Does aspect of intertrochanteric fracture in elderly caused by low-energy trauma affected by gluteus muscle volume?

Seok hwan Jeong1, and Dong hun Han2

1Department of Orthopedic Surgery, Gumi CHA medical center, 12, Shinsho ro 10 gil, Gumi-si, Gyeongsangbuk-do 39295, Republic of Korea
2Department of Orthopedic Surgery, Bundang CHA Medical Center, CHA university, School of Medicine, 59 Yatap-ro, Bundang-gu, Seongnam-si, Gyeonggi-do 13496, Republic of Korea

Introduction

Intertrochanteric fracture in elderly person are increasing drastically as he older population increases. The fracture pattern as well as the implant position, patient compliance, and the severity of osteoporosis, are significant factor of prognosis. Previous studies showed that bone mineral density (BMD) was significantly correlated with the incidence of intertrochanter fractures. However, the factors affecting the stability of intertrochanteric fracture in low-energy injuries (simple falls) have not been definitely revealed.

We hypothesized that muscularity around the hip affects the pattern of intertrochanteric fractures. We used body mass index (BMI) to correct for the muscle volume (area) in each patient's physique. BMI was calculated by weight divided by height squared, representing the cross-sectional area of a certain person. Therefore, we assumed that the BMI-adjusted gluteus muscle area represented muscularity around the hip.

Material and Method

Patients (n = 205)
- Over 65 years old intertrochanteric fractures
- January 2016 – December 2020
- Exclusion criteria
  - Previous contralateral hip injury or spine fracture
  - Inability to walk
  - Bone tumor
  - Neuromuscular disease such as spinal cord injury or cerebrovascular disease which affect muscle power
  - High energy injury

Data analysis
- Intertrochanteric fracture was classified by Jensen modification of the Evans classification
- Gluteus minimus and medius area measured at the S3 level, the gluteus maximus at the greater trochanteric tip level of contralateral hip in the axial cut in the pelvic CT

Results and discussion

Patients information
- Average -> 81.24 years
- Male-to-female ratio = 48 : 157
- Stable fracture(Evans 1 and 2) : Unstable fracture (Evans 3 - 5) = 63 : 142

Statistical analysis
- Age , weight and BMI in both groups were not statistically different and gluteus minimus, medius, and maximus mass were slightly larger in unstable group but the differences were not statistically significant.
- In single-variable analysis, stable intertrochanteric fracture group showed taller height (p<0.011) and higher BMI-adjusted gluteus maximus and medius muscle area (p=0.009 and 0.025) than unstable group.
- In multivariable analysis, only the BMI adjusted gluteus maximus (p<0.042) and total gluteal areas (p=0.035) were significantly higher in stable group.

Discussion
- Many studies have suggested that BMD, height, BMI direction of the fall and many other factors can affect intertrochanter fracture pattern in elderly
- But, mechanism of how and whether hip fracture pattern affected by theses factors was not clearly known and no consensus was made
- In our study, the BMI-adjusted gluteus maximus and total gluteal volumes showed differences between two groups.
- Possible reason for the difference could be that muscle contracts at the moment of impact and distributes the force to the surrounding tissue and bones absorbing shock more effectively than subcutaneous fat

Conclusion

Not only BMD affected the incidence and stability of intertrochanteric fractures, but also gluteal muscularity around the hip, especially the gluteus maximus, significantly affected the stability of intertrochanteric fractures.

Gluteal muscle strengthening around the hip may prevent or reduce the severity of intertrochanter fractures caused by low-energy injuries.