The Egyptian Journal of Hospital Medicine (January 2023) Vol. 90 (2), Page 2492-2499

Subclinical Myopathy in Some Systemic Diseases

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ABSTRACT

Background: Subclinical myopathy is an earlier stage that can be easily managed to prevent or delay the associated complications and progression to evident myopathy.

Objective: To evaluate subclinical manifestations and distribution of muscle affection in diabetes mellitus (DM), chronic liver disease (CLD) and chronic kidney disease (CKD).

Patients and methods: The study includes 60 patients who were classified into 3 equal groups: Group 1 included diabetes mellitus cases, group 2 included chronic liver disease cases, group 3 included chronic kidney disease cases and another 20 normal individuals as control who were age- and sex-matched (Group 4). The study was conducted at Outpatient Clinic and Inpatient Neurology Department at Mansoura University Hospitals. Four groups were subjected to Electromyography, Magnetic resonance imaging and laboratory investigations.

Results: There was statistically significant difference between the studied groups regarding the CK (creatine kinase) and LDH (lactate dehydrogenase) levels. The CK level was higher in CLD and CKD groups than in DM and control groups but within upper normal level. The pattern of myopathy in DM cases was more in proximal than distal muscles at upper and lower limbs. In CLD cases, the myopathic pattern at upper and lower limbs were close in proportions. The pattern of myopathy in CKD cases was more in proximal than distal muscles at upper and lower limbs. The distribution of myopathic pattern in control group was 5%.

Conclusion: Subclinical myopathy isn't uncommon in DM, CLD and CKD. CK level is high in CLD and CKD patients but within normal upper limit that need further follow up for diagnosis of myopathy.

Keywords: Subclinical myopathy, DM, CLD, CKD, Electromyography, Magnetic resonance imaging.

INTRODUCTION

Myopathy is a muscular disease in which the muscle fibers do not function for any one of many reasons, resulting in muscular weakness. On a structural and functional level, underlying diseases can influence muscles. These effects can include metabolic changes and changes in muscle ion channels [(1)].

In 2011, Chawla [(2)] classified Myopathies in systemic disorders to: (1) Endocrine myopathies: Conn's syndrome, thyroid disorders, and DM. (2) Inflammatory myopathies: collagen diseases as SLE and RA. (3) Myopathy associated with paraneoplastic disease. (4) Infectious myopathy: myositis caused by the influenza virus. (5) Myopathies brought on by toxins and drugs (Critical illness myopathy). (6) Chronic renal failure, hepatic failure, and COPD are myopathies that are related to metabolic diseases.

Muscle fatigue rather than actual weakness is more typical in endocrine myopathies. It is unclear what causes the disorder's weakness. There is also the question of whether a disease of the muscles affects the muscles themselves, or whether it affects some other part of the motor system. In most cases, the level of CK in the serum is within normal limits (except in hypothyroidism or hyperthyroidism). The treatment is successful for most endocrine myopathies **[(3)].**

Numerous factors, including hyperglycemia, hypoinsulinemia, and changes in important hormones like glucocorticoids, can be blamed for the significant loss of muscle mass in Type 2 diabetes [(4)].

Specifically in the muscles of the lower limbs, proximal weakness and wasting are brought on by the development of a myopathy in chronic kidney disease. With glomerular filtration rates of less than 25 ml/min, uremic myopathy typically develops and has been linked to increased fatigability and decreased exercise tolerance **[(5)].** Since electromyography and creatine kinase levels are typically normal, the diagnosis is made primarily based on clinical factors **[(6)].**

Patients with liver cirrhosis frequently report losing muscle mass, which is a classic clinical observation. The wasting most likely causes disability and motor dysfunction. Although there is little information on the functional repercussions, lower muscle mass can lead to impaired skeletal muscle metabolism or contractile functions, which can contribute to the unfavourable outcomes in cirrhosis. Although it is likely that inadequate protein intake and malnutrition play a role in the wasting, patients with normal dietary intake can still lose muscle mass **[(7)].**

Electromyography (EMG) may be a crucial component of the myopathy diagnosis, alongside blood tests, muscle biopsies, and genetic analysis. The EMG is rarely used to distinguish between different myopathies [(8)].

MRI is a key tool for defining muscle anatomy and morphology as well as characterizing changes to muscle composition. MRI helps to significantly narrow the broad differential diagnosis, influencing the treatment and predicting prognosis in patients with muscle complaints, even though eventually biopsy may be required to establish diagnosis **[(9)].**

Received: 30/08/2022
Accepted: 03/11/2022

PATIENT AND METHODS

This was a prospective cross-sectional study to evaluate subclinical muscle affection and distribution in diabetes mellitus (DM), chronic liver disease (CLD) and chronic kidney disease (CKD). The study was conducted at Outpatient Clinic and Inpatient Neurology Department at Mansoura University Hospitals.

The current study included 60 patients diagnosed by DM, CLD and CKD. Their ages are between 40 to 75 years old and another 20 normal individuals are age and sex match as control subjects. All subjects did not complain from clinical manifestation of muscle affection.

The subjects were classified into 4 equal groups as follows:

- **Group 1:** Included 20 DM patients based on diagnosis by WHO guidelines 2011: (1) Fasting blood glucose (FBG) level of ≥126 mg/dl. (2) Post prandial blood glucose (PPBG) level of ≥ 200 mg/dl. (3) Hemoglobin A1c (HbA1c) of ≥ 6.5%, and they are taking oral hypoglycemic medication or insulin **(10).**
- **Group 2:** Includes 20 chronic liver disease patients who were diagnosed as hepatic patients by low concentration of albumin, elevated bilirubin concentration, ALT and AST were generally in the normal range or only mildly elevated and by upper abdominal ultrasonography (U/S) **(11, 12).**
- **Group 3:** based on a diagnosis of 20 patients with chronic kidney disease and a GFR less than 60 mL/min/1.73 m^2 for three months or longer. Equations like the Modification of Diet in Renal Disease (MDRD) Study equation or the Cockcroft-Gault formula that are calibrated for serum creatinine can be used to estimate GFR **(13).**
- **Group 4: (Control group):** Included 20 normal individuals that were age- and sex matched.

Inclusion criteria: Age: 40 to 75 years. Gender: Both genders. Diabetes mellitus, chronic liver disease and chronic kidney disease (DM, CLD, CKD) patients and not complaining from clinical manifestation of muscle affection.

Exclusion criteria: Age less than 20 years or more than 75 years. Patients complaining from clinical manifestation of muscle affection. Other systemic diseases than DM, CLD and CKD.

All subjects underwent the following:

I. History taking: Full neurological history taking stressing on history of DM, CLD and CKD and if there are subjective or objective symptoms and manifestation of myopathy.

II. Neurological clinical examination: Full sheet neurological examination especially muscle state, power grading, superficial and deep reflexes. All patients are with normal power muscle grading as regards the Medical Research Council Manual Muscle Testing scale (MRC).

III. Laboratory Investigations:

1. Liver functions: Aspartate aminotransferase (AST), Alanine aminotransferase (ALT), total bilirubin and serum albumin.
2. Diabetes profile: Hemoglobin A1c (HbA1c), fasting blood glucose (FBS) and post prandial blood glucose (PPBS).
3. Serum creatinine (CR) and glomerular filtration rate (GFR).
4. Creatine kinase (CK), and lactate dehydrogenase (LDH).
5. Others: Alkaline phosphatase, serum calcium and serum phosphorous.

Sample collection and preparation: 10 milliliters venous blood were withdrawn from each subject by sterile venipuncture. The samples were delivered into plain tube and left for clotting, then centrifuged at 3000 rpm for 15 minutes for the serum preparation.

Electromyography (EMG): Conventional electromyography was done in Neurology Department at Mansoura University Hospitals. EMG was made by using disposable concentric needles inserted into group of upper and lower limb muscles (right & left). Upper limb muscles: supraspinatus, deltoid, triceps, biceps, brachioradialis, abductor pollicis brevis and abductor digiti minimi. Lower limb muscles: quadriceps (VL, RF, VM), tibialis anterior, gluteus maximus, gluteus medius, hamstring (semimembranosus, biceps femoris), adductor longus and gastrocnemius.

In current study we depended on muscle amplitude to diagnose myopathy by EMG. **Mills (14)** said that in muscle disease, amplitude of motor unit potentials (MUP) is small; typical values would be 0.5 mV or less.

Magnetic resonance imaging (MRI):

Magnetic resonance imaging of muscles was performed using 1.5 T scanner in Radiology Department in Mansoura University Hospitals. MRI protocol include T1-weighted images, T2-weighted images and short tau inversion recovery (STIR) images without contrast. The finding of MRI showed presence of inflammation and its degree (mild, moderate and marked inflammation) or not in quadriceps muscle, vastus medialis (VM), rectus femoris (RF) and vastus lateralis (VL). We depend on extent of muscle edema to diagnose the severity of muscle inflammation as in **Andersson *et al.* (15)** study. **Andersson *et al.* (15)** divided the muscle edema severity into; grade 0 was defined as no edema, grade 1 as <33.3% (minor (mild) extent),

grade 2 as >33.3% to <66.6% (moderate extent) and grade 3 as > 66.6% (major (marked) extent).

Ethical approval:

The study was approved by the Institutional Review Board (IRB) on 12/4/2018, Faculty of Medicine-Mansoura University, with proposal code "MS.18.12.387." Confidentiality and personal privacy are respected in all levels of study. Patients feel free to be withdrawn from the study at any time without any consequences. The information collected will not be used for any other purposes. After explaining our research objectives, written informed consents were obtained from all study participants. This study was conducted in compliance with the code of ethics of the world medical association (Declaration of Helsinki) for human subjects.

Statistical analysis

The statistical package for social sciences (SPSS 27.0, IBM/SPSS Inc., Chicago, IL) was used to statistically analyse the results. **Descriptive statistics:** It included estimation for the mean (X), standard deviation (SD), and range for normally distributed continuous data, or for skewed continuous data. For the presentation of qualitative data, frequency with percentage (percent) was used.

Analytical or inferential statistics:

(1) Pearson Chi-square (χ^2) test: It is employed to compare two or more groups with regard to a particular qualitative variable.

(2) Analysis of variance (ANOVA or F test): When testing continuous data for differences between more than two normally distributed groups, the one-way ANOVA test is used. P value ≤ 0.05 was considered significant.

RESULTS

The current study included 60 patients that were classified into 3 groups. Each group contained 20 patients suffering from DM, CLD and CKD respectively. The control group included 20 normal individuals with age- and sex-matched that of the patients. There was no statistically significant difference regarding the age and sex between the different study groups (Table 1).

Table (1): Demographic characteristics between the studied groups

	DM N=20	**CLD N=20**	**CKD N=20**	**Control N=20**	**Overall sig.**	**Between groups**	**Between groups & control**
Age/years	57.9±6.65	62.0±7.14	60.05±7.05971	59.4±5.66	F=1.303 P=0.280	P1=0.055 P2=0.031 P3=0.357	P4=0.478 P5=0.221 P6=0.758
Sex N (%) **Male** **Female**	 8(40) 12(60)	 11(55) 9(45)	 12(60) 8(40)	 9(45) 11(55)	 X^2 P=0.572	P1=0.342 P2=0.206 P3=0.749	P4=0.749 P5=0.527 P6=0.342

F: One Way ANOVA test, X^2: Chi-Square test, P: Overall sig. between DM, CLD, CKD and control, P1: difference between DM & CLD, P2: difference between DM & CKD, P3: difference between CKD & CLD, P4: difference between DM & control, P5: difference between Control & CLD, P6: difference between control & CKD, *statistically significant.

Concerning the lactate dehydrogenase (LDH), there was a statistically significant difference between DM and each of CLD, CKD groups (p<0.001*) and between DM, CLD, CKD groups in comparison with control group (p<0.001*). The creatine kinase level (CK) was higher in CLD and CKD groups than in the other 2 groups but within upper normal level. A statistically significant difference in CK level was present between DM and CKD and CLD respectively (p<0.001*) and between CLD and CKD groups in comparison with control group (p<0.001*) (Table 2).

Table (2): Laboratory findings between the study groups

	DM N=20	CLD N=20	CKD N=20	Control N=20	Overall sig.	Between groups
CK U/L	**83.50±19.96**	**237.25±58.15**	**218.95±54.40**	**73.85±16.64**	**F=43.24 P<0.001***	**P1<0.001* P2<0.001* P3=0.282**
LDH IU/L	**205.40±33.07**	**253.50±30.06**	**254.35±19.52**	**153.45±12.34**	**F=72.69 P<0.001***	**P1<0.001* P2<0.001* P3=0.915**
AST IU/L	**31.75±6.68**	**88.9±21.13**	**28.4±6.51**	**28.70±7.11**	**F=42.39 P<0.001***	**P1<0.001* P2=0.605 P3<0.001***
ALT IU/L	**29.8±6.6**	**95.15±20.43**	**29.65±6.43**	**31.9±7.60**	**F=49.12 P<0.001***	**P1<0.001* P2=0.982 P3<0.001***
T.BIL mg/dl	**0.775±0.18**	**2.015±0.43**	**0.635±0.12**	**0.70±0.16**	**F=58.87 P<0.001***	**P1<0.001* P2=0.252 P3<0.001***
Albumin g/dl	**4.04±0.57**	**2.98±0.14**	**4.23±0.62**	**4.36±0.65**	**F=27.424 P<0.001***	**P1<0.001* P2=0.281 P3<0.001***
HbA1C (%)	**6.55±0.72**	**4.75±0.53**	**5.31±0.74**	**5.27±0.72**	**F=24.98 P<0.001***	**P1<0.001* P2<0.001* P3=0.012**
FBS mg/dl	**119.50±29.00**	**75.30±16.84**	**65.60±14.75**	**70.65±15.56**	**F=26.50 P<0.001***	**P1<0.001* P2<0.001* P3=0.159**
PPBS mg/dl	**177.95±42.91**	**131.±7.26**	**130.05±6.11**	**132.4±6.18**	**F=18.84 P<0.001***	**P1<0.001* P2<0.001* P3=0.901**
Creatinine mg/dl	**0.83±0.13**	**0.855±0.14**	**2.45±0.48**	**0.88±0.15**	**F=175.45 P<0.001***	**P1=0.770 P2<0.001* P3<0.001***
GFR mL/min/1.73 m²	**86.97±14.28**	**88.33±21.28**	**26.80±6.01**	**83.98±20.61**	**F=61.53 P<0.001***	**P1=0.801 P2<0.001* P3<0.001***
ALK.ph IU/L	**86.65±20.11**	**204.33±50.74**	**286.30±57.95**	**92.50±7.55**	**F=79.53 P<0.001***	**P1<0.001* P2<0.001* P3<0.001***
Serum.Ca mg/dl	**9.21±0.42**	**7.33±0.88**	**8.09±0.21**	**9.37±0.55**	**F=57.25 P<0.001***	**P1<0.001* P2<0.001* P3<0.001***
Serum.Ph mg/dl	**3.13±0.59**	**3.28±0.68**	**4.88±0.42**	**3.35±0.69**	**F=36.8 P<0.001***	**P1=0.436 P2<0.001* P3<0.001***

F: One Way ANOVA test, P: Overall sig. between DM, CLD, CKD and control, P1: difference between DM & CLD, P2: difference between DM & CKD, P3: difference between CKD & CLD, P4: difference between DM & control, P5: difference between Control & CLD, P6: difference between control & CKD, *statistically significant

Regarding DM group, Rt Biceps was the most affected muscle by 30%, while Rt. Supraspinatus was affected by 25%. Both Lt. Deltoid and Lt Triceps were affected by 20% each one. In CLD group, the most affected muscle was Lt. Deltoid (30%) followed by Rt. Biceps that affected by 20%. In CKD group, Lt. Biceps was the first muscle affected by 45% while Lt. Supraspinatus (35%) and Rt. Supraspinatus and Rt. Biceps (30% each one). In the control group, a myopathic pattern existed in Lt. Supraspinatus and Rt. Brachioradialis by 5% each one (Table 3).

Table (3): Pattern of myopathy in muscles of upper limb by EMG in study groups

	DM (N=20)	CLD (N=20)	CKD (N=20)	Control (N=20)
Rt. Supraspinatus N (%)	5(25)	2(10)	6(30)	0(0)
Lt. Supraspinatus N (%)	0(0)	3(15)	7(35)	1(5)
Rt. Deltoid N (%)	1(5)	1(5)	2(10)	0(0)
Lt. Deltoid N (%)	4(20)	6(30)	3(15)	0(0)
Rt. Biceps N (%)	6(30)	4(20)	6(30)	0(0)
Lt. Biceps N (%)	2(10)	2(10)	9(45)	0(0)
Rt. Triceps N (%)	3(15)	2(10)	1(5)	0(0)
Lt. Triceps N (%)	4(20)	1(5)	3(15)	0(0)
Rt. Brachioradialis N (%)	2(10)	2(10)	4(20)	1(5)
Lt. Brachioradialis N (%)	1(5)	1(5)	1(5)	0(0)
Rt. Abduc. Digiti Minimi N (%)	0(0)	0(0)	0 (0)	0 (0)
Lt. Abduc. Digiti Minimi N (%)	1(5)	0 (0)	0 (0)	0 (0)
Rt. Abduc. Pollicis brevis N (%)	1(5)	3(15)	2(10)	0 (0)
Lt. Abduc.Pollicis brevis N (%)	0(0)	1(15)	0 (0)	0 (0)

Regarding DM group, Rt. Rectus Femoris is the most affected muscle by 35% next to it Right Gluteus Medius, Left Gluteus Maximus and Left Adductor longus by 25% each one. In CLD group, the most affected muscle is Left Adductor longus by 35% followed by Right Gluteus Medius (25%), Right Vastus Lateralis, Right Gluteus Maximus and Right Adductor longus (20% each one). In CKD group, Right Adductor longus is the most affected muscle by 40% followed by left Adductor longus (30%), then Right Gluteus Medius (20%). In control group, we found a myopathic changes in Lt. Rectus Femoris, Lt Gastrocnemius, Rt Semimembranosus, Rt Gluteus Medius and both Rt. & Lt. Gluteus Maximus muscles by 5% each muscle (Table 4).

Table (4): Pattern of myopathy in muscles of lower limb by EMG in study groups

	DM (N=20)	CLD (N=20)	CKD (N=20)	Control (N=20)
Rt. Vastus Lateralis N(%)	2(10)	4(20)	1(5)	0(0)
Lt. Vastus Lateralis N(%)	2(10)	3(15)	3(15)	0(0)
Rt. Rectus Femoris N(%)	7(35)	2(10)	0 (0)	0(0)
lt. Rectus Femoris N(%)	1(5)	3(15)	3(15)	1(5)
Rt. Vastus Medialis N(%)	0(0)	0(0)	1(5)	0 (0)
Lt. Vastus Medialis N(%)	1(5)	0(0)	1(5)	0 (0)
Rt. tibialis anterior N(%)	2(10)	0 (0)	1 (5)	0 (0)
Left. tibialis anterior N(%)	0 (0)	0 (0)	1(5)	0 (0)
right Gastrocnemius N(%)	2(10)	2(10)	0 (0)	0 (0)
left Gastrocnemius N(%)	1(5)	0(0)	1(5)	1 (5)
Right Semimembranosus N(%)	1 (5)	0 (0)	0 (0)	1 (5)
left Semimembranosus N(%)	0 (0)	0 (0)	1(5)	0(0)
Right biceps femoralis N(%)	1(5)	3(15)	3(15)	0(0)
left biceps femoralis N(%)	4(20)	2(10)	1(5)	0(0)
Right Gluteus Medius N(%)	5(25)	5(25)	4(20)	1 (5)
left Gluteus Medius N(%)	2(10)	3(15)	1(5)	0(0)
Right Gluteus Maximus N(%)	3(15)	4(20)	2(10)	1 (5)
left Gluteus Maximus N(%)	5(25)	3(15)	3(15)	1(5)
Right Adductor longus N(%)	4(20)	4(20)	8(40)	0(0)
left Adductor longus N(%)	5(25)	7(35)	6(30)	0 (0)

There was a statistically significant difference in the degree of inflammation in bilateral vastus medialis and bilateral rectus femoris muscles between DM, CLD and CKD groups in comparison with the control group. Except in right vastus medialis there was no statistically significant difference between CKD and control group (Table 5).

Table (5): Degree of inflammation of quadriceps muscle by MRI between study groups

	Degree of muscle inflammation	DM N=20	CLD N=20	CKD N=20	Control N=20	Overall sig.	Between groups	Between groups & control
Vastus Lateralis	Right					**χ^{2MC}=10.09**	**P1=0.737**	**P4=0.064**
	No	**12(60)**	**14(70)**	**16(80)**	**19(95)**	**P=0.343**	**P2=0.414**	**P5=0.102**
	Mild	**5(25)**	**4(20)**	**2(10)**	**1(5)**		**P3=0.670**	**P6=0.274**
	Moderate	**1(5)**	**0**	**0**	**0**			
	Marked	**2(10)**	**2(10)**	**2(10)**	**0**			
	Left					**χ^{2MC}=8.96**	**P1=0.543**	**P4=0.268**
	No	**13(65)**	**15(75)**	**16(80)**	**18(90)**	**P=0.411**	**P2=0.346**	**P5=0.254**
	Mild	**4(20)**	**4(20)**	**2(10)**	**1(5)**		**P3=0.597**	**P6=0.327**
	Moderate	**2(10)**	**0**	**0**	**1(5)**			
	Marked	**1(5)**	**1(5)**	**2(10)**	**0**			
Vastus Medialis	Right						**P1=0.344**	**P4=0.029***
	No	**14(70)**	**16(80)**	**15(75)**	**20(100)**	**χ^{2MC}=8.94**	**P2=0.832**	**P5=0.035***
	Mild	**4(20)**	**4(20)**	**4(20)**	**0**	**P=0.177**	**P3=0.597**	**P6=0.057**
	Moderate	**2(10)**	**0**	**1(5)**	**0**			
	Marked	**0**	**1(5)**	**0**	**0**			
	Left						**P1=0.197**	**P4=0.014***
	No	**13(65)**	**15(75)**	**14(70)**	**20(100)**	**χ^{2MC}=12.73**	**P2=0.563**	**P5=0.017***
	Mild	**4(20)**	**5(25)**	**5(25)**	**0**	**P=0.048***	**P3=0.596**	**P6=0.029***
	Moderate	**3(15)**	**0**	**1(5)**	**0**			
	Marked	**1(5)**	**0**	**0**	**0**			
Rectus Femoris	Right					**χ^{2MC}=45.33**	**P1=0.385**	**P4<0.001***
	No	**6(30)**	**3(15)**	**2(10)**	**19(95)**	**P<0.001***	**P2=0.264**	**P5<0.001***
	Mild	**11(55)**	**12(60)**	**13(65)**	**1(5)**		**P3=0.433**	**P6<0.001***
	Moderate	**3(15)**	**3(15)**	**5(25)**	**0**			
	Marked	**0**	**2(10)**	**0**	**0**			
	Left						**P1=0.257**	**P4<0.001***
	No	**6(30)**	**3(15)**	**2(10)**	**19(95)**	**χ^{2MC}=47.76**	**P2=0.097**	**P5<0.001***
	Mild	**13(65)**	**12(60)**	**13(65)**	**1(5)**	**P<0.001***	**P3=0.433**	**P6<0.001***
	Moderate	**1(5)**	**3(15)**	**5(25)**	**0**			
	Marked	**0**	**2(10)**	**0**	**0**			
Vastus Intermedius	Right						**P1=0.531**	**P4=0.195**
	No	**15(75)**	**17(85)**	**16(80)**	**19(95)**	**χ^{2MC}=8.25**	**P2=0.537**	**P5=0.292**
	Mild	**4(20)**	**3(15)**	**3(15)**	**1(5)**	**P=0.509**	**P3=0.597**	**P6=0.323**
	Moderate	**0**	**0**	**1(5)**	**0**			
	Marked	**1(5)**	**0**	**0**	**0**			
	Left				**19(95)**	**χ^{2MC}=8.25**	**P1=0.531**	**P4=0.195**
	No	**15(75)**	**17(85)**	**16(80)**	**1(5)**	**P=0.509**	**P2=0.537**	**P5=0.292**
	Mild	**4(20)**	**3(15)**	**3(15)**	**0**		**P3=0.597**	**P6=0.323**
	Moderate	**0**	**0**	**1(5)**	**0**			
	Marked	**1(5)**	**0**	**0**	**0**			

χ^2:Chi-Square test, P: Overall sig. between DM, CLD, CKD and control, P1: difference between DM & CLD, P2: difference between DM & CKD, P3: difference between CKD & CLD, P4: difference between DM & control, P5: difference between Control & CLD, P6: difference between control & CKD, *statistically significant. *NO: grade 0 was defined as no inflammation,*Mild: grade 1 as <33.3% inflammation, *Moderate: grade 2 as >33.3% to <66.6% inflammation, *Marked: grade 3 as >66.6% inflammation.

DISCUSSION

In the current study we used the amplitude of EMG that is less than 0.5 mV to diagnose the myopathic pattern. In muscle disease, the amplitude of motor unit potentials (MUP) is small, typical values would be 0.5 mV or less [(14)].

Regarding DM group that included 20 patients with type 2 DM, with mean age of 57.9±6.65 years with 40% males and 60% females. It was seen that the pattern of myopathy obtained by EMG in upper and lower limb was more in proximal muscles than in distal muscles. Lower limb was more than upper limb.

By laboratory, the creatine kinase (CK) was within normal level. In the study conducted by **Pillai and Rao** [(16)] in India that included 150 patients with type 2 DM, there were 70% males and 30% females. The main age group was between 50-70 years like other persistent issues. Diabetes myopathy is thought to result from a microvascular pathological process that causes the affected muscles' ischemia, infarction, and inflammation. There were 17.3% more people with myopathy than normal. Regarding the distribution of myopathy, the lower limbs' proximal muscles were affected in most patients (32.4%), followed by their distal muscles (7.4%). This study differs from the current study as it included large number of patients and depended on clinical features of myopathy. By investigation, CK level was increased in this study but it is within normal level in our study. EMG was done only on lower limb but we did it on upper limb also that revealed myopathic affection in both studies. In the First medical department Danube University, Krems, Austria, the authors included 99 patients with diabetes mellitus, 38 women (38%) and 61 men (62%) with age from 19 to 87 years. This study were assessed between May 2008 and April 2010. They noticed an increase in creatine kinase levels in 9% of the patients, the majority of whom were taking optimal oral hypoglycemic agents [(17)]. It is noticed that CK level was within normal level in current study. The reason may be due to large number of patients that were used than in our study.

Chronic kidney disease (CKD) is a silent epidemic that affects thousands of patients and is predicted to affect more than half of Americans born in the current generation [(18)], and approximately 40% of the population in Europe [(19)]. The functional and morphological abnormalities collectively referred to as uremic myopathy, which frequently also includes uremic cardiomyopathy, muscular weakness, muscle wasting, limited endurance, exercise intolerance, and fatigue [(20)]. Although the exact cause of uremic myopathy is unknown, it is believed that uremic toxicity and hypokinesis interact to cause these abnormalities in people with CKD, particularly those who are receiving hemodialysis (HD) therapy for end-stage renal disease (ESRD) [(21)]. According to CKD group that included 20 patients, there were 60% males and 40% females and mean age was 60.05 ± 7.05971 years. The pattern of myopathy in upper and lower limbs was more in proximal than distal muscles. Upper was more than lower limb. By investigation, creatine kinase level was high but within upper normal level. In one study including 330 dialysis patients, 203 participants (62%) were men and 127 (38%) were female and mean age was 53 ±13 years. Sarcopenia (defined as decreased muscle mass with decreased function/mobility) was present in 20%, decreased muscle mass alone was present in 24%, and decreased muscle strength was present in 15% [(22)]. This study is different than the present study as it included dialysis patients and large sample but we included only CKD patients. Patients with CKD frequently complain of muscle weakness and fatigue, which can be caused by a number of factors including hormonal imbalance, malnutrition, ATP and glycogen depletion, inadequate oxygen transport as a result of anaemia, metabolic acidosis and electrolyte disorder, changes in lifestyle, muscle wasting, and weakness brought on by muscle fiber atrophy [(23)].

It is well known that alcoholic skeletal myopathy can coexist with alcoholism and alcoholic liver diseases [(24)]. Additionally, patients with liver cirrhosis were found to experience more muscle cramps than a population without cirrhosis, and it was suggested that this should be considered a cirrhosis symptom [(25)]. In current study, CLD group that included 20 patients, there were 55% males and 45% females with mean age of 62.0 ± 7.14 years. The Pattern of myopathy in upper and lower limbs were more in proximal than distal muscles. Lower was more than upper limb.

The CK level was high but within upper normal limit and LDH level was normal. In a study conducted in South Korea by **Lee *et al.*** [(26)] on 5440 patients with mean age of 51± 10 years. Based on the results of the laboratory and clinical tests, myopathy was diagnosed. Skeletal muscle damage results in elevated levels of muscle enzymes; AST, CK, and LDH peaked 5–6 days after the onset of symptoms, and symptom relief was followed by a decline in muscle enzymes level, which reached a minimum at 1264.8 IU/L, 20 693.2 IU/L, and 1926.7 IU/L respectively. Of the 5440 patients with liver cirrhosis, 89 (1.8%) experienced acute myopathy. Except for 4 patients who experienced myopathy following transarterial embolization and required hospitalisation. 2.96% of the patients (24) were men, with the majority of them in their sixties [(26)]. This study differs from the current study in that it used a greater number of patients and was founded on the hypothesis that skeletal muscle injury results in elevated levels of muscle enzymes.

In current study, it was observed that MRI on quadriceps muscle showed mild inflammation more in rt. rectus muscle in the four study groups by different percentages than other muscles. The inflammation was classified into four degrees; no, mild, moderate, and marked. **Jelinek *et al.*** [(27)] in their study conducted in USA and included 21 patients with diabetic muscle infarction. Patients were 12 women and 9 men and the average age was 48. (Range, 30-77 years). According to MRI results, the large muscles of the thigh were affected in about 80% of cases, while the calf muscles

were affected in about 20% of cases. More than 10% of times, both limbs were impacted. [27] In their analysis of MRI diabetic myopathy findings.

Huang *et al.* [28] found that calf involvement occurred almost as frequently as thigh involvement. [28] This study is similar to current study as it included same number of patients but they were with diabetic muscle infarction against our patients who were with DM but no muscle infarction. MRI was done in this study on large muscles of the thigh and calf muscle but in current study MRI was done on quadriceps muscle only.

Trujillo-Santos [29] study that was conducted in Spain and included 115 patients with diabetic muscle infarction. Patients were 54 women and 61 men with mean age of 42.63 years. DMI can be identified using a combination of radiological imaging, muscle biopsy, and clinical presentation. Physicians typically avoided using any invasive diagnostic techniques, but MRI has a good prognostic value. A biopsy should only be performed in situations where the clinical presentation is unusual, the diagnosis is ambiguous, or when the appropriate course of treatment is ineffective. [29]

Finally, no previous studies have assessed the incidence of pattern of myopathy in this 3 chronic diseases in a single study as the current study. The difference between studies' results is related to the difference in numbers of patients, sex, mean age, race and the method of diagnosing myopathy.

CONCLUSION

From this study, we concluded that:

1-Subclinical myopathy isn't uncommon in DM, CLD and CKD.

2-The pattern of myopathy by EMG present in different proportions despite of absence of clinical manifestations of muscles affection.

3- CK level is high in CLD and CKD patients but within normal upper limit that needs further follow up for diagnosis of myopathy.

Financial support and sponsorship: Nil.
Conflict of interest: Nil.

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