

Application of Muscle Ultrasound to Evaluate Morphological Changes of Lower Limb Muscles in Type 2 Diabetes Mellitus with Diabetic Peripheral Neuropathy: A Preliminary Study

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Presented by

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INTRODUCTION



- Type II Diabetes Mellitus (DM) one of the major health challenge of 21st century.(Parasoglou P et al.,2017)
- A significant consequence of Diabetic Peripheral Neuropathy (DPN) on the skeletal muscle is the accelerated loss of muscle mass, compared to DM alone. (Parasoglou P et al.,2017)
- Therefore, an accurate estimate of the muscle mass is important for the diabetic patients. (Takai Y et al., 2013)

Application of muscle ultrasound to evaluate morphological changes of lower limb muscles in Type 2 Diabetes Mellitus with Diabetic Peripheral Neuropathy

OBJECTIVE



To evaluate the morphological changes of lower limb muscles in Type 2 Diabetes Mellitus with peripheral neuropathy using muscle ultrasonography

METHODOLOGY



Approval was obtained from Institutional Research Committee MCHP and Institutional Ethics Committee KMC Manipal (IEC-496/2021)



A total of 20 participants who were clinically diagnosed with type 2 diabetes were recruited



An assessment of diabetic peripheral neuropathy by a physiotherapist was conducted



An ultrasound scan of the lower limb muscles was performed

METHODOLOGY



Anterior Quadriceps Muscle

Subcutaneous Fat

Rectus Femoris

Vastus Intermedius

Thigh Muscle Thickness

Ankle Dorsiflexor

Tibialis Anterior

Extensor Hallucis Longus

Extensor Digitorum Longus

Foot Muscle:

Extensor digitorum brevis

Abductor hallucis brevis

RESULT



Table 1:- Demographic Characteristics of the subjects

Characteristics	Mean±SD
Age	65.25±9.94
Height	161.98±12.58
Weight	66.81±12.10
BMI	24.63±4.41
Duration Of Diabetes	19.0±11.76
Hba1c (%)	8.12±1.47
VPT_R	26.36±17.69
VPT_L	27.46±16.88
Mono-filament_R	3.50±1.90
Mono-filament_L	4.15±2.00

* VPT-Vibration Perception Test, HbA1C- Glycated Hemoglobin

RESULT



Table 2:- Association Between Duration Of Diabetes Mellitus and Anterior Quadriceps Muscles Thickness

Anterior Quadriceps Muscles

Duration of Diabetes (Years)	Subcutaneous fat Thickness (Cm)		Rectus Femoris Thickness (Cm)		Vastus Intermedius Thickness (Cm)		Thigh Muscle Thickness (Cm)	
	Right	Left	Right	Left	Right	Left	Right	Left
1_5	1.04 \pm 0.95	1.06 \pm 0.15	1.32 \pm 0.40	1.44 \pm 0.08	1.34 \pm 0.01	1.37 \pm 0.21	2.73 \pm 0.48	2.84 \pm 0.37
6_10	1.17 \pm 1.01	0.81 \pm 0.62	1.32 \pm 0.28	1.17 \pm 0.27	1.36 \pm 0.39	1.44 \pm 0.20	2.72 \pm 0.66	2.71 \pm 0.47
11_15	0.82 \pm 0.37	0.81 \pm 0.37	1.06 \pm 0.32	1.05 \pm 0.39	0.98 \pm 0.26	1.06 \pm 0.22	2.09 \pm 0.61	2.14 \pm 0.50
16 & Above	0.62 \pm 0.17	0.56 \pm 0.17	1.09 \pm 0.33	1.12 \pm 0.21	1.24 \pm 0.39	1.36 \pm 0.37	2.40 \pm 0.64	2.69 \pm 0.67

RESULT



Table 3:- Association Between Duration Of Diabetes Mellitus And Ankle Dorsiflexor Muscle Thickness

Ankle Dorsiflexor Muscles								
Duration of Diabetes (Years)	Extensor Digitorum Longus-thickness (Cm)		Extensor Hallucis Longus-thickness (Cm)		Tibialis Anterior thickness (Cm)		Tibialis Anterior-cross Section Area (Cm)	
	Right	Left	Right	Left	Right	Left	Right	Left
1_5	2.03 ±0.28	2.02 ±0.35	0.61 ±0.26	0.56 ±0.17	2.39 ±0.26	2.66 ±0.19	5.47 ±0.89	7.28 ±1.55
6_10	1.72 ±0.44	1.69 ±0.34	1.01 ±0.49	0.57 ±0.21	2.36 ±0.38	2.50 ± 0.30	5.99 ±1.44	5.99 ±1.11
11_15	1.40 ±0.42	1.59 ±0.69	0.63 ± 0.18	0.60 ±0.17	2.32 ±0.34	2.29 ±0.33	5.65 ±1.35	5.51 ±1.03
16 & Above	1.55 ±0.56	1.55 ± 0.24	0.88 ±0.47	0.93 ±0.47	2.46 ±0.34	2.45 ±0.35	5.55 ±1.69	6.09 ±1.66

RESULT



Table 4:- Association Between Duration Of Diabetes Mellitus And Foot Muscle Thickness

Foot Muscles				
Duration of Diabetes (Years)	Extensor Digitorum Brevis-thickness (Cm)		Abductor Hallucis Brevis-thickness (Cm)	
	Right	Left	Right	Left
1_5	0.59 ±0.33	0.62 ±0.20	0.90 ±0.08	1.01 ±0.03
6_10	0.60 ±0.97	0.64 ±0.07	1.08 ±0.30	1.15 ±0.37
11_15	0.53 ±0.17	0.62 ±0.19	0.83 ±0.18	0.77 ±0.23
16 & Above	0.64 ±0.14	0.61 ± 0.16	0.94 ±0.25	1.05 ±0.28

CONCLUSION



- According to the study results we have noted a clinically significant *reduction* in the *thickness of the lower limb muscles* with an *increase in the duration of Type 2 Diabetes Mellitus with DPN*.
- In order to prevent long-term complications associated with Type 2 Diabetes Mellitus, *ultrasound can be considered as a reliable screening tool to monitor the morphology of the muscles*.

CLINICAL SIGNIFICANCE



- With *ultrasound screenings*, *early changes* in muscle morphology can be identified and recognized, reducing the risk of negative outcomes such as impaired balance, altered gait, and decreased functional capacity.
- Muscle characteristics can be *quantitatively* assessed using ultrasound.
- Ultrasound is a relatively *cost-effective* and *safe diagnostic tool* that consumes *less time* than other technologies

RESEARCH OUTPUT



- Manuscript titled “Assessment of Lower Limb Muscle Morphology with Ultrasound in Diabetic Peripheral Neuropathy” has been submitted to journal of Clinical Epidemiology and Global Health(CEGH-S-23-00430) (Q2)

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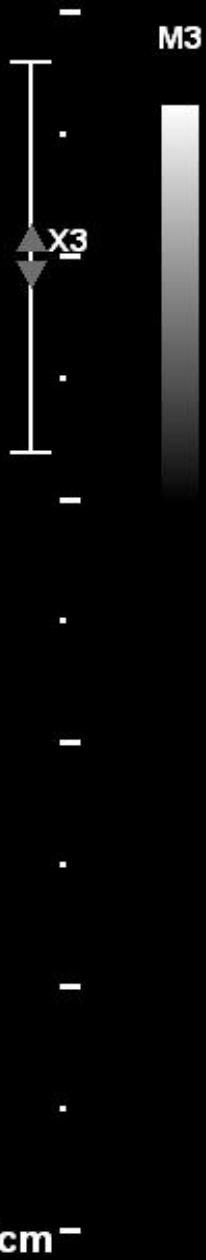
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eL18-4
42Hz
RS

2D
44%
Dyn R 68
P Med
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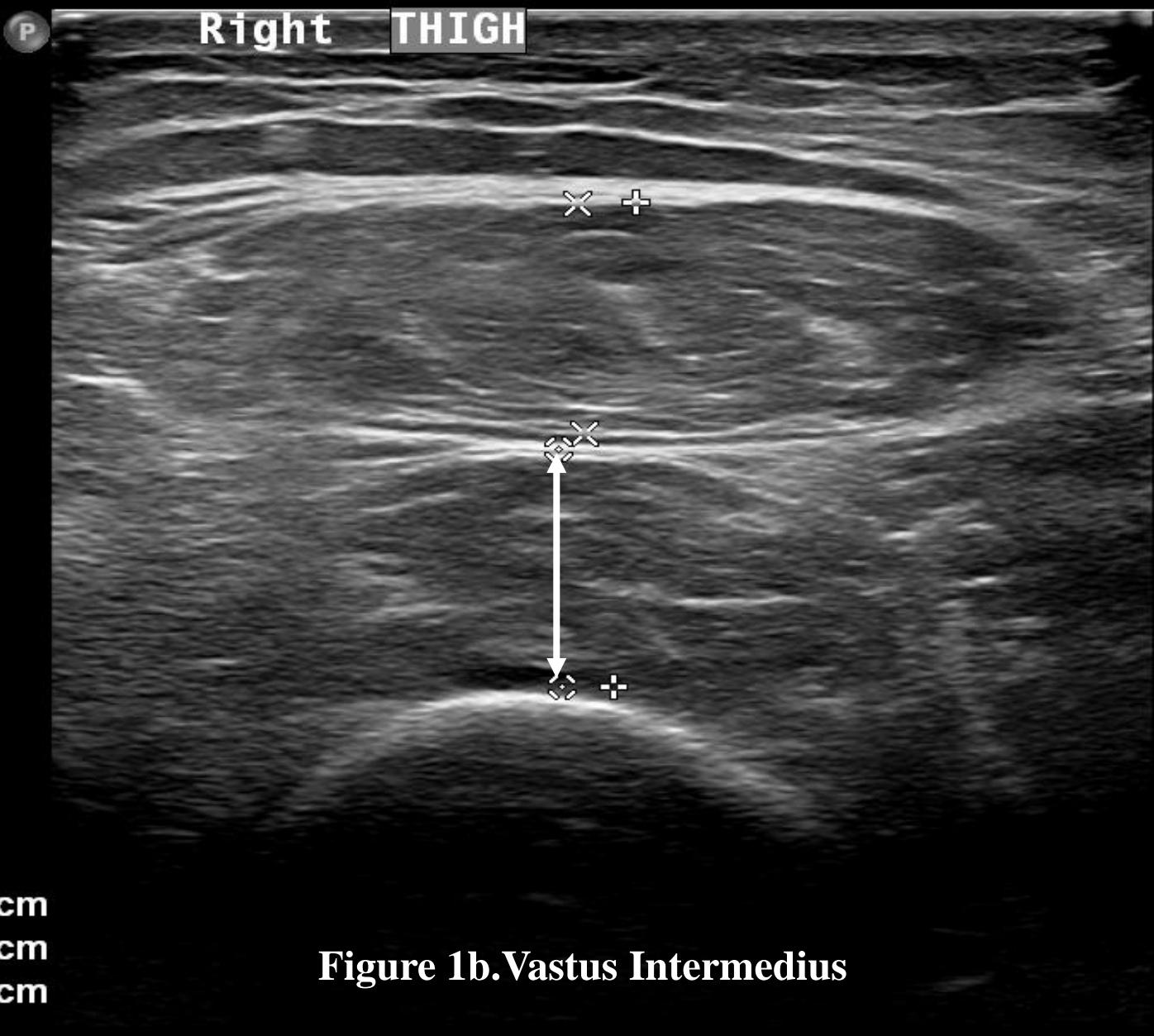
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Figure 1a.Rectus Femoris

MSK Superfic
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2D
44%
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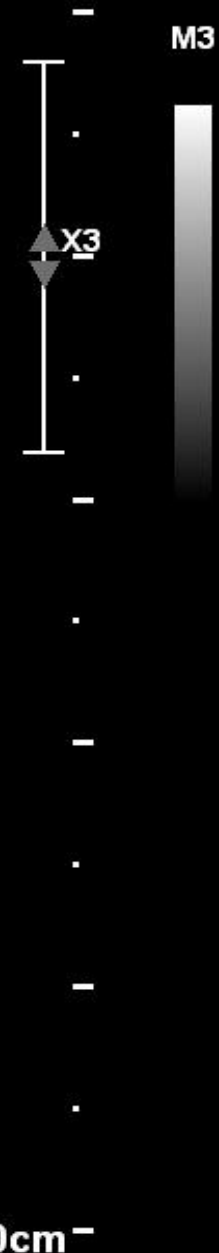
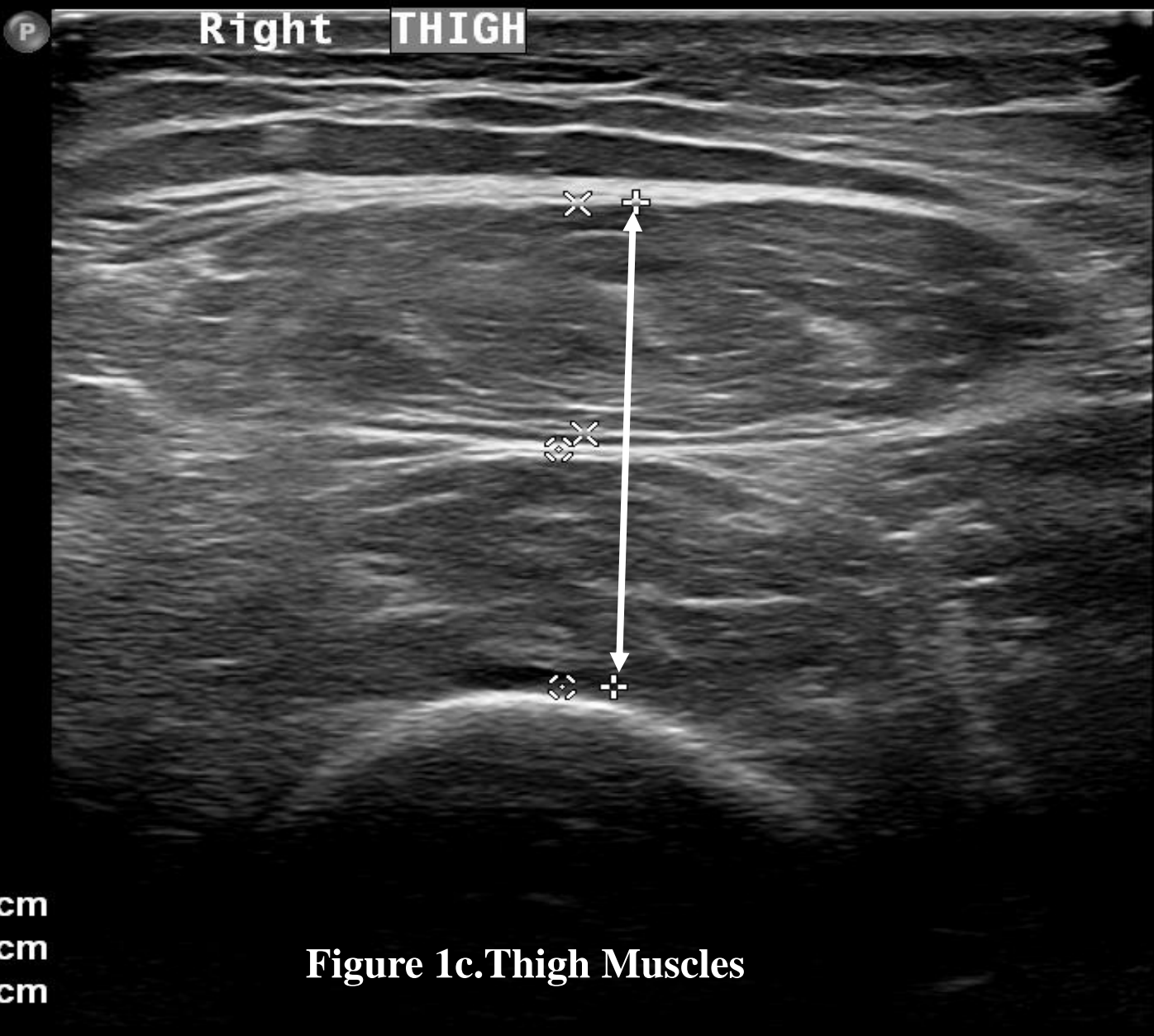
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Figure 1b.Vastus Intermedius

MSK Superfic
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44%
Dyn R 68
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Figure 1c. Thigh Muscles

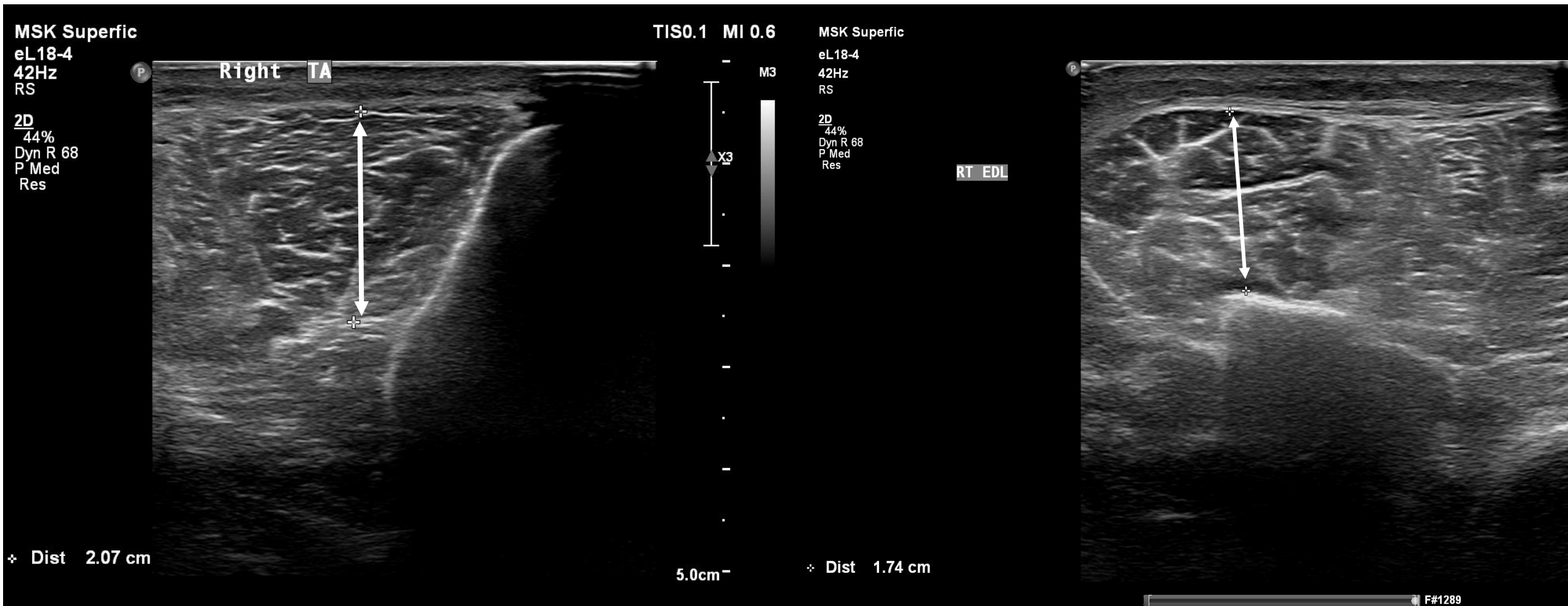


Figure 2a. Tibialis anterior

2b. Extensor Digitorum Longus

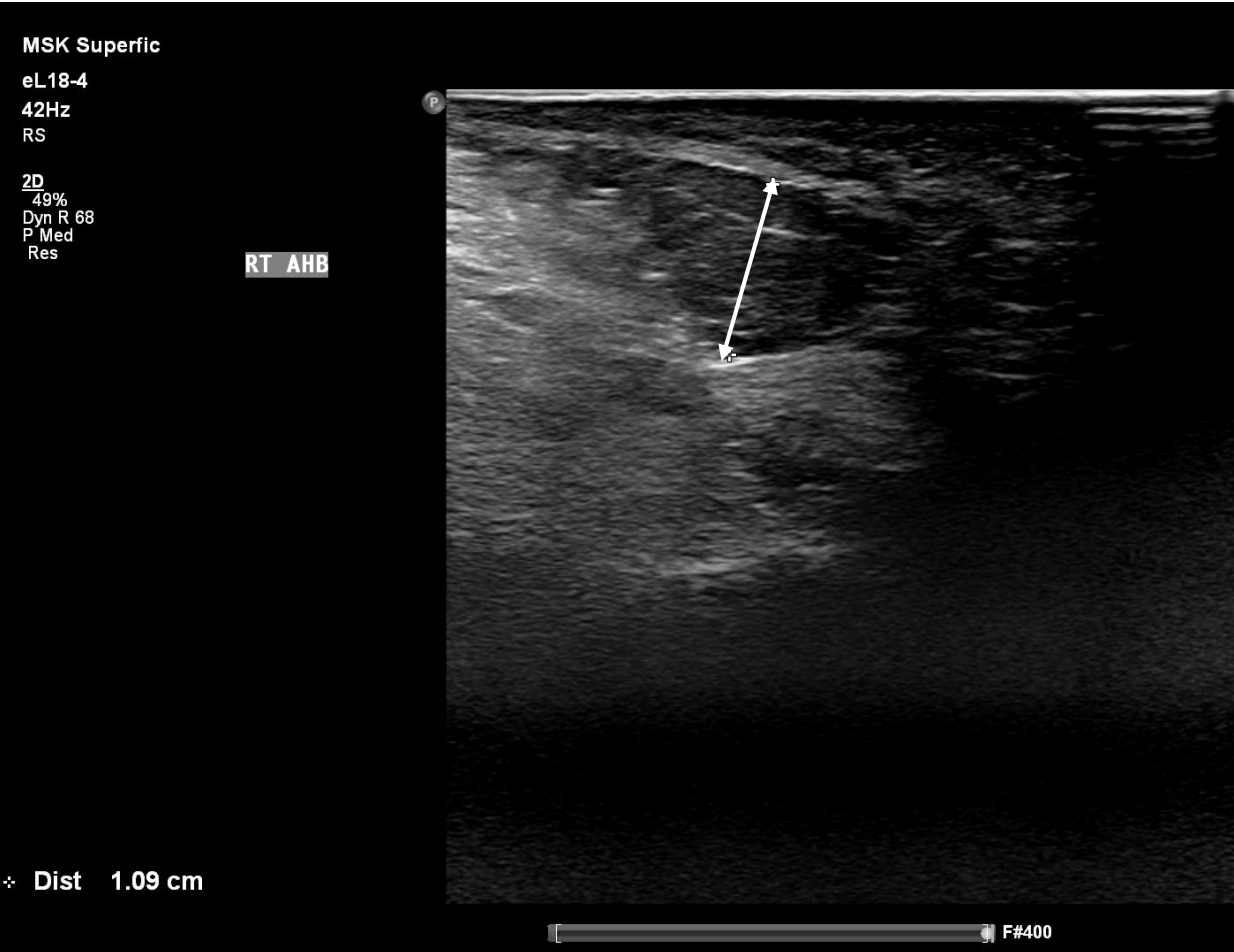
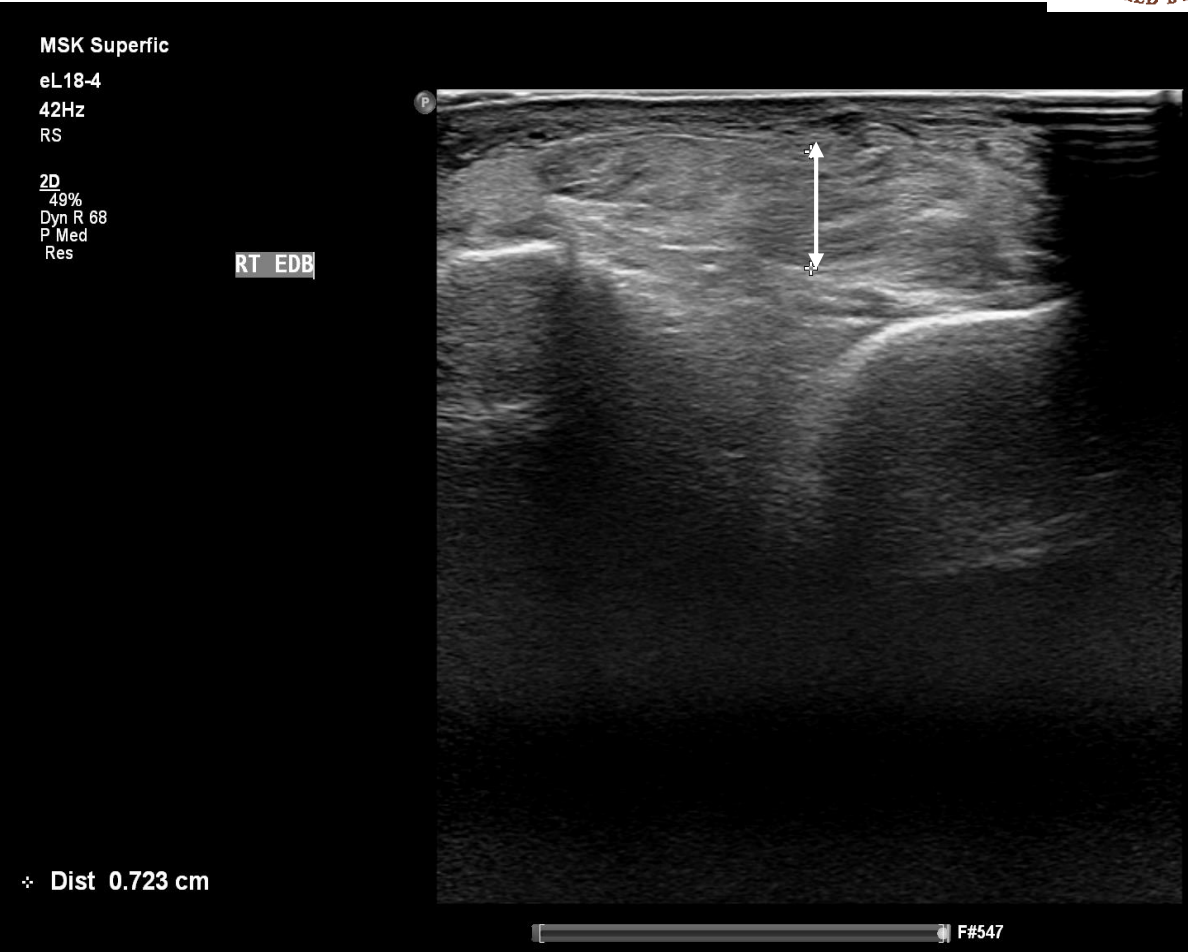


Figure 3a. Abductor Hallucis Brevis



3b. Extensor Digitorum Brevis