Muscle Recovery Following Time Spent in an Intensive Care Unit (ICU)

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ICU Muscle Wasting

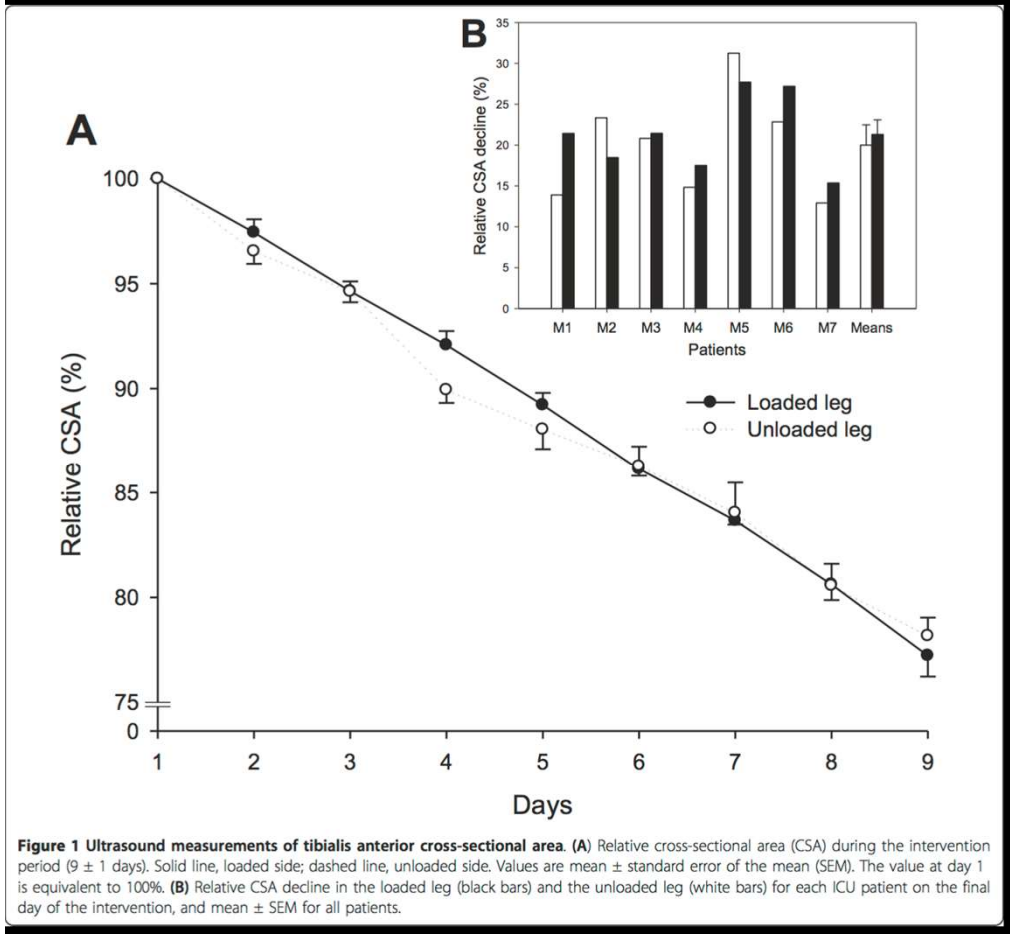
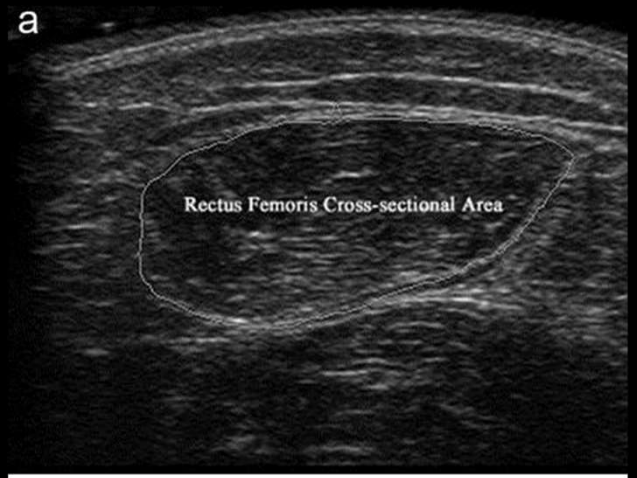
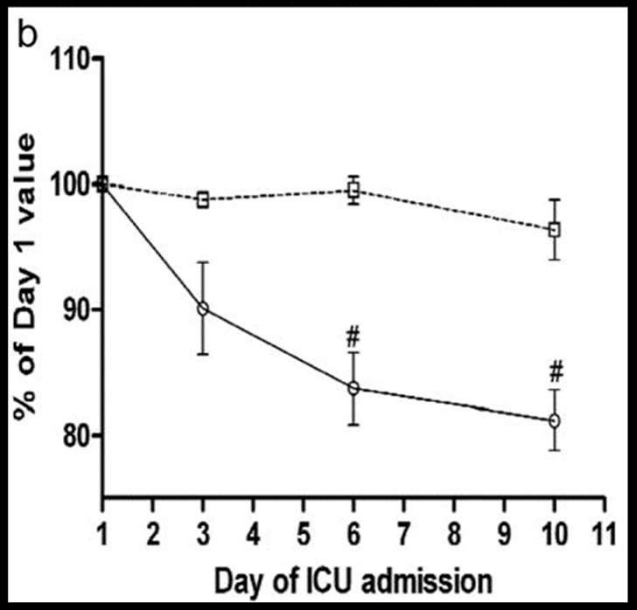


Figure 1 Ultrasound measurements of tibialis anterior cross-sectional area. **(A)** Relative cross-sectional area (CSA) during the intervention period (9 ± 1 days). Solid line, loaded side; dashed line, unloaded side. Values are mean ± standard error of the mean (SEM). The value at day 1 is equivalent to 100%. **(B)** Relative CSA decline in the loaded leg (black bars) and the unloaded leg (white bars) for each ICU patient on the final day of the intervention, and mean ± SEM for all patients.

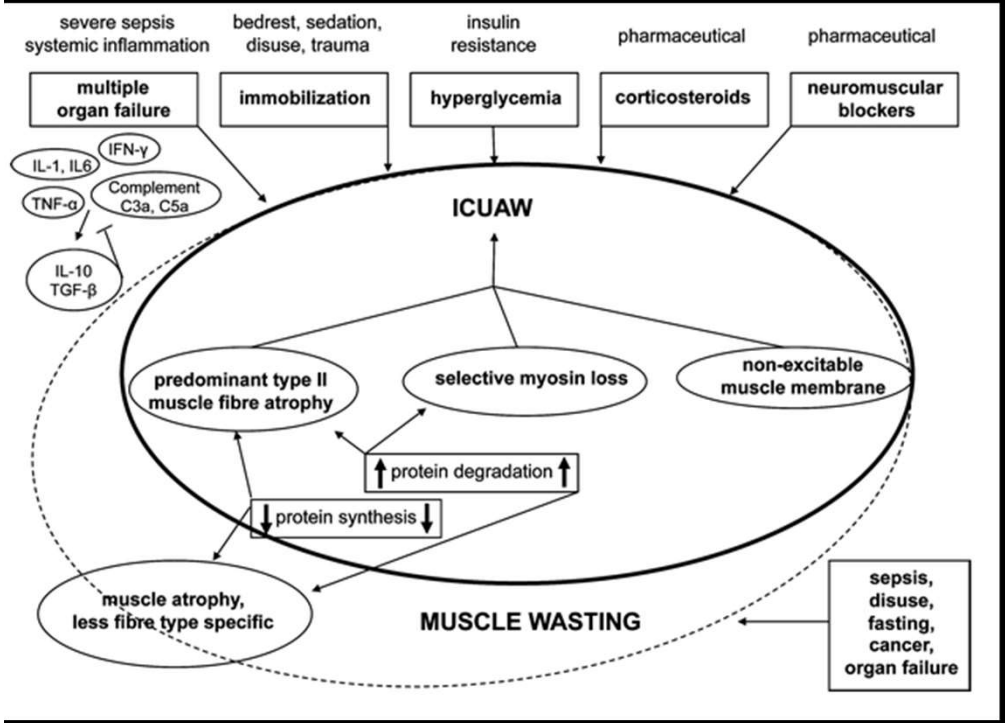
Llano-Diez et al., Critical Care, 2012

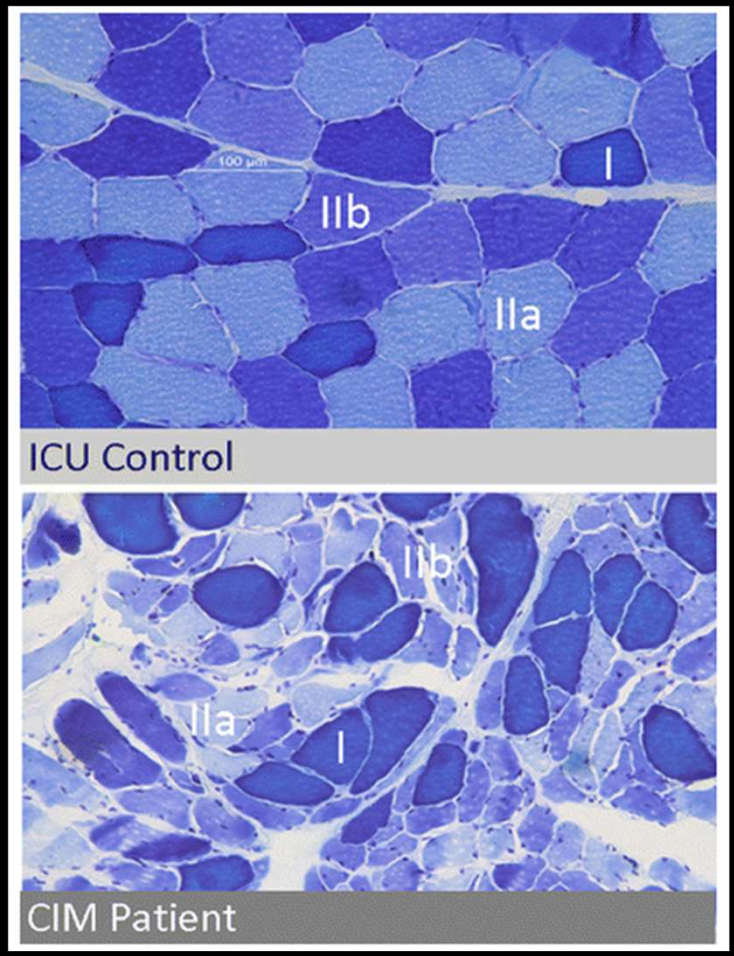




Puthucheary et al., Critical Care, 2010

ICU Muscle Weakness





Schefold et al., JCSM, 2010

Study Aim

Investigate changes in the

size and the mechanical properties

of muscle as a result of time in ICU and following convalescence

Methods

Patients were recruited following ICU discharge:

- 9 Patients (45.60[±15.31] years)
- 4 Returned patients (4.5[±1] months)
- 8 Age matched controls (43.82[±12.05] years)
  - **Recruitment is ongoing**

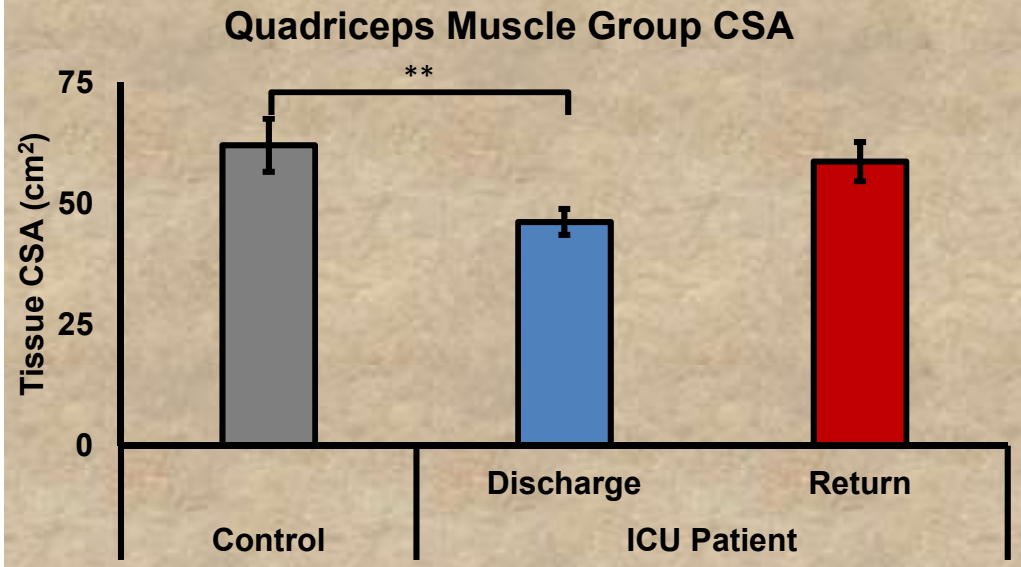
Multi-frequency MRE was employed (25, 32.5, 50, 62.5Hz)[1]

- Loudspeaker thigh cuff actuator

Group comparisons of muscle CSA and |G*| through ROI analysis

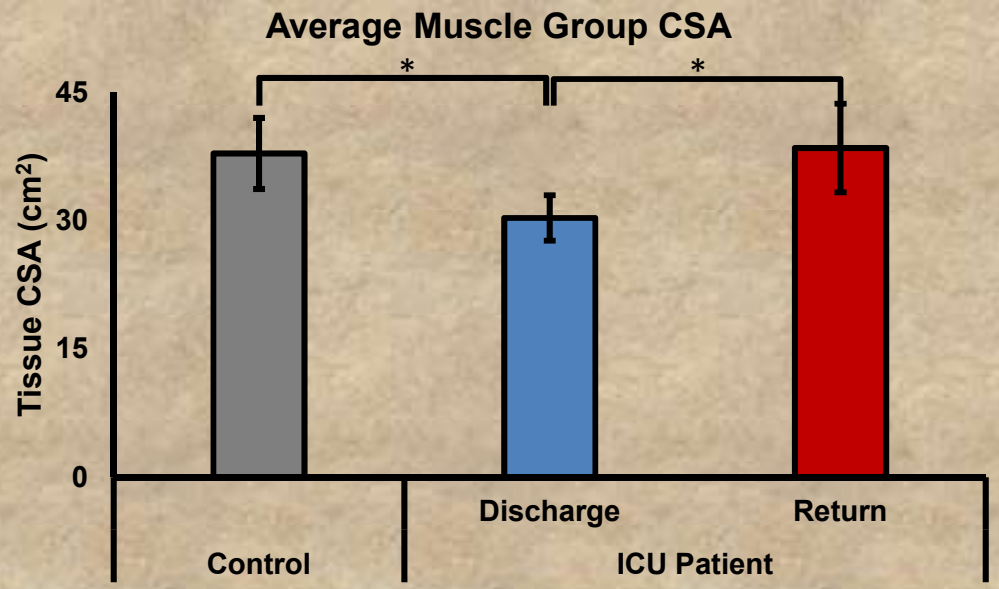
1.Papazoglou et al., MRM, 2006;

Muscle Size



ICU Discharge compared to control

- Av. Muscle Group CSA -20% (**p**=.015)
- Quadriceps CSA -26% (**p**=.028)
- Vastus Intermedius CSA -30% (**p**=.05)

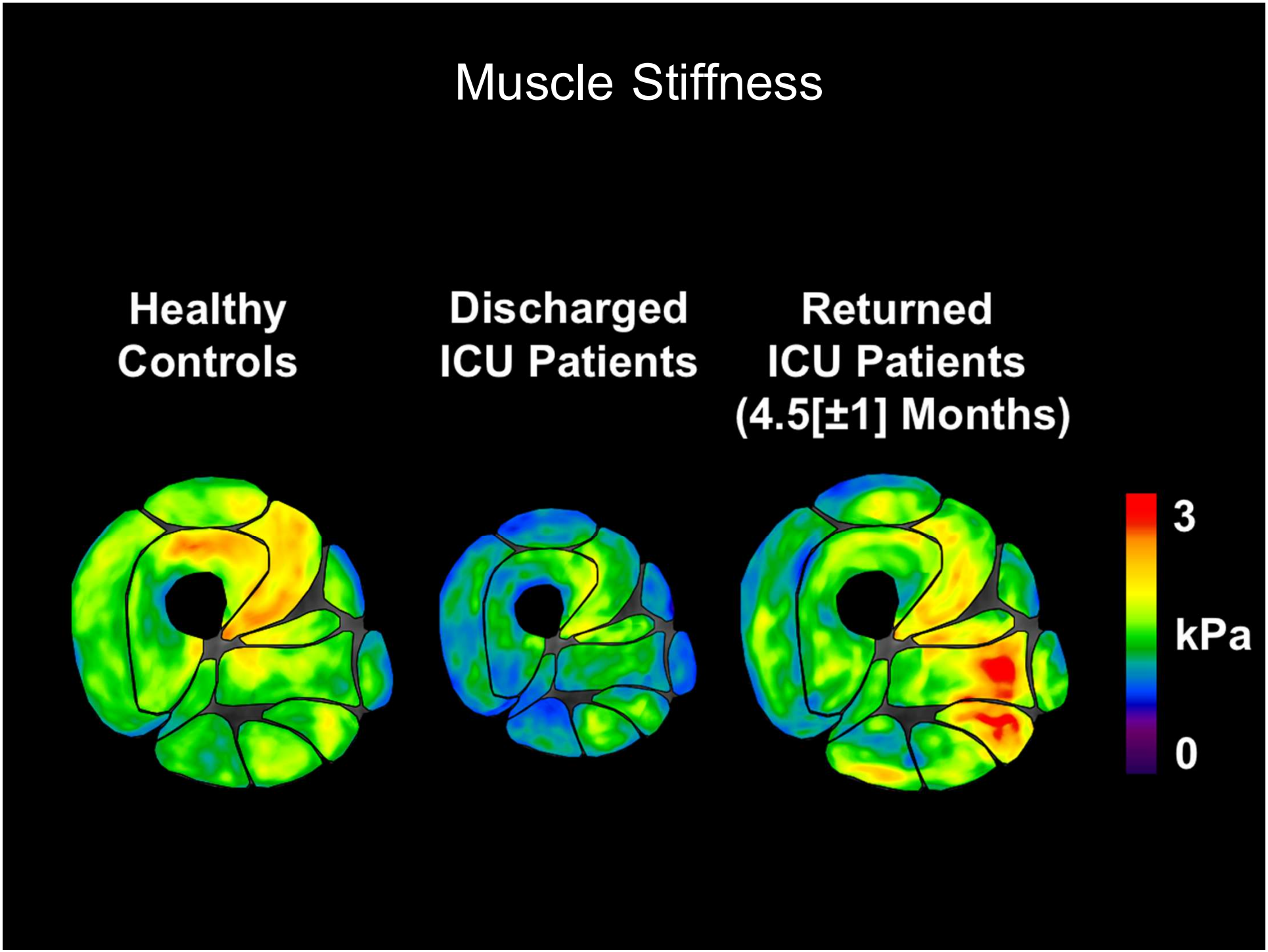


ICU Return compared Discharge

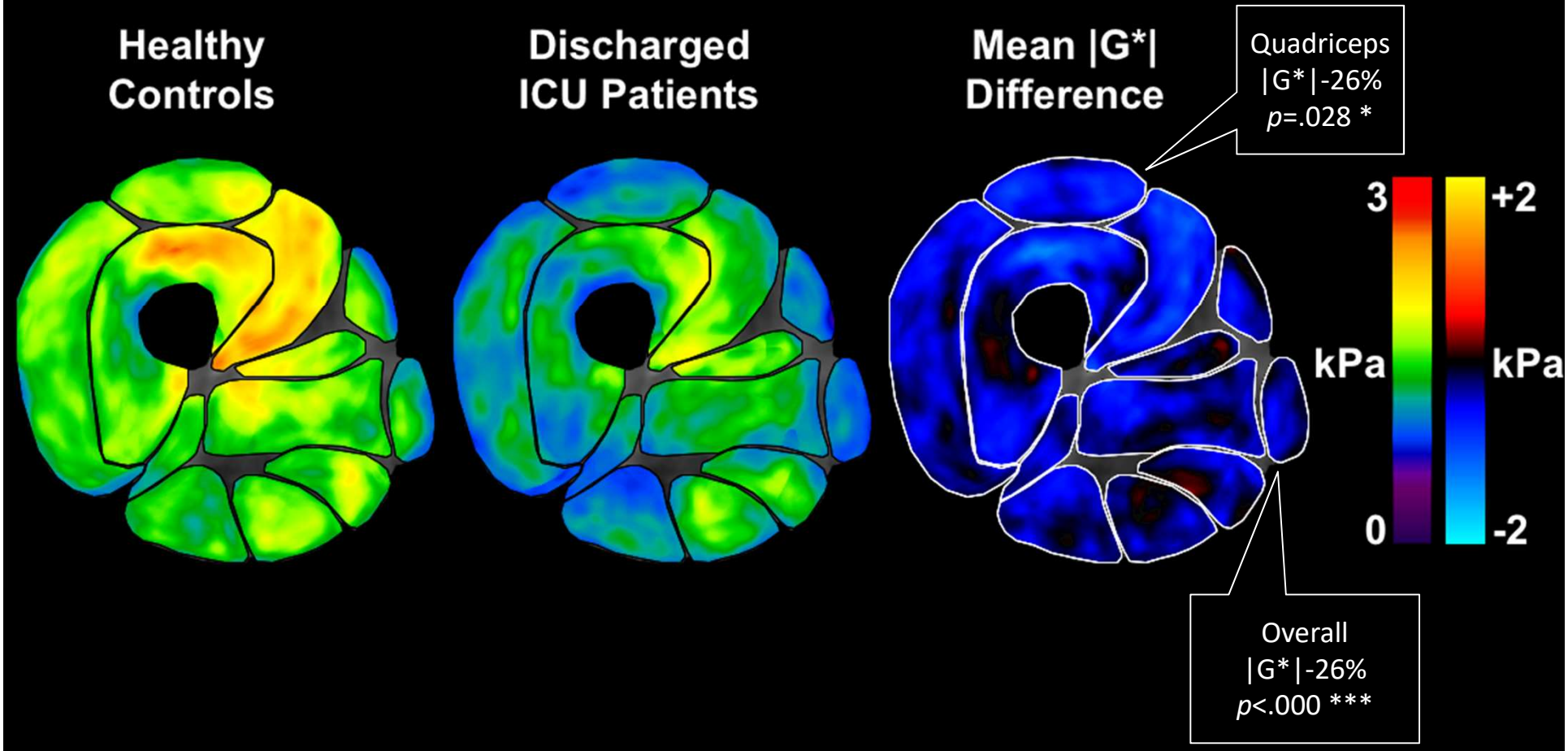
- Av. Muscle Group CSA +27% (**p**=.037)

Controls showed significant correlation between CSA and |G*| (R^2=.24; **p**=.017), not seen in ICU Patients.

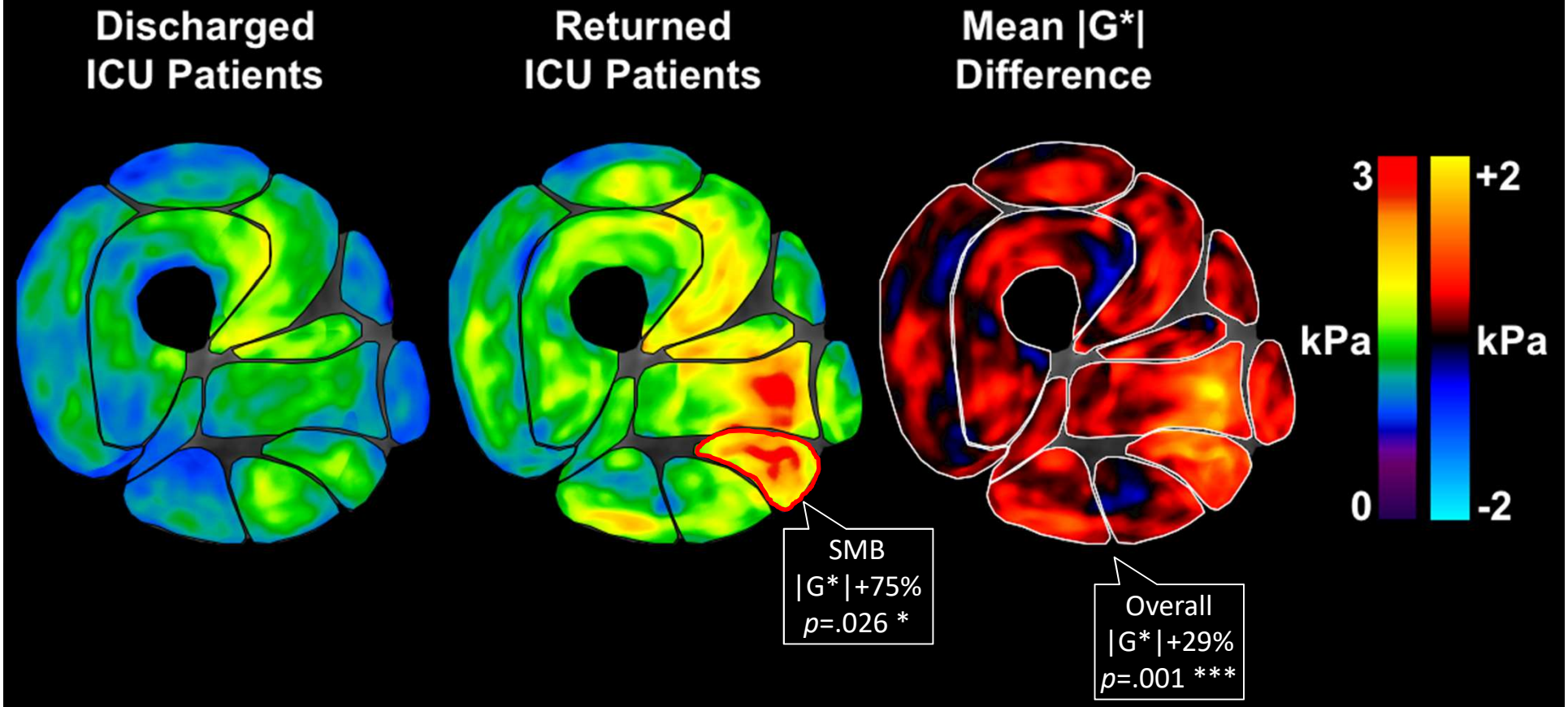
Muscle Stiffness



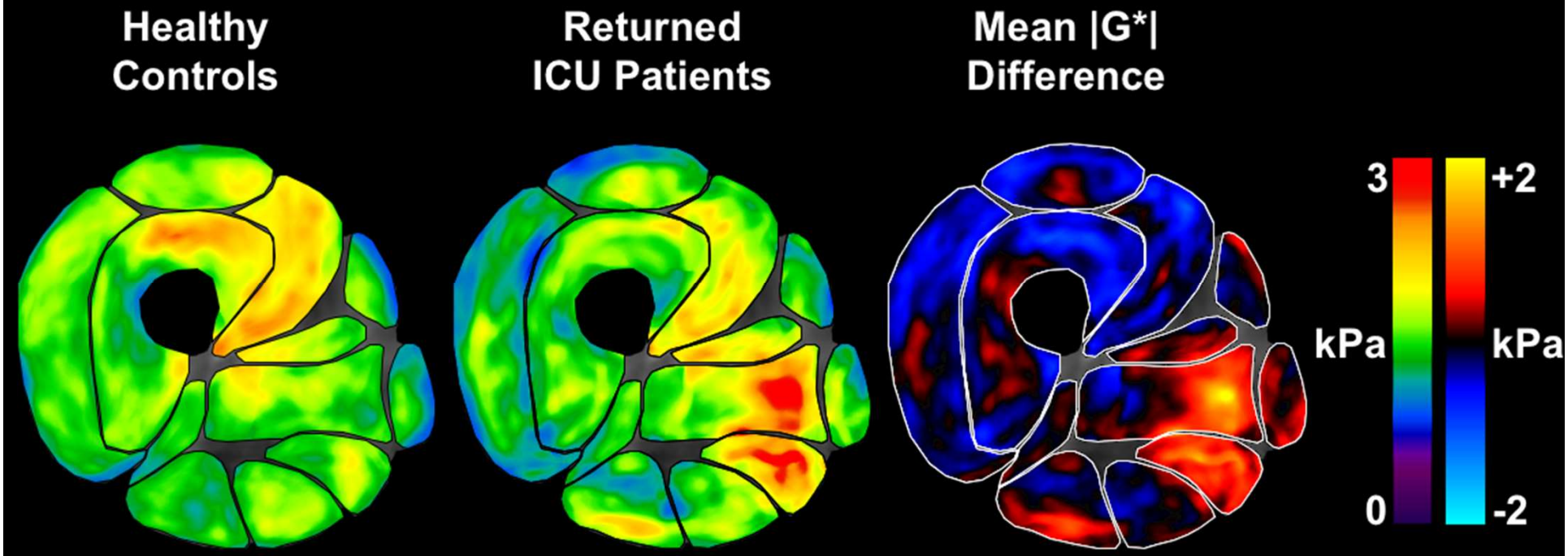
Control and Discharged Patients



ICU Patients at Discharge and after Convalescence



Control and ICU Patients after Convalescence



Results Summary

Average muscle CSA and |G*| at ICU patient discharge was significantly lower than healthy controls, with an increase following convalescence (4.5[±1] Months)

Muscle |G*| and CSA correlation:

- Healthy controls (R^2=.24; **p**=.017)
- Discharged patients (R^2=.017; **p**=.872)
- Returning patients (R^2=-.015; **p**=.930)

Discussion

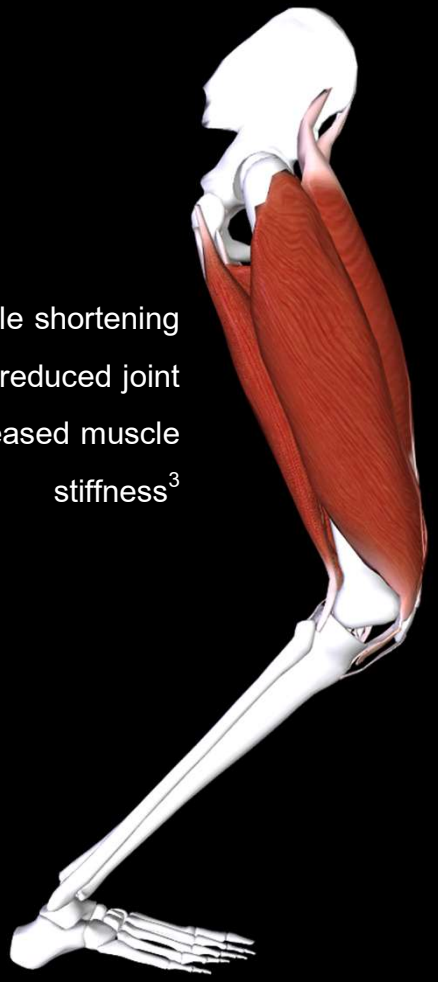
Increased Semimembranosus |G*| is a new finding for critical care research, and shows the importance of whole thigh physiotherapy

Increased Hamstring Stiffness

Ability to fully extend knee and stretch Hamstrings

Healthy Individual

Muscle shortening following immobility[1], reduced joint range[2] and Increased muscle stiffness[3]



Recovering ICU Patient

1.Herridge et al., N Engl J Med, 2003; 2. Young et al., CORR., 1987; 3.Sinkjaer J. Neurophysiol., 1988

Conclusion

Using MRE we have shown that both muscle CSA and |G*| significantly decrease whilst in ICU, however following a period of 4.5 months, do show signs of recovery

These results also suggest greater focus should be placed on Hamstring stretches to reduce the amount of muscle strain

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