

MUSCLE MASS EVALUATION BY QUADRICEPS FEMORIS ULTRASOUND IN ESRD PATIENTS ON HEMODIALYSIS

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Introduction and objectives

Protein-Energy Wasting (PEW) is a pathological condition characterized by a progressive reduction of patients' energy and protein assets (1). It is highly prevalent among End-Stage Renal Disease (ESRD, CKD stage 5) patients, and is associated with poor outcomes (2). The assessment of nutritional status is essential for the identification of patients at risk for the development of PEW, but also for the monitoring of the nutritional intervention. As part of the nutritional status evaluation, an increasing attention is now paid to the assessment of muscle mass, the most relevant part of the lean body mass (3). Ultrasound methods (US) are widely available in many clinical settings, and are easily applicable at the bedside to different skeletal muscle groups (4).

This study was aimed at: 1) Evaluating if quadriceps rectus femoris thickness (QRFT) and quadriceps vastus intermedius thickness (QVIT) are reduced in patients with ESRD in hemodialysis in comparison to health subjects and well-nourished hospitalized patients with normal renal function; and 2) if QRFT and QVIT are different in patients with ESRD in hemodialysis when they are stratified based on conventional variables frequently used for the assessment of nutritional status in this clinical setting.

Patients and Methods

This was a prospective observational study conducted at five hemodialysis units in Italy. We studied 3 groups of subjects: healthy subjects (control group), well-nourished patients hospitalized in a medicine ward and with normal renal function (HPNRF), and ESRD patients on hemodialysis aged > 18 years. QRFT and QVIT were measured by US in both legs, at the mid point and at the lower two-thirds of the thigh. ESRD patients were then divided in subgroups based on commonly used nutritional variables and accepted criteria: BMI (≥ 23 versus < 23 Kg/m²), and MIS score (< 6 versus ≥ 6).

Results

We enrolled 24 healthy controls, 28 HPNRF and 88 ESRD patients on hemodialysis. QRFT and QVIT of ESRD patients were significantly reduced as compared both to control subjects and hospitalized patients with normal renal function ($P < 0,01$) (Table 1)

Table 1. Demographic clinic and quadriceps muscle thickness.

	Control (n = 24)	ESRD (n = 88)	HPNRF (n = 28)	ANOVA
Age (range)	39 (24-58) [†]	67 (24-94)	62 (24-92)	< 0.0001
Sex (male) %	38	65	54	0.03 (Chi-square)
Height (SD) cm	1.68 (0.12)	1.66 (0.09)	1.69 (0.1)	0.2551
Weight (SD)	69.9 (17.1)	67.6 (12.8)	75.8 (16.7) ¹	0.0316
BMI (SD)	24.7 (4.8)	24.7 (4.8)	26.5 (5.0)	0.2088
Anthropometry				
QRFT dx 1/2 cm	1.89 (0.35)	1.56 (0.47) ²	1.88 (0.53)	0.0005
QVIT dx 1/2 cm	1.67 (0.46)	1.24 (0.44) ²	1.46 (0.48)	0.0001
QRFT dx 2/3 cm	1.42 (0.36)	1.07 (0.37) ²	1.36 (0.43)	< 0.0001
QVIT dx 2/3 cm	1.38 (0.40)	0.97 (0.34) ²	1.15 (0.37) ³	< 0.0001
QRFT sx 1/2 cm	1.95 (0.37)	1.51 (0.45) ²	1.84 (0.53)	< 0.0001
QVIT sx 1/2 cm	1.71 (0.45)	1.23 (0.45) ²	1.43 (0.48) ³	< 0.0001
QRFT sx 2/3 cm	1.41 (0.34)	1.05 (0.37) ²	1.31 (0.45)	< 0.0001
QVIT sx 2/3 cm	1.36 (0.38)	0.98 (0.37) ²	1.12 (0.36) ³	< 0.0001

BMI, body mass index; ESRD, end-stage renal disease; HPNRF: health patients with normal renal function; QRFT, quadriceps rectus femoris thickness; QVIT, quadriceps vastus intermedius thickness

[†] p < 0.05 vs ESRD

¹ p < 0.0001 in comparison to ESRD and HPNRF

² p < 0.01 vs Control and HPNRF

³ p < 0.05 vs control

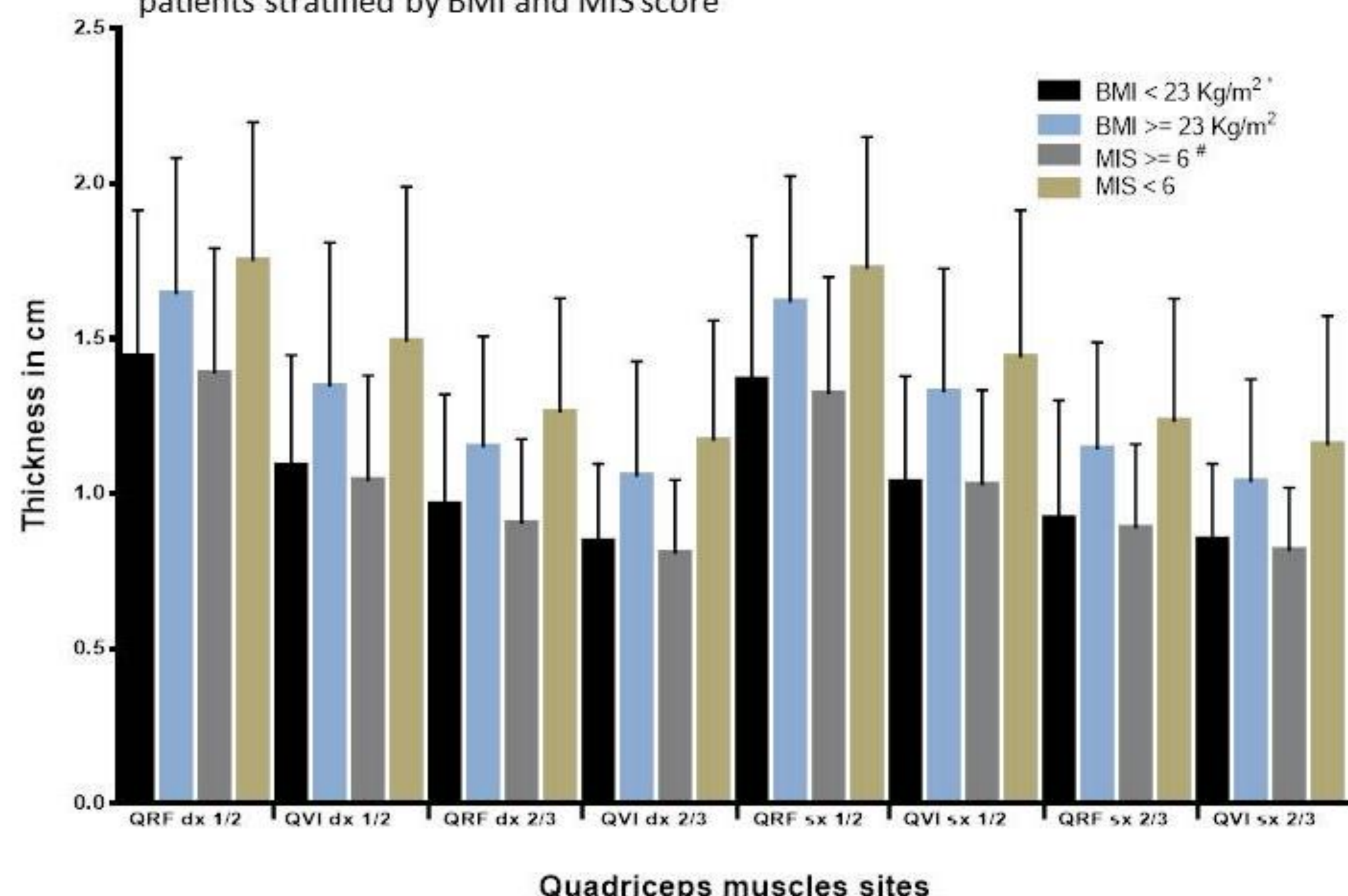
When ESRD patients were stratified in subgroups according to nutritional status, QRFT and QVIT of patients with worse nutritional status (BMI < 23 Kg/m² and MIS score ≥ 6) were significantly lower as compared to those of well-nourished ESRD patients (Table 2). Even after adjusting for age, differences in muscle thickness measured by US between BMI and MIS score subgroups remained significant (Figure 1)

Table 2. Non-adjusted comparison of QRFT and QVIT of ESRD patients stratified by BMI and MIS score.

	BMI < 23 (n = 37)	BMI ≥ 23 (n = 51)	P value BMI	MIS < 6 (n = 43)	MIS ≥ 6 (n = 45)	P value MIS
QRFT dx 1/2	1.44 (0.47)	1.64 (0.44)	0.0421	1.75 (0.45)	1.39 (0.40)	< 0.0001
QVIT dx 1/2	1.09 (0.36)	1.35 (0.47)	0.0040	1.49 (0.50)	1.04 (0.34)	< 0.0001
QRFT dx 2/3	0.96 (0.36)	1.15 (0.36)	0.0184	1.26 (0.37)	0.90 (0.27)	< 0.0001
QVIT dx 2/3	0.84 (0.25)	1.06 (0.37)	0.0020	1.17 (0.39)	0.81 (0.24)	< 0.0001
QRFT sx 1/2	1.37 (0.47)	1.62 (0.41)	0.0080	1.73 (0.43)	1.32 (0.38)	< 0.0001
QVIT sx 1/2	1.04 (0.34)	1.33 (0.40)	0.0006	1.44 (0.48)	1.03 (0.31)	< 0.0001
QRFT sx 2/3	0.92 (0.38)	1.14 (0.35)	0.0052	1.23 (0.40)	0.89 (0.27)	< 0.0001
QVIT sx 2/3	0.85 (0.25)	1.04 (0.33)	0.0032	1.16 (0.42)	0.82 (0.20)	< 0.0001

BMI, body mass index; ESRD, end-stage renal disease; MIS, malnutrition inflammation score; QRFT, quadriceps rectus femoris; QVIT, quadriceps vastus intermedius

Figure 1. Quadriceps rectus femoris and vastus intermedius thickness of ESRD patients stratified by BMI and MIS score



Adjusted P-values using ANCOVA:

P < 0.01 for all sites in comparison to the subgroup BMI ≥ 23 Kg/m²

* P < 0.01 for all sites in comparison to the subgroup MIS < 6

BMI, body mass index; MIS, malnutrition inflammation score; QRF, quadriceps rectus femoris; QVI, quadriceps vastus intermedius

Conclusion

Ultrasonography of the QRF and QVI muscles is a simple technique, easily applicable to the bedside in hemodialysis units, and is likely to be adequate for the identification of patients with reduced muscle mass.

References

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Topic 27. Dialysis - Nutrition & inflammation