 1. Sher J, et al. Abnormal findings on magnetic resonance images of asymptomatic shoulders. *The Journal of Bone And Joint Surgery. American Volume* January 1995
- 2. Tempelhof S, Rupp S, Seil R. Age-related prevalence of rotator cuff tears in asymptomatic shoulders. *Journal of Shoulder and Elbow Surgery* July 1999
- 3. Melis B, et al. Natural history of fatty infiltration and atrophy of the Supraspinatus muscle in rotator cuff tears. *Clinical Orthopaedics & Related Research*, June 2010



- This suggests that fatty infiltration would most likely pre-dates an acute injury
- ► This may assist with some insurance claim determinations



- Lack of statistical significance
  - Increased number of participants
    - Increasing the number of surgeons, and
    - Increasing the number of medical imaging practices



- Lack of understanding of pre-existing state of the muscle
  - A new tear of the supraspinatus muscle
  - Extension of a pre-existing partial thickness tear
  - Pre-existing non-symptomatic full thickness tears that is now symptomatic



- Lack of time for fatty infiltration to developed
  - Melis et al<sup>1</sup> found a period of 3-6 years was required for fatty infiltration to develop
  - The longest period in this study was 459 days
  - It would be unethical to let such a condition develop as repairable prior to Goutallier grade 2

1. Melis B, et al. Natural history of fatty infiltration and atrophy of the Supraspinatus muscle in rotator cuff tears. *Clinical Orthopaedics* & *Related Research* June 2010

#### Future Directions

- Prospective study of at risk working populations
  - Regular MRI's to identify fatty infiltration and tendon tears in asymptomatic patients
  - Unethical to leave a young symptomatic patient to develop fatty infiltration as tendon are repairable



- This study failed to demonstrate a correlation between the time elapsed between an acute rupture of the Supraspinatus tendon and MRI was related to the development of fatty infiltration of the supraspinatus muscle
- Further investigation of the natural history of fatty infiltration of the Supraspinatus muscle following trauma is required
- Such studies may be unethical to conduct due to good outcomes of repairs of the Supraspinatus tendon