Diagnostic Value of Ultrasound in Calf Muscle Strain Injuries

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Background

While MRI is the gold standard for diagnosing calf muscle strain injuries, its routine use is impractical due to cost and accessibility.

Ultrasound, being simple and minimally invasive, has gained attention as an alternative diagnostic tool.

This study aims to evaluate the diagnostic accuracy of ultrasound in detecting calf muscle strain injuries.

Methods

We conducted a retrospective review of medical records from June 2019 to March 2024.

We included patients who were suspected of having a gastrocnemius or soleus muscle strain injury based on physical examination and subsequently underwent ultrasound followed by MRI.

MRI findings were used as the reference standard to determine the sensitivity and specificity of ultrasound.

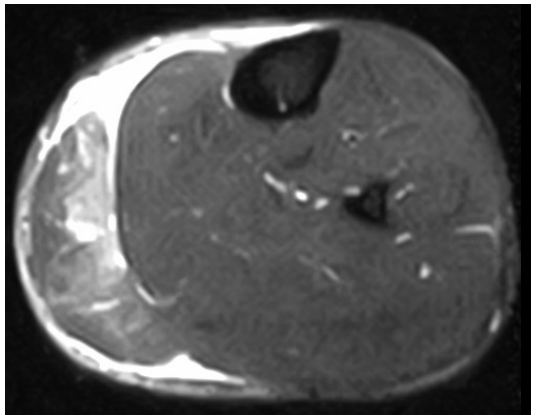
Methods

Within five days

Injury

Ultrasound

MRI



Reference standard

To determine the sensitivity and specificity of ultrasound

Results

140 legs (128 males, 12 females; average age 22 years old) were included.

MRI confirmed calf muscle injuries in 101 legs (gastrocnemius 31, soleus 70).

Total		MRI(reference)	
		Positive	Negative
Ultrasound	Positive	60	9
	Negative	41	30

Sensitivity 59% Specificity 77%

Results

Gastrocnemius		MRI(reference)	
		Positive	Negative
Ultrasound	Positive	22	3
	Negative	9	8

Sensitivity 71%

Specificity 72%

Soleus		MRI(reference)	
		Positive	Negative
Ultrasound	Positive	38	6
	Negative	32	22

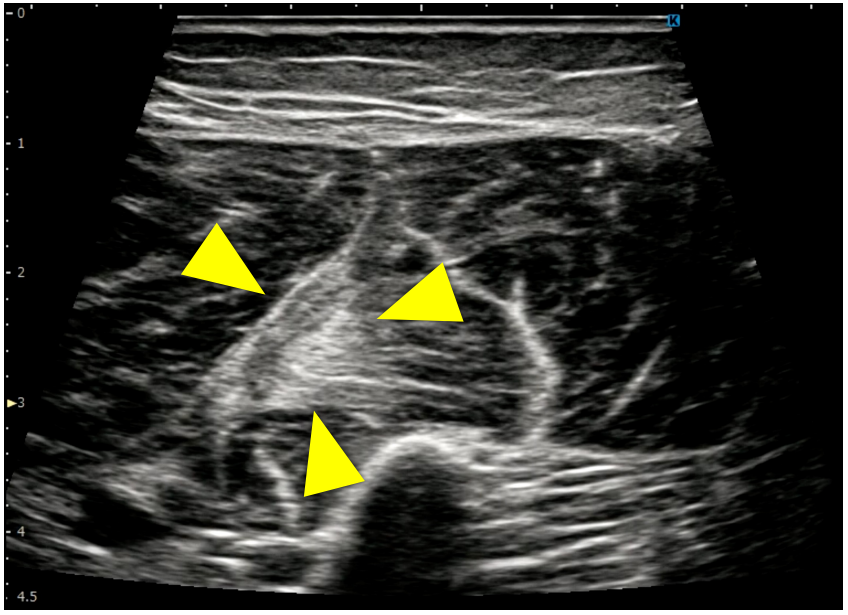
Sensitivity 54%

Specificity 79%

Case

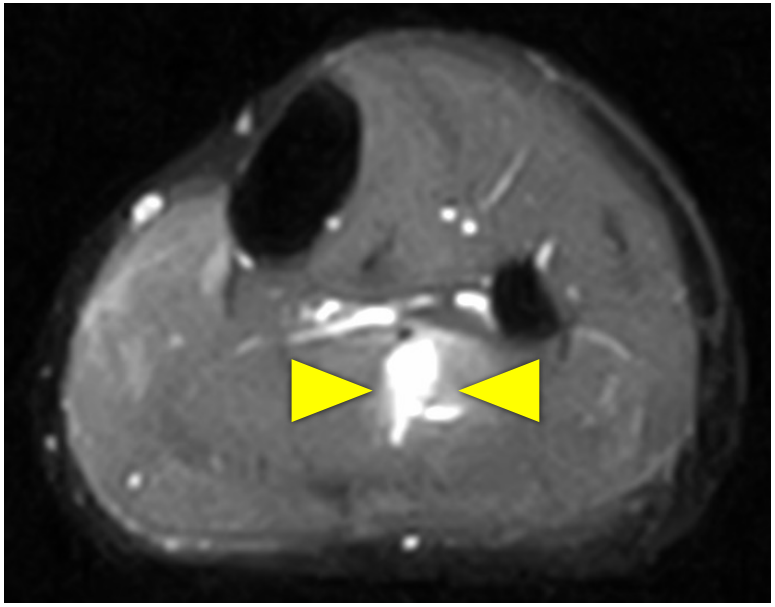
Soleus(central tendon) strain injury

Ultrasound



Positive

MRI

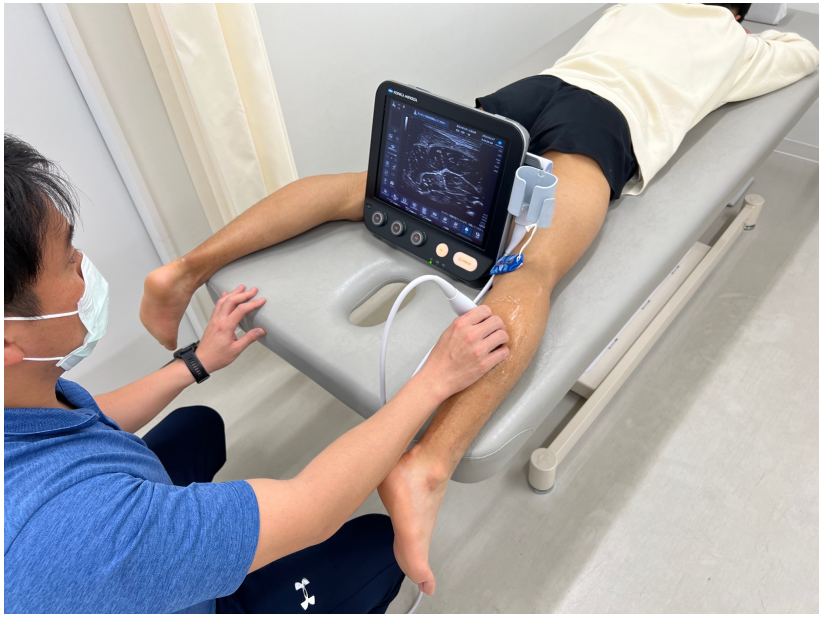


Positive

Limitations of Ultrasound and Practical Solutions: 1

Operator Dependency

Ultrasound is highly operator-dependent.

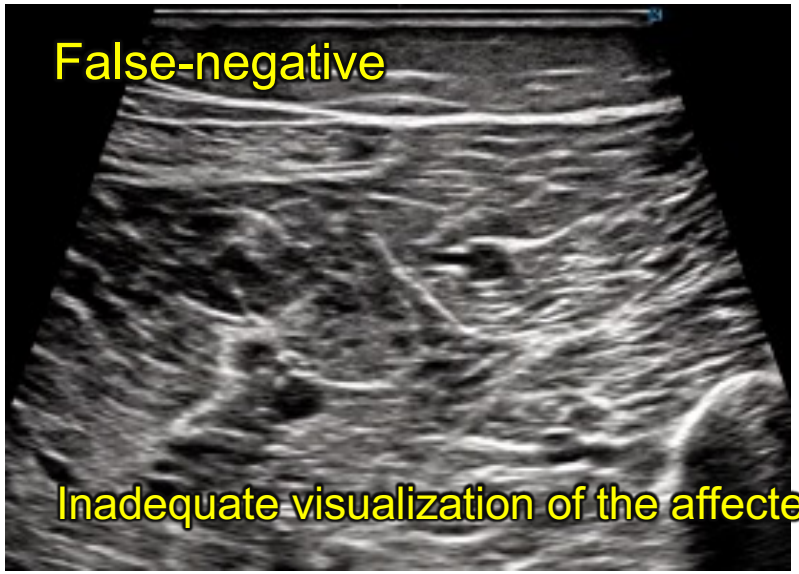


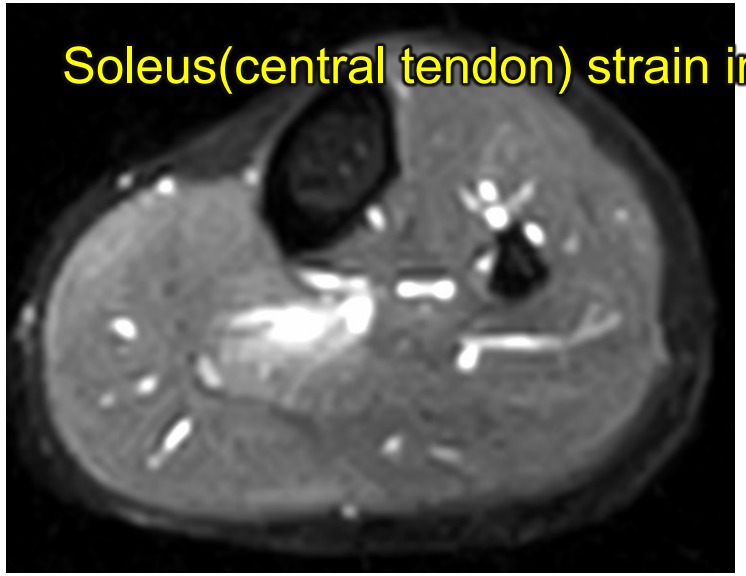
Establish structured training programs for clinicians.

Limitations of Ultrasound and Practical Solutions: 2

Mismatch Between Pain and Injury Site

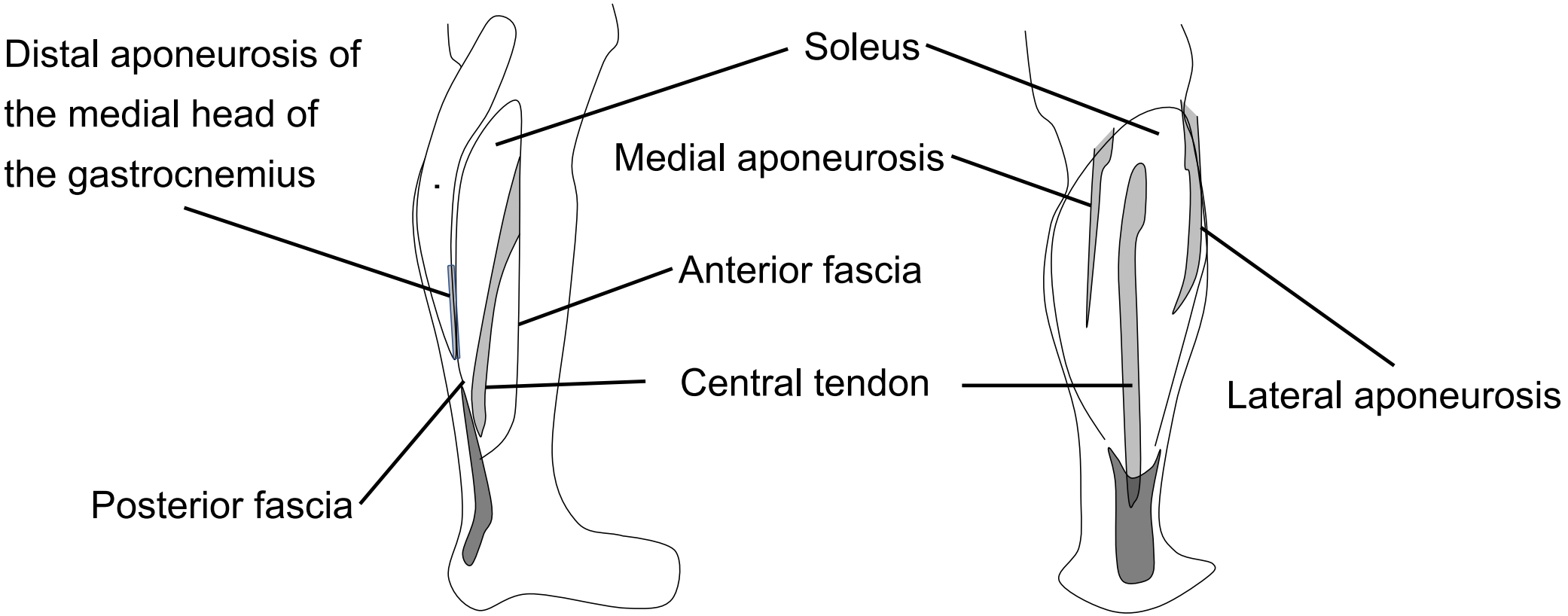
The site of patient-reported pain may differ from the actual injury location.





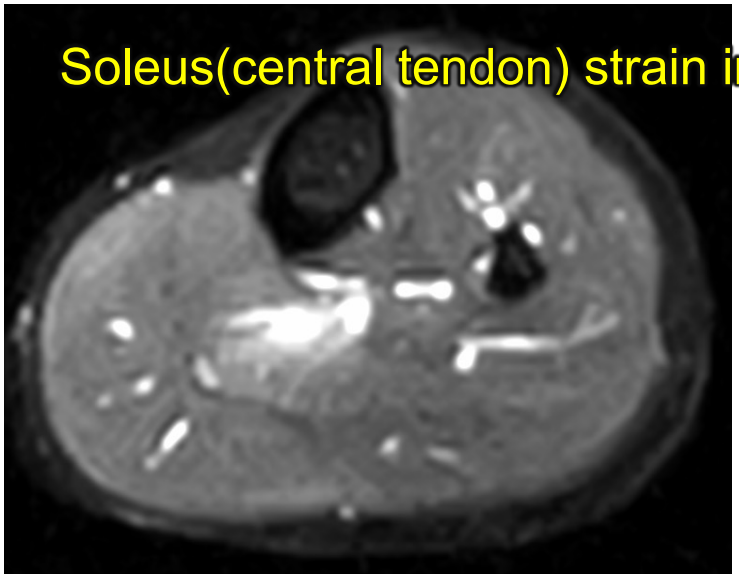
Limitations of Ultrasound and Practical Solutions: 2

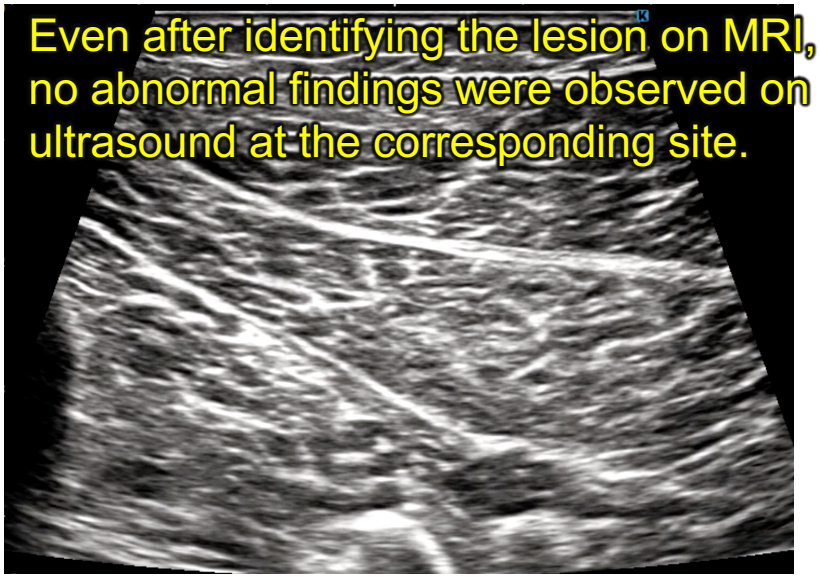
Routinely scan common sites of calf muscle strains to avoid missed diagnoses.



Limitations of Ultrasound and Practical Solutions: 3

Ultrasound shows a low negative predictive value (41%) for soleus injuries.





Be aware of the anatomical limitations of ultrasound

— recognize both its strengths and blind spots.

Conclusion

Ultrasound showed moderate diagnostic accuracy for calf muscle strain injury, with an overall sensitivity of 59% and specificity of 77%.

Sensitivity was relatively higher for gastrocnemius muscle strain injury (71%) compared to soleus muscle strain injury(54%).

Notably, the negative predictive value for soleus muscle injury was as low as 41%, indicating that false-negative results are not uncommon.

These findings suggest that particular caution is needed when ruling out soleus muscle strain injury based on ultrasound findings alone.