Long-Term MRI Assessment of Multifidus Muscle Changes Following Biportal Endoscopic Spinal Surgery (BESS)

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Introduction

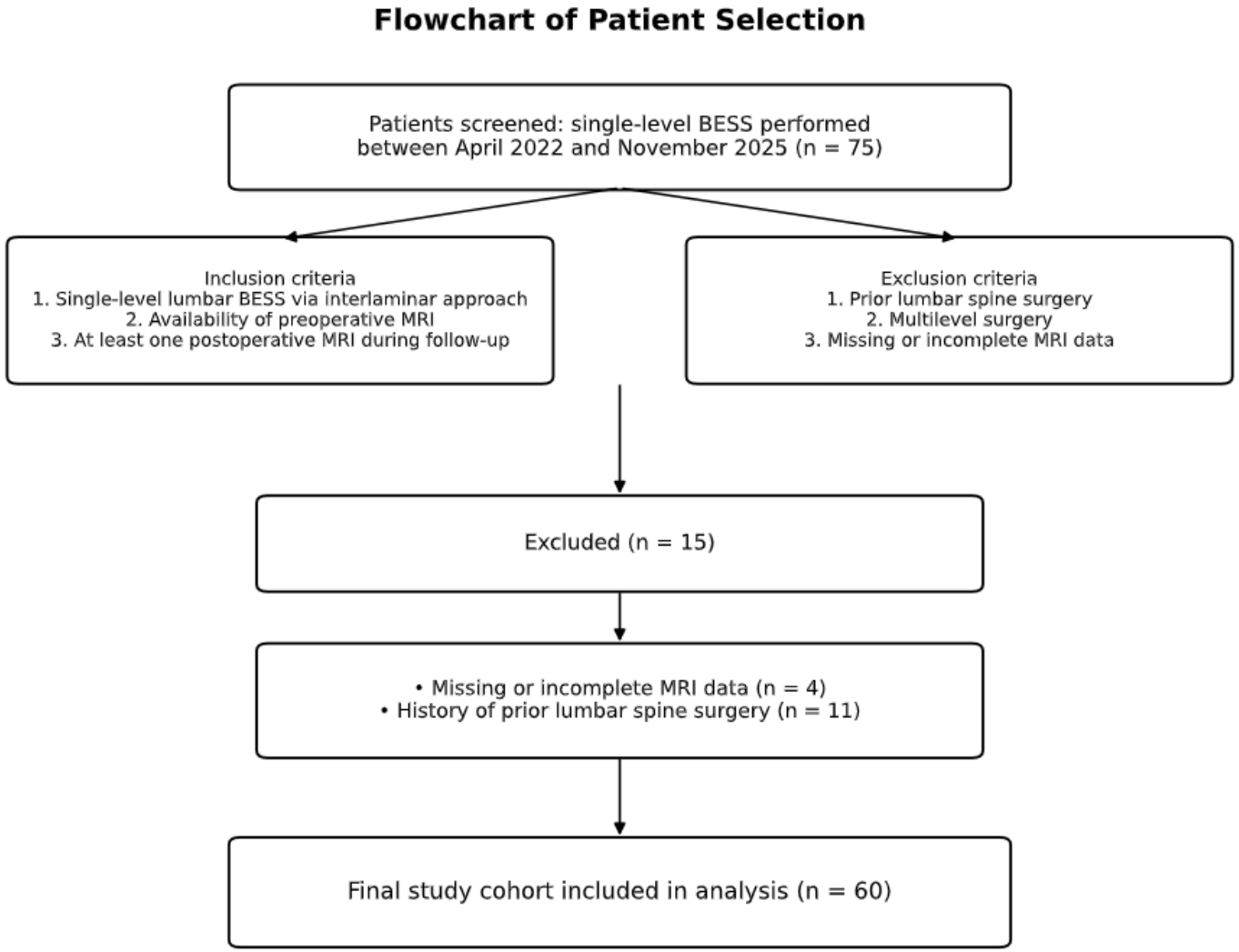
- Paraspinal muscle injury after posterior lumbar surgery causes post-op LBP & functional impairment.

- **BESS**
  - Minimizes soft-tissue disruption
  - portal creation & saline irrigation may still affect multifidus

- **Previous MRI-based BESS studies**
  - Short follow-up with symptomatic-patient selection bias

- **Aim**: Routine protocol-based MRI to 3 years post single-level BESS to minimize selection bias

Materials & Methods

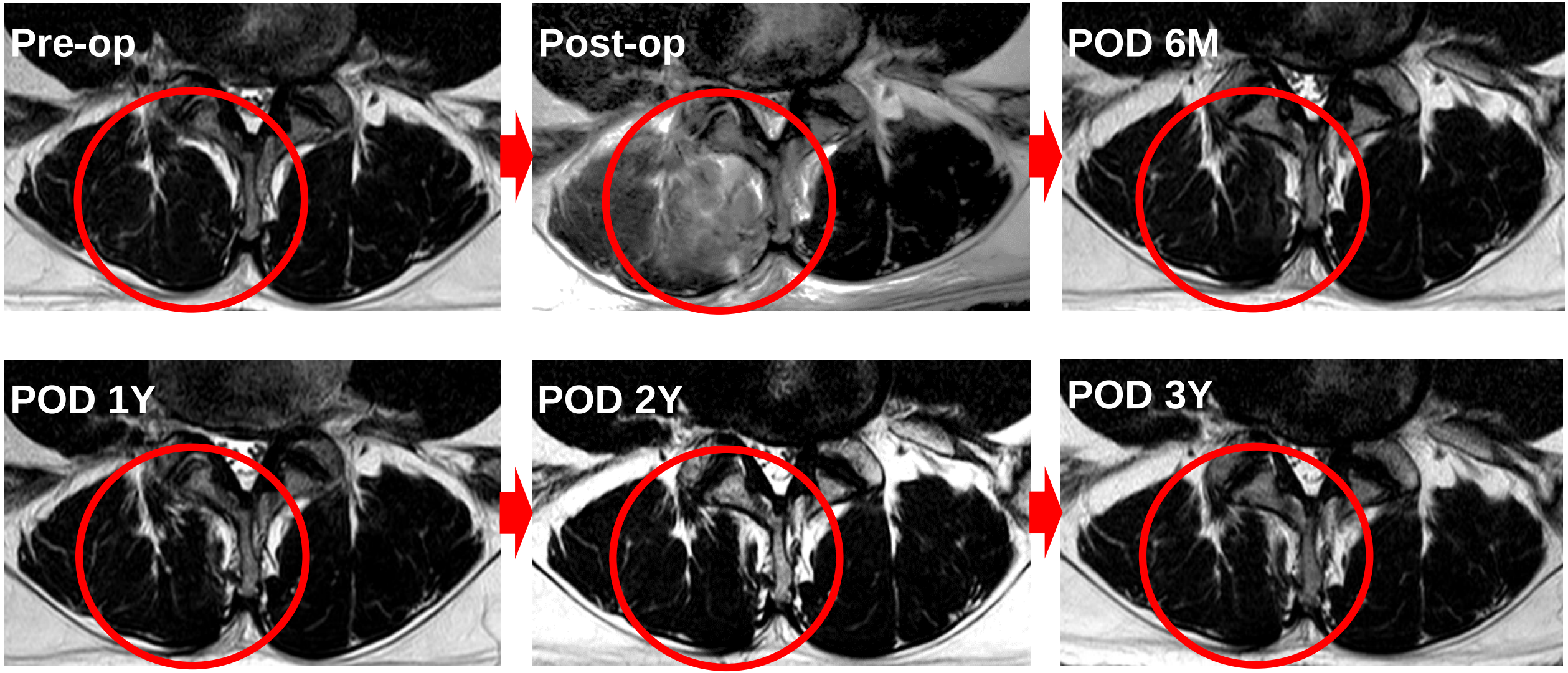


Results – *Patient demographics*

Characteristic	Value
Patients	60 (100)
Age (years)	60.2 ± 10.9
Gender	
Male	54 (90.0)
Female	6 (10.0)
Diagnosis	
Disc herniation (HIVD)	35 (58.3)
Spinal stenosis (SS)	25 (41.7)
Operative level	
L2-3	2 (3.3)
L3-4	5 (8.3)
L4-5	39 (65.0)
L5-S1	14 (23.3)

Characteristic	Value
Follow-up period (days)	524.1 ± 370.7
Follow-up period (years)	1.43 ± 1.01
VAS score	
Pre-op	7.2 ± 1.2
Final follow-up	2.4 ± 1.5
Macnab criteria	
Excellent	20
Good	26
Fair	13
Poor	1

Results – *MRI measurements by time points*

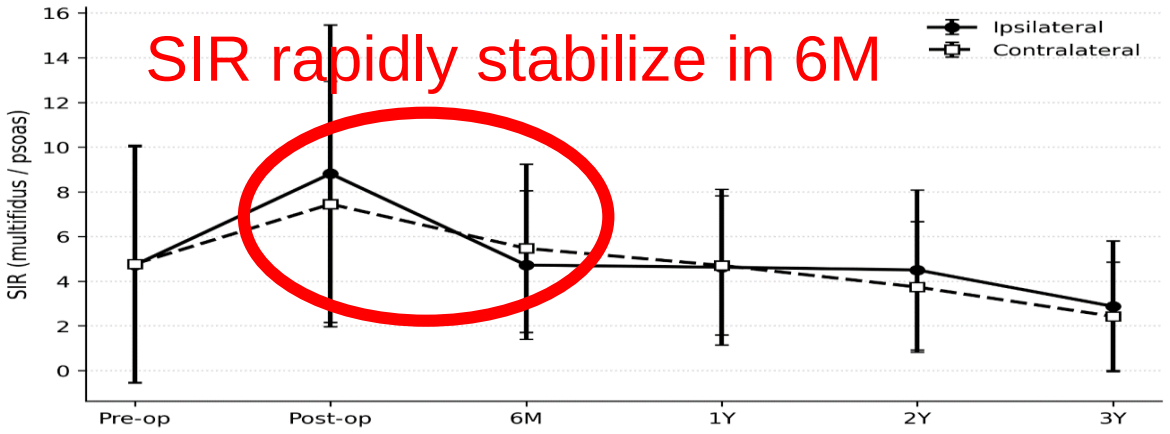


Results – *MRI measurements by time points*

- **SIR** (Signal intensity ratio)
  - Ipsilateral SIR increased early post-OP; stabilized beyond 1Y ($P > 0.01$)
- **CSA** (Cross-sectional area)
  - No significant long-term reduction; bilateral muscle volume stable
  - Decrease at 6M likely d/t post-op exercise restrictions until POD 3M
- **fCSA** (Functional cross-sectional area)
  - Ipsilateral fCSA decreased at ≥ 2Y ($P=0.0002$ at 2Y; $P=0.0014$ at 3Y)
  - Contralateral stable
- **Window Analysis**
  - CSA % change differed across windows ($P = 0.0095$)
  - Early vs. mid-term significant

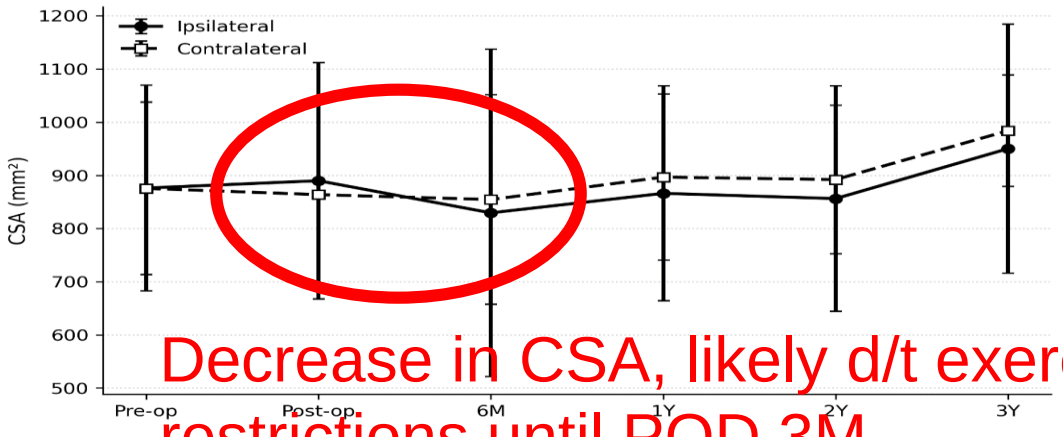
Results – *Serial change in SIR, CSA*

Figure 1. Serial change in T2-weighted signal intensity ratio (SIR)



n (ipsi/contra): Pre-op 60/60, Post-op 43/43, 6M 11/11, 1Y 44/44, 2Y 27/27, 3Y 9/9

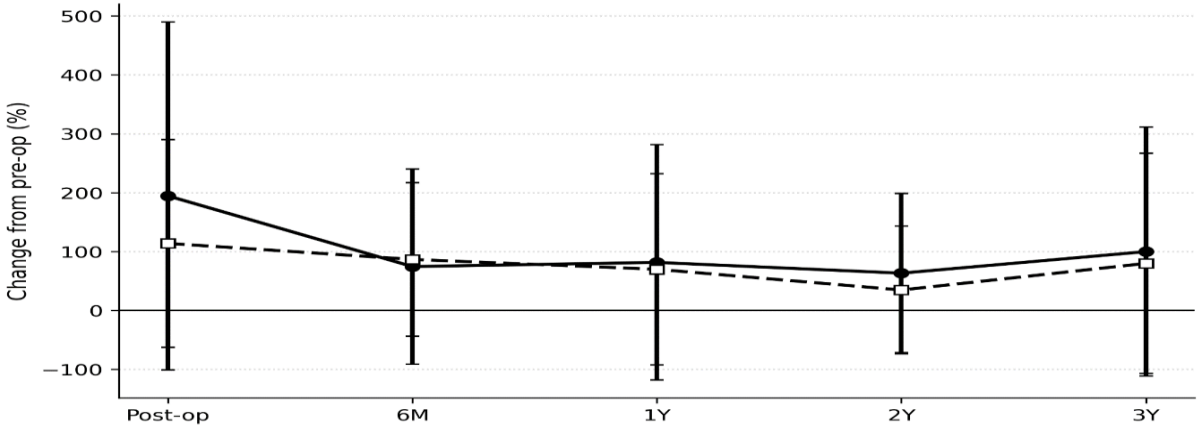
Figure 2. Serial change in multifidus cross-sectional area (CSA)



Decrease in CSA, likely d/t exercise restrictions until POD 3M

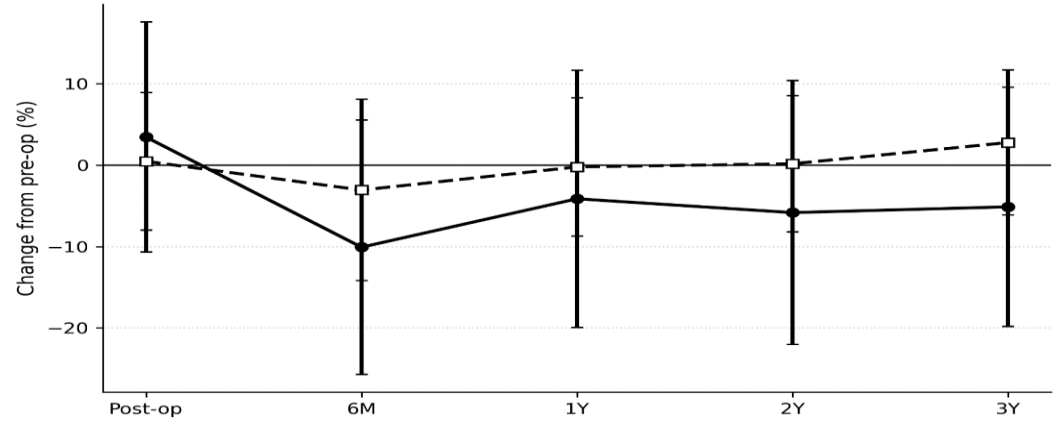
n (ipsi/contra): Pre-op 60/59, Post-op 43/43, 6M 11/11, 1Y 44/44, 2Y 27/27, 3Y 9/9

Percent change from pre-op



paired n (ipsi/contra): Post-op 43/43, 6M 11/11, 1Y 44/44, 2Y 27/27, 3Y 9/9

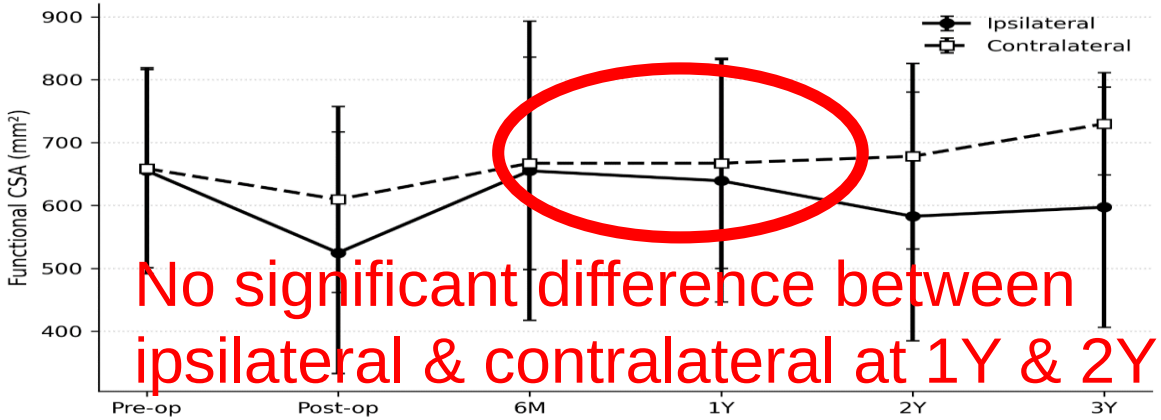
Percent change from pre-op



paired n (ipsi/contra): Post-op 43/43, 6M 11/11, 1Y 44/44, 2Y 27/27, 3Y 9/9
Note: one apparent data-entry outlier in the pre-op contralateral CSA/fatty-area fields (case No. 36) was excluded from CSA-related summaries.

Results – *Serial change in fCSA, FA*

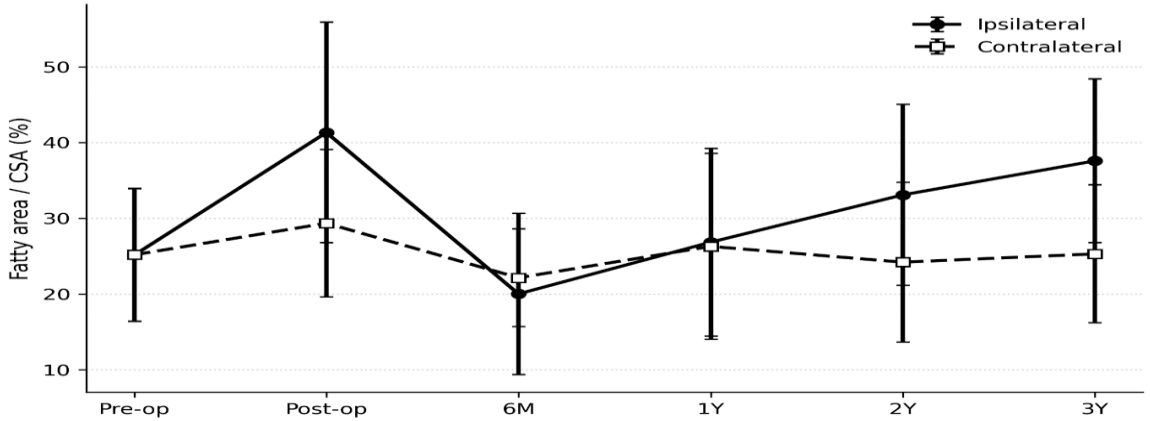
Figure 3. Serial change in functional cross-sectional area (fCSA)



No significant difference between ipsilateral & contralateral at 1Y & 2Y

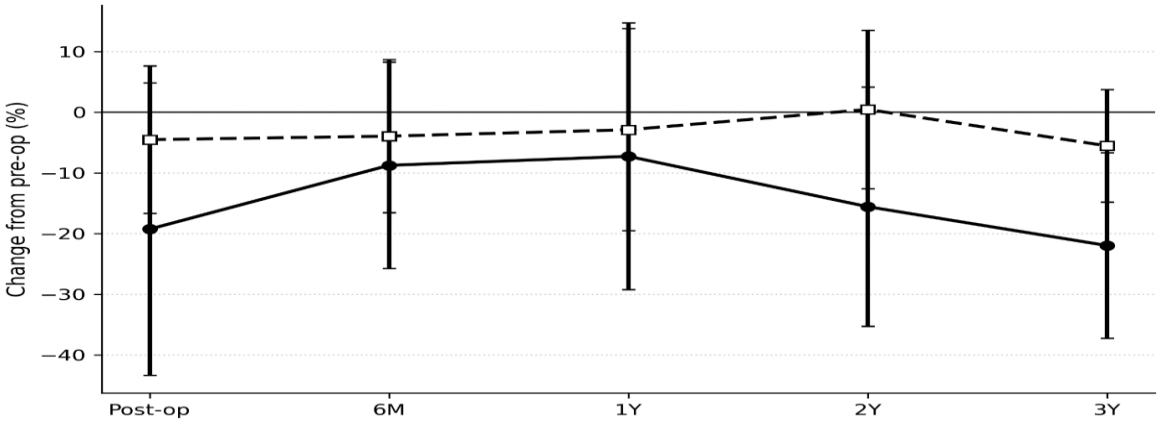
n (ipsi/contra): Pre-op 60/59, Post-op 43/43, 6M 11/11, 1Y 44/44, 2Y 27/27, 3Y 9/9

Figure 4. Serial change in fatty area proportion



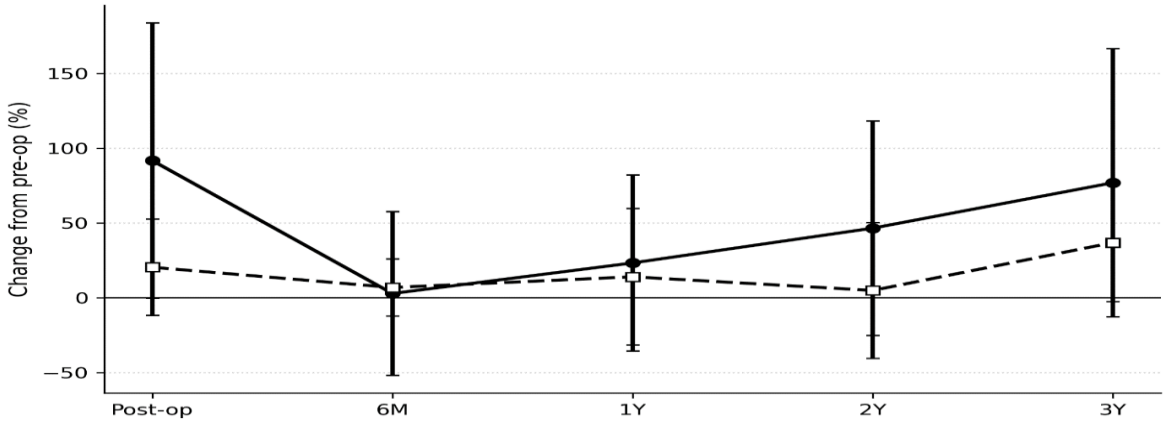
n (ipsi/contra): Pre-op 60/59, Post-op 43/43, 6M 11/11, 1Y 44/44, 2Y 27/27, 3Y 9/9

Percent change from pre-op



paired n (ipsi/contra): Post-op 43/43, 6M 11/11, 1Y 44/44, 2Y 27/27, 3Y 9/9
Note: the same pre-op contralateral outlier case was excluded from fCSA-related summaries for consistency.

Percent change from pre-op



paired n (ipsi/contra): Post-op 43/43, 6M 11/11, 1Y 44/44, 2Y 27/27, 3Y 9/9
Note: the same pre-op contralateral outlier case was excluded from fatty-area-ratio summaries for consistency.

Discussion

- Early SIR elevation => **Transient edema/inflammation**
- Stable CSA => **Preserved gross volume w/o atrophy**
- **NO significant fCSA difference btw. ipsi. & contralateral** at **1Y & 2Y**
- Late fCSA decline => **Qualitative change**
- Routine imaging **REDUCED** selection bias

Conclusions

1. Long-term MRI f/u shows **minimal irreversible multifidus injury** with preserved contralateral muscle quality

2. Early signal changes **largely stabilize** over time

3. Late ipsi. fCSA decline = **qualitative change, not gross atrophy**

4. CSA & fCSA changes confirmed **BESS** as a **muscle-preserving technique**

Thank you

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