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Hyperglycemia Is Associated with Impaired Muscle Quality in Older Men with Diabetes: The Korean Longitudinal Study on Health and Aging (*Diabetes Metab J* 2016;40:140-6)

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Ever since the introduction of the concept of sarcopenia [1], its definition has been changed over the past two decades. Although many researchers have only investigated the changes of muscle mass, recent evidence suggest that the functional changes of skeletal muscle are also important in the elderly [2]. Thus, several groups started to propose new criteria for sarcopenia including not only skeletal muscle mass but also the result of functional test [3-5]. It has been well-established that elderly patients with type 2 diabetes have increased risk of sarcopenia [6], but little is known about the association between diabetes and muscle quality.

In this journal, Yoon et al. [7] conducted a case-control study, as a subsidiary study of the community-based cohort study (the Korean Longitudinal Study of Health and Aging [KLoSHA]) and enrolled 269 men. Muscle quality was defined as the ratio of lower muscle strength assessed by isokinetic dynamometer (newton meter, Nm), and muscle mass (kg) was determined by dual-energy X-ray absorptiometry (DXA). They demonstrated that uncontrolled hyperglycemia (glycosylated hemoglobin >8.5%) significantly increased the risk of impaired muscle quality, even though there were no differences between muscle mass and strengths in elderly patients with diabetes. Numerous attempts have been made on skeletal muscle 'mass' in diabetes, but this study is quite interesting because there are few reports that investigated muscle 'quality.' These findings provide clinical insights and reasons as to why physicians should pay attention to elderly patients with poorly controlled diabetes; because they are at high risks of falls which can lead to serious injury and accidental death. However, there are some points that need to be addressed.

First, the operational definition, standardized measurement method and clinical applications of muscle quality are still lacking. In addition, there is growing evidence that increased intramuscular adipose tissue with age contributes to impaired muscle strength and quality. To determine the lipid contents in skeletal muscle, various imaging tests have been reported such as DXA [8], computed tomography [9], and ^{1}H-magnetic resonance spectroscopy [10]. Although Nm/kg has been suggested as a muscle quality index in this study and it is appropriate for large population study due to simplicity and cost, it can be underestimated when compared with imaging tests. In addition, ectopic fat accumulation of skeletal muscle is closely related with insulin resistance in patients with type 2 diabetes, and it also could lead to aggravate hyperglycemia. Therefore, the causality of hyperglycemia on muscle quality might not be clear.

Second, poorly controlled diabetes can lead to diabetic complications including peripheral arterial insufficiency and

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neuropathy can cause lower muscle weakness [11,12]. A previous study demonstrated that peripheral arterial disease assessed by ankle-brachial index (ABI) was significantly associated with lower muscle strength [13]. Progressive muscle weakness of lower extremity was reported in patients with symptomatic diabetic neuropathy, and it was related with the severity of neuropathy. However, the presence and degree of complications were not properly described in the present study. To clarify the causal relationship between hyperglycemia and muscle quality, these complications should be considered as possible confounding factors.

It is widely assumed that sarcopenia can lead to frailty, risk of falls and increased mortality in elderly adults, but direct link between impaired muscle quality and such outcomes still remain sparse. I hope that KLoSHA will provide the answers in the near future.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

REFERENCES

1. Baumgartner RN, Koehler KM, Gallagher D, Romero L, Heymsfield SB, Ross RR, Garry PJ, Lindeman RD. Epidemiology of sarcopenia among the elderly in New Mexico. Am J Epidemiol 1998;147:755-63.
2. Umegaki H. Sarcopenia and diabetes: hyperglycemia is a risk factor for age-associated muscle mass and functional reduction. J Diabetes Investig 2015;6:623-4.
3. Cruz-Jentoft AJ, Baeyens JP, Bauer JM, Boirie Y, Cederholm T, Landi F, Martin FC, Michel JP, Rolland Y, Schneider SM, Topinkova E, Vandewoude M, Zamboni M; European Working Group on Sarcopenia in Older People. Sarcopenia: European consensus on definition and diagnosis. Report of the European Working Group on Sarcopenia in Older People. Age Ageing 2010;39:412-23.
4. Chen LK, Liu LK, Woo J, Assantachai P, Auyeung TW, Bahyah KS, Chou MY, Chen LY, Hsu PS, Krairit O, Lee JS, Lee WJ, Lee Y, Liang CK, Limpawattana P, Lin CS, Peng LN, Satake S, Suzuki T, Won CW, Wu CH, Wu SN, Zhang T, Zeng P, Akishita M, Arai H. Sarcopenia in Asia: consensus report of the Asian Working Group for Sarcopenia. J Am Med Dir Assoc 2014;15:95-101.
5. Studenski SA, Peters KW, Alley DE, Cawthon PM, McLean RR, Harris TB, Ferrucci L, Guralnik JM, Fragala MS, Kenny AM, Kiel DP, Kritchevsky SB, Shardell MD, Dam TT, Vassileva MT. The FNIH sarcopenia project: rationale, study description, conference recommendations, and final estimates. J Gerontol A Biol Sci Med Sci 2014;69:547-58.
6. Morley JE, Malmstrom TK, Rodriguez-Manas L, Sinclair AJ. Frailty, sarcopenia and diabetes. J Am Med Dir Assoc 2014;15:853-9.
7. Yoon JW, Ha YC, Kim KM, Moon JH, Choi SH, Lim S, Park YJ, Lim JY, Kim KW, Park KS, Jang HC. Hyperglycemia is associated with impaired muscle quality in older men with diabetes: the Korean Longitudinal Study on Health and Aging. Diabetes Metab J 2016;40:140-6.
8. Hansen RD, Williamson DA, Finnegan TP, Lloyd BD, Grady JN, Diamond TH, Smith EU, Stavrinos TM, Thompson MW, Gwinn TH, Allen BJ, Smerdely PI, Diwan AD, Singh NA, Singh MA. Estimation of thigh muscle cross-sectional area by dual-energy X-ray absorptiometry in frail elderly patients. Am J Clin Nutr 2007;86:952-8.
9. Volpato S, Bianchi L, Lauretani F, Lauretani F, Bandinelli S, Guralnik JM, Zuliani G, Ferrucci L. Role of muscle mass and muscle quality in the association between diabetes and gait speed. Diabetes Care 2012;35:1672-9.
10. Petersen KF, Dufour S, Befroy D, Garcia R, Shulman GI. Impaired mitochondrial activity in the insulin-resistant offspring of patients with type 2 diabetes. N Engl J Med 2004;350:664-71.
11. Marso SP, Hiatt WR. Peripheral arterial disease in patients with diabetes. J Am Coll Cardiol 2006;47:921-9.
12. Andreassen CS, Jakobsen J, Andersen H. Muscle weakness: a progressive late complication in diabetic distal symmetric polyneuropathy. Diabetes 2006;55:806-12.
13. McDermott MM, Criqui MH, Greenland P, Guralnik JM, Liu K, Pearce WH, Taylor L, Chan C, Celic L, Woolley C, O'Brien MP, Schneider JR. Leg strength in peripheral arterial disease: associations with disease severity and lower-extremity performance. J Vasc Surg 2004;39:523-30.