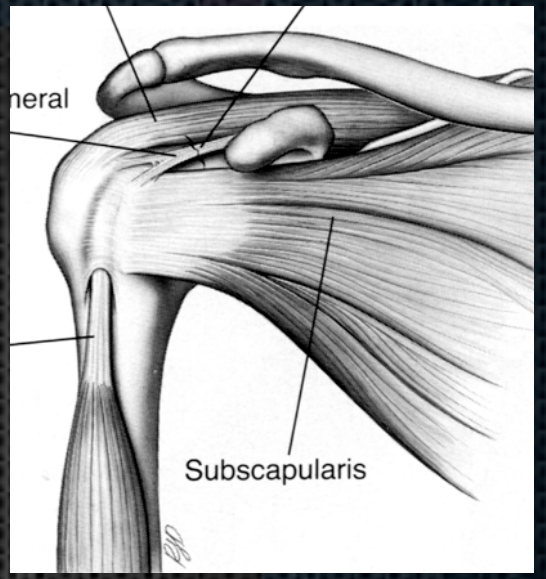
The rotator cuff in arthroplasty Introduction and the role of subscapularis



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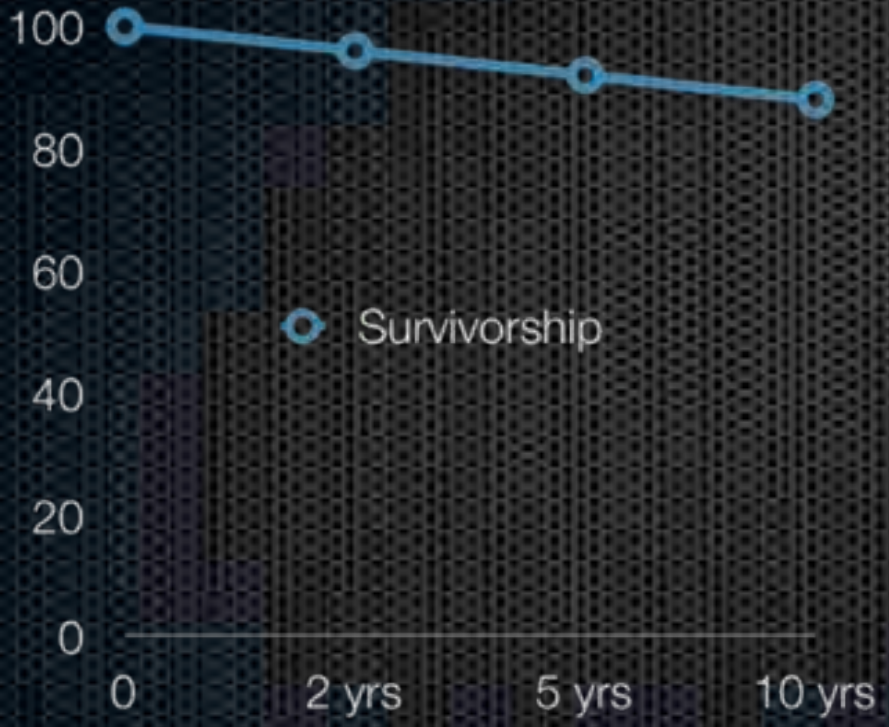
Shoulder replacement



- 7000 TSR / year in the USA from 1996-2002 (Bohsali)
- 17000 SR (Norris)
- 75% are performed by surgeons who do less than 2/yr on average

SR complication rate

- Complication rate: 10-16%
  - ★ 414/2810 = 14,7% (Literature review)
  - ★ 204/1459 = 14% (Wirth)
  - ★ 53/431 = 12% (Chin)
  - ★ 123 / 1183 = 10% TSR (Cofield)

Complications

- Component loosening
- Prosthetic instability
- Cuff rupture
- Stiffness
- Peri-prosthetic Fx
- Infection
- Implant breakage
- Deltoid weakness
- Neural lesions

1997

+

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- Component loosening
- Instability
- Periprosthetic Fx
- Rotator cuff tears
- Neural injury
- Infection
- Deltoid muscle dysfonction

2006

Causes for revision of shoulder arthroplasty

	Dines, JBJS 2006	Bayley, 2005	Swedish R
Glenoid revision	22	25	6
Conversion hemi to total	16	19	65
Humeral stem revision	8	3	12
Periprosthetic Fx	4	3	5
Rotator cuff repair	10	24	
Tuberosity reconstruction	4		
Cuff tear	4		11
Instability	5		59
Infection	4	1	19

Take home message

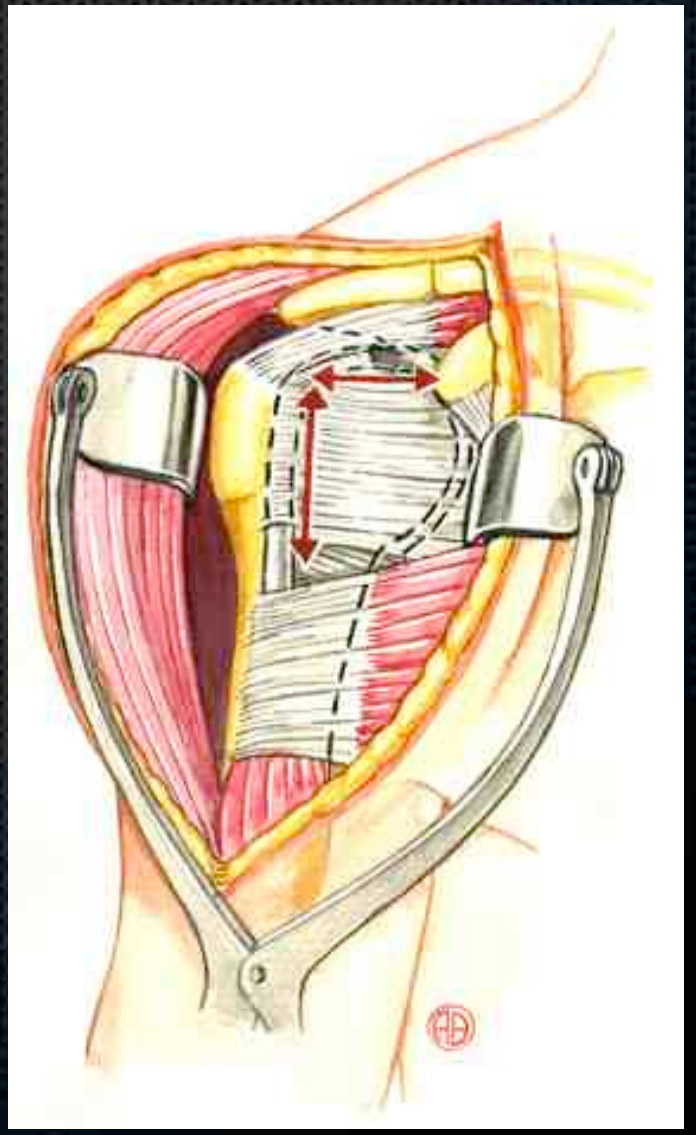
- Rotator cuff problems are among the most frequent problems after TSR
- They also interfere with glenoid fixation and prosthetic stability
- They must be checked before - during and after surgery

Subscapularis

- Is violated during the surgical approach in almost all cases
- Can be damaged after surgery due to:
  - Implant designs/size
  - Implant instability

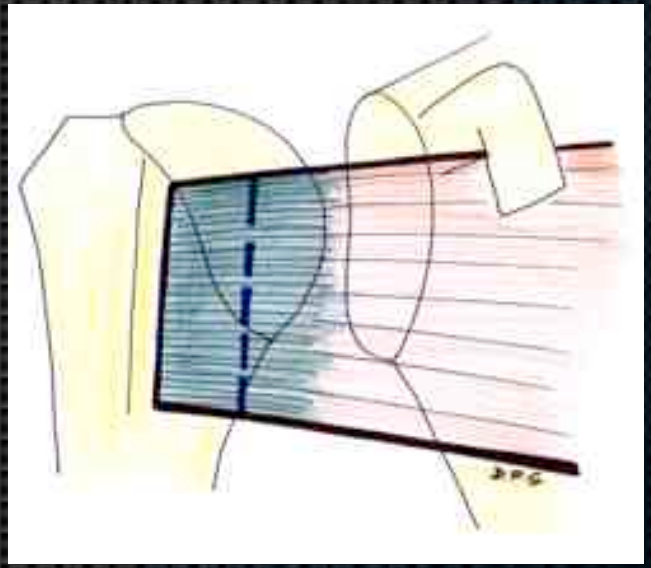
Surgical approach

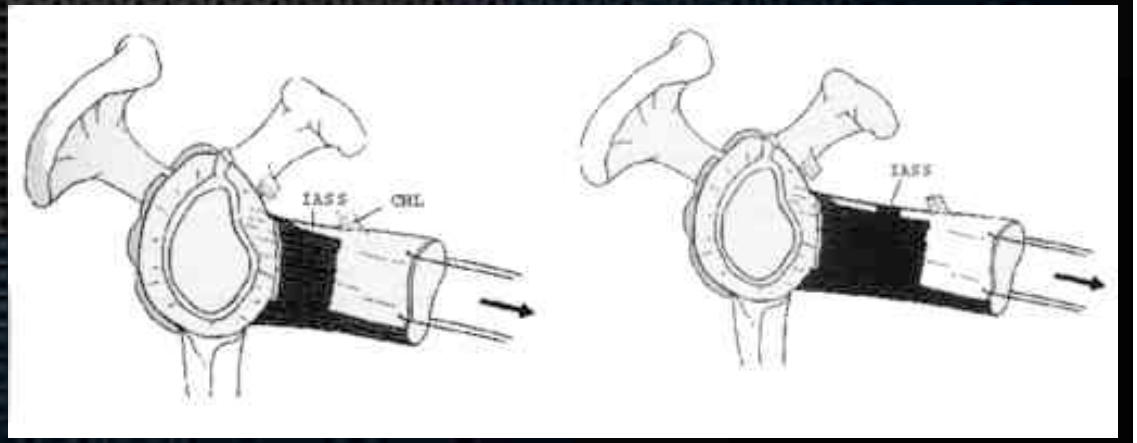
- 1st: There is no “retraction” of the subscapularis muscle
- 2nd: Solid subscapularis repair is mandatory
  - Be able to do a “360° release” to mobilize the tendon (axillary nerve)
  - Anticipate the difficulty “to lenghten” the tendon (bone resorption, loss of ER (1 cm = 20°), …)



Subscapularis

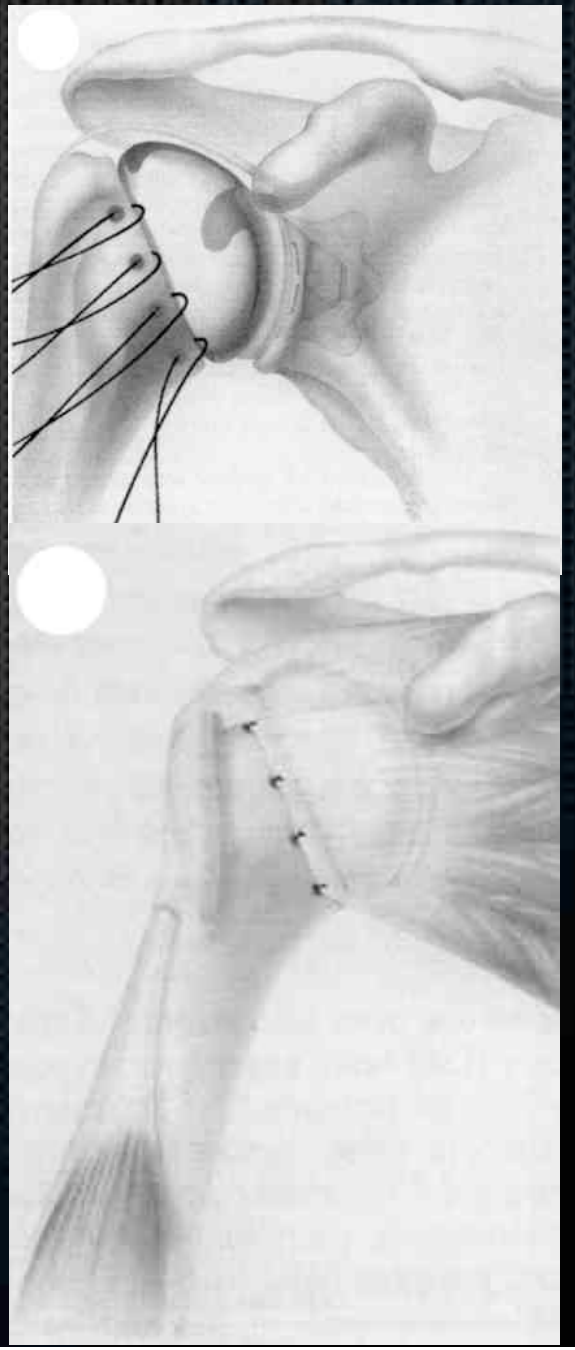
- Section of the tendon (1,5 cm from insertion) with suture at the end (ER > 35°)
- Length is gained by releasing the CH ligament +/- the intra-articular subscapularis tendon





Subscapularis

- Disinsertion from the lesser tuberosity
- Length is gained by releasing the CH ligament +/- the intra-articular subscapularis tendon +/- reinsertion of the tendon into the humeral edges



Subscapularis

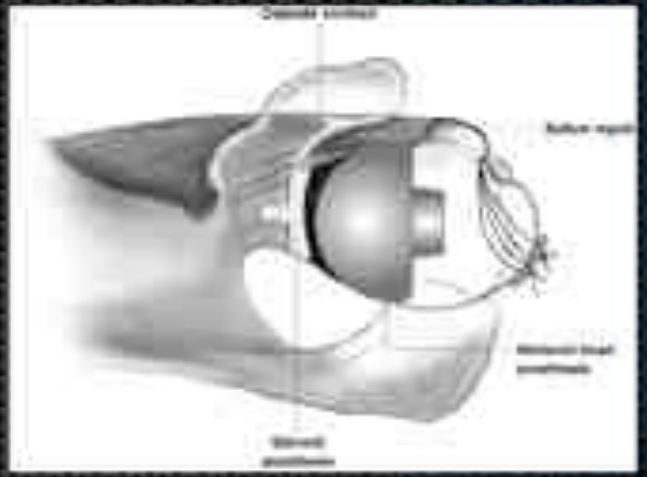
- Abnormal results in 2/3 of patients for lift-off and press-belly tests (Miller, JSE 2003).
- Patients reported difficulty in tucking up their shirt in the back
  - Does subscapularis release / section lead to muscle denervation ?

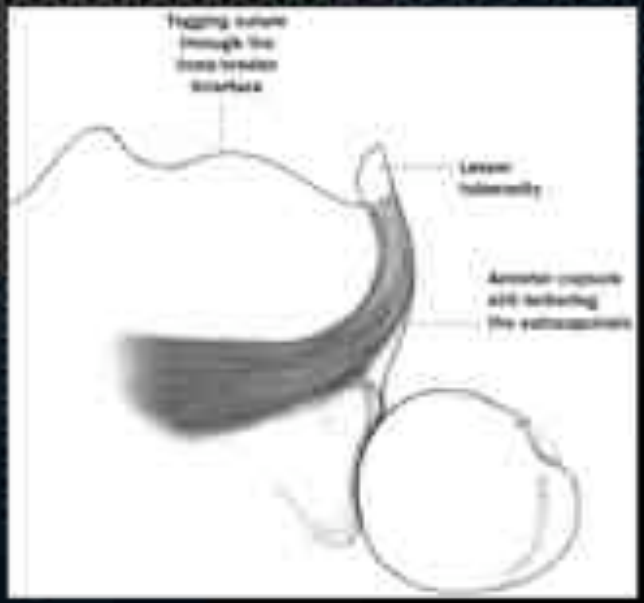
Subscapularis

- Osteotomy of the lesser tuberosity

Subscapularis

- Osteotomy of the lesser tuberosity





Subscapularis osteotomy

- 39 patients
- All osteotomy healed
- 2/3 to 3/4 of patients had normal lift-off or press-belly test

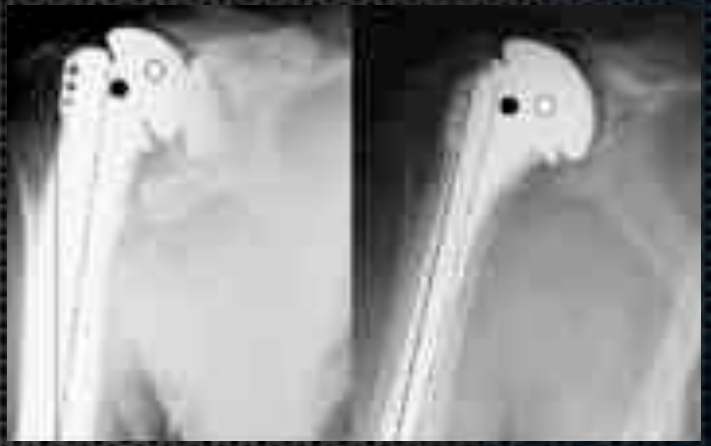
➡ Fatty infiltration had progressed by one stage (24%), by two stages (15%), and by three stages (6%) and was correlated with poorer results

Subscapularis experimental repair

- After repair, length of the subscapularis tendon was reduced by 15% in the tendon-to-tendon group and by 12% in the bone-to-bone group and was increased by 7% in the tendon-to-bone group.
- Complete failure occurred in four tendon-to-bone specimens, one tendon-to-tendon specimen, and no bone-to-bone specimen during the 150-N cyclic test (Hoeneke)
- On the basis of the ultimate strength, the osteotomized specimens with single and double-row repair had a significantly higher load to failure than the tenotomy specimens did (430, 466, and 252 N, respectively).

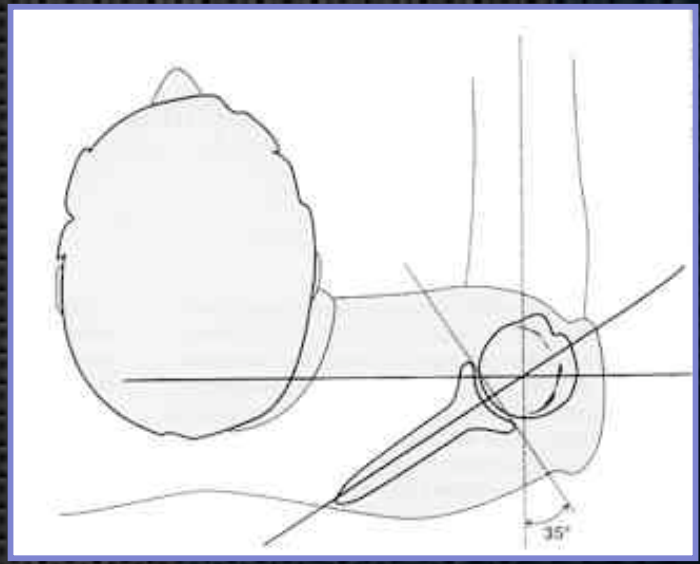
Implant positioning

- Oversized heads
- Lateralization
  - will increase loadings on the tendon repair



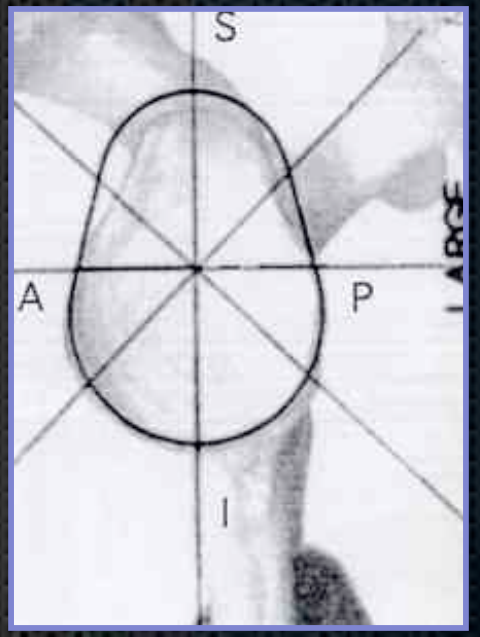
Implant positioning

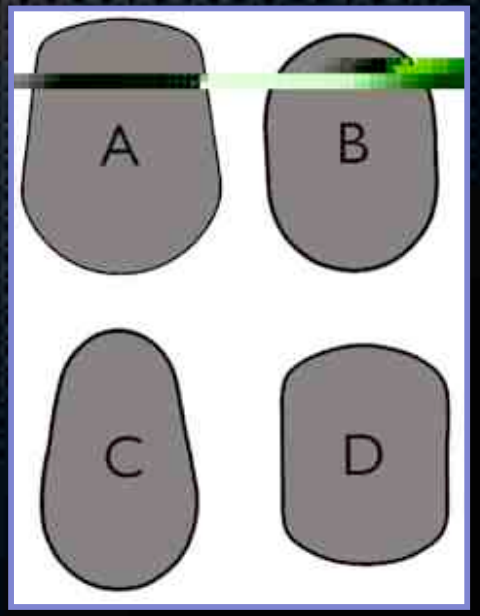
- Increased retroversion increases loads on the subscapularis during external rotation +++
  - Per-op testing (40-50-60 rules)



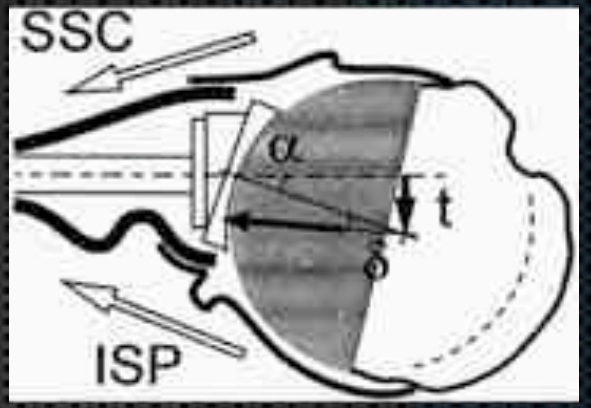
Implant design

- Almost 100% of glenoid component did not fit glenoid anatomy
- Larger implant may act as a buttress on the subscapularis

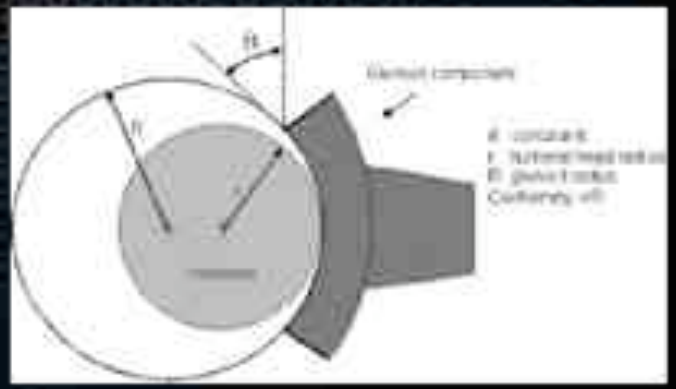




Implant design



- The humeral head is almost a sphere
- Radius in the frontal plane > sagittal plane
  - If the prosthesis is fitted in the frontal plane ➟ oversized in the sagittal plane (≈ 3 mm)



Conclusion

- Subscapularis is a major stabilizer of SR arthroplasty
- Outcomes of SR is linked to integrity of the subscapularis tendon
- Surgical approaches violate the integrity of the subscapularis
- Implant design and positioning may also interfere with the subscapularis