

ORIGINAL RESEARCH

Assessment of alteration in the cross-sectional area ratio of the paraspinal muscles following vertebral insufficiency fractures

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ABSTRACT

Background: Osteoporosis is a disease of the skeleton, characterised by micro-architectural deterioration of bone tissue and loss of bone mass. The present study was conducted to assess alteration in the cross-sectional area (CSA) ratio of the paraspinal muscles following vertebral insufficiency fractures. **Materials & Methods:** 75 patients of vertebral insufficiency fractures of both genders were divided into 3 groups based on the presence of vertebral insufficiency fractures. Group I was with no fractures, group II with 2 and group III with >2 fractures. All were subjected to MR scan. The cross-sectional area (CSA) and cross-sectional area ratio (CSAR) of the psoas and paraspinal muscles (multifidus) at the level of L4/5-disc space was calculated on axial-T2 MRI images. **Results:** Group I had 13 males and 12 females, group II had 14 males and 11 females and group III had 15 males and 10 females. The difference was non-significant ($P > 0.05$). The mean CSAR in group I was 2.54, in group II was 2.05 and in group III was 2.18. The difference was significant ($P < 0.05$). **Conclusion:** Vertebral insufficiency fractures in the elderly show significant association with atrophy in psoas and the multifidus group of muscles. They also affect the CSAR depending on the number of fractures.

Key words: Osteoporosis, MRI, Vertebral insufficiency fractures

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INTRODUCTION

Osteoporosis is a disease of the skeleton, characterised by micro-architectural deterioration of bone tissue and loss of bone mass. Osteoporosis increases bone fragility and susceptibility to fracture.¹ However, due to significant advances in osteoporosis management over the last 50 years – including widespread availability of various effective pharmacological therapies – it is no longer considered an inevitable consequence of ageing. Clinical diagnosis of osteoporosis is challenging: fracture-based criteria may exclude populations-at-risk who would benefit from treatment, whilst the original 1994 World Health Organisation definition by bone mineral density (BMD) alone may not take account of other risk factors.²

Vertebral fractures are recognized as a hallmark of osteoporosis and are associated with increased morbidity and mortality.³ Vertebral insufficiency fractures may occur spontaneously or as a result of

routine activities such as bending, walking, etc. As low back pain is common in the elderly, vertebral insufficiency fractures may go unrecognized or result in pain, disability, often leading to a reduced quality of life, inability to cope with daily activities, lengthy rehabilitation, long-term care, and social isolation.⁴ Cross-sectional area (CSA) of both paraspinal and psoas muscles can be altered in patients with unilateral back pain, monosegmental degenerative disc disease, lumbar spinal stenosis, acute and chronic low back pain. It has been evaluated using magnetic resonance imaging (MRI) studies to assess muscle atrophy, fatty infiltration or direct treatment strategies.⁵ The present study was conducted to assess alteration in the cross-sectional area (CSA) ratio of the paraspinal muscles following vertebral insufficiency fractures.

MATERIALS & METHODS

The present study consisted of 75 patients of vertebral insufficiency fractures of both genders. All were informed regarding the study and their written consent was obtained.

Data such as name, age, gender etc. was recorded. Patients were divided into 3 groups based on the presence of vertebral insufficiency fractures.

Group I was with no fractures, group II with 2 and group III with >2 fractures. All were subjected to MR scan. The cross-sectional area (CSA) and cross-sectional area ratio (CSAR) of the psoas and paraspinal muscles (multifidus) at the level of L4/5-disc space was calculated on axial-T2 MRI images. Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

RESULTS

Table I: Distribution of patients

Gender	Group I	Group II	Group III	P value
Male	13	14	15	0.97
Female	12	11	10	0.94

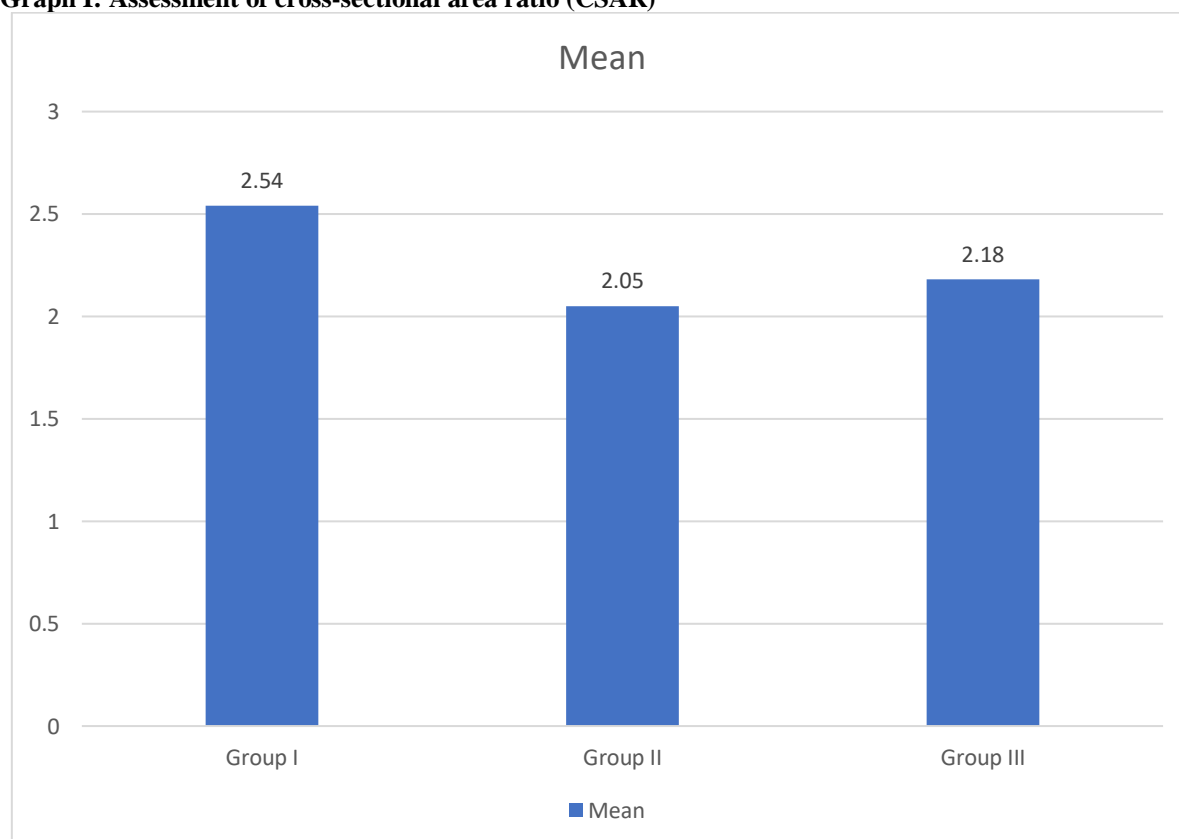
Table I shows that group I had 13 males and 12 females, group II had 14 males and 11 females and group III had 15 males and 10 females. The difference was non-significant ($P > 0.05$).

Table II: Assessment of cross-sectional area ratio (CSAR)

Groups	Mean	P value
Group I	2.54	0.05
Group II	2.05	
Group III	2.18	

Table II, graph I shows that mean CSAR in group I was 2.54, in group II was 2.05 and in group III was 2.18. The difference was significant ($P < 0.05$).

Graph I: Assessment of cross-sectional area ratio (CSAR)



DISCUSSION

According to a report by the US Surgeon General, approximately 10 million Americans over the age of 50 have osteoporosis, with a further 34 million at risk of the disease. Osteoporotic fractures in the USA are extremely common, with an estimated 1.5 million

suffering fragility fractures each year.⁶ A similar burden of disease has been observed in the UK, with epidemiological studies hypothesising that one in two women and one in five men aged over 50 years will suffer an osteoporotic fracture in their lifetime.⁷ For both sexes, vertebral fracture prevalence increases

with age, ranging from 3% in female participants below 60 years (7.5% in men) to 19% in female participants over 70 years (20% in men).⁸The present study was conducted to assess alteration in the cross-sectional area (CSA) ratio of the paraspinal muscles following vertebral insufficiency fractures.

We found that group I had 13 males and 12 females, group II had 14 males and 11 females and group III had 15 males and 10 females. The majority of vertebral deformities in men occur at younger ages, likely as a result of trauma. In elderly women, vertebral fractures usually occur due to normal activities such as lifting and bending over, as opposed to direct trauma from falling.⁹ Note that the prevalence of vertebral fracture may be underestimated as many such fractures are asymptomatic and therefore individuals do not seek medical attention. Vertebral fractures are associated with significant morbidity including back pain, kyphosis and height loss. This results in a marked reduction in quality of life as assessed by quality of life scores, which decrease as the number of vertebral fractures increases.¹⁰

We observed that mean CSAR in group I was 2.54, in group II was 2.05 and in group III was 2.18. Shah et al¹¹ in their study magnetic resonance imaging (MRI) studies for 100 consecutive patients, older than 60 years presenting with lower back pain, were included. For each MRI study, the CSA of the psoas and paraspinal muscles (multifidus) at the level of L4/5-disc space was measured to calculate the cross-sectional area ratio (CSAR) by two readers. They divided the patients (n = 100) into various groups based on the number of vertebral fractures. In total, 77 patients with vertebral body fractures (48 with one, 16 with two and 13 with more than two fractures) were identified with a mean age of 73 (range 60–92) years. The ratio of multifidus CSA to psoas CSA was calculated with mean values of each group (1–4) as 2.56, 1.89, 2.09 and 2.16, respectively. There was statistically significance difference of the CSAR between the cohorts (p-value = 0.0115).

Most physical therapists include strengthening exercises in treatment of patients with lower back pain and it is known that training to increase strength is usually expected to result in an increase in muscle CSA as it is a primary determinant of the capacity of a muscle to generate force.¹² Bolton et al¹³ also concluded that exercise as part of management of patients with fragility fractures may have benefit for pain. Therefore, early involvement of physiotherapy in patients with back pain and osteoporotic vertebral fractures would help with pain control and build-up of muscle strength which leads to increased back strength, endurance and improved balance as well as associated with reduce fear of falling.¹⁴

The limitation the study is small sample size.

CONCLUSION

Authors found that vertebral insufficiency fractures in the elderly show significant association with atrophy in psoas and the multifidus group of muscles. They also affect the CSAR depending on the number of fractures.

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