

The incidence and risk factors of lumbodorsal fasciitis in osteoporotic vertebral compression fractures: a retrospective study in 1182 cases

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Research Article

Keywords: osteoporotic vertebral compression fracture, lumbodorsal fasciitis, thoracolumbar fascia, fascia edema, paravertebral muscle

Posted Date: July 5th, 2022

DOI: <https://doi.org/10.21203/rs.3.rs-1765714/v1>

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Abstract

Background Lumbodorsal fasciitis contributes to residual back pain after percutaneous kyphoplasty in osteoporotic vertebral compression fractures (OVCF). This study aimed to identify the incidence and risk factors of lumbodorsal fasciitis in OVCF cases without previous spine surgery.

Methods A retrospective study of OVCF patients in a single spine center between June 2016 and October 2020. Demographics, spine trauma, back pain duration, vertebral fractures number, and comorbidity profile of OVCF with and without lumbodorsal fasciitis were summarized and compared.

Results 1182 OVCF patients averaged to 72.19 years old were included and 532 showed lumbodorsal fasciitis, approximating to a comorbidity rate of 45%. The incidence of lumbodorsal fasciitis was: 22.2% in age group < 60 and increased to 39.5% in 60–70, 45.1% in 70–80, and 59.4% in > 80 years old; 42.26% in females and increased to 57% in males; 40% in OVCF caused by apparent spine trauma and increased to 53.5% in non-traumatic OVCF; 40.6% in single OVCF and increased to 57.1% in multiple fractures involving two and 72.7% involving three or more vertebra; 36.8% in patients with pre-hospital back pain for < 1 week and increased to 43.75% for 1–2 weeks, 54.09% for 2–4 weeks, and 69.89% for 1–3 months. Patients with multiple and cardio-cerebrovascular comorbidities including hypertension, coronary heart disease, and cerebral infarction had higher risk of lumbodorsal fasciitis.

Conclusions Lumbodorsal fasciitis is a common comorbidity of OVCF. Male gender, increasing age, non-traumatic and multiple OVCF, prolonged symptom of back pain, multiple and cardio-cerebrovascular comorbidities dispose higher risk of lumbodorsal fasciitis.

Background

Osteoporotic vertebral compression fractures (OVCF) are the leading cause of back pain in ageing populations, affecting 1.4 million per year worldwide and causing high economic burdens[1, 2]. On T2-weighted fat suppression Magnetic Resonance (MR) imaging of spine, a fresh OVCF shows hyperintense signal indicating of vertebral bone marrow edema[3]. In some patients, an edema signal could also be detected subcutaneously dorsal to the thoracolumbar fascia, suggesting a comorbidity of lumbodorsal fasciitis in the OVCF[3–5]. While the epidemiology and pathogenesis of lumbodorsal fasciitis remain elusive, evidence accumulates that the lumbodorsal fascia is innervated with terminal nerves and could be a potential source of acute or chronic low back pain[6–12]. It has been increasingly recognized that the presence of thoracolumbar fascia edema potentially contributes to the residual back pain after percutaneous kyphoplasty[15–16]. However, to date, few studies have specifically investigated the incidence and risk factors of lumbodorsal fasciitis in patients with OVCF.

In this study, the demographics, spine trauma, back pain characteristics, vertebral fractures number, and comorbidity profile of OVCF were respectively summarized and compared between patients with and without thoracolumbar fascia edema. By identifying potential causes and risk factors of lumbodorsal

fasciitis, our study may help to better understand the pathomechanism of the induction and relief of back pain associated with OVCF.

Methods

Study population

This study was approved by Ethic Committee for Clinical Research of Zhongda hospital affiliated to Southeast University (No.2022ZDSYLL016-P01). Medical records and MR imaging of patients received vertebroplasty or kyphoplasty from June 2016 to October 2020 in Zhongda hospital were retrospectively studied. The inclusion criteria included: (1) aged ≥ 45 years old; (2) diagnosis of OVCF based on a complain of back pain and vertebral edema signal on T2-weighted fat suppression MR imaging; (3) full medical records depicting type of spine trauma, co-morbidity, and duration of back pain before hospitalization. Exclusion criteria included: (1) aged < 45 years old; (2) diagnosis of vertebral infection, hemangioma, multiple myeloma, metastatic tumors, and other pathological vertebral fractures; (3) previous spine surgery including vertebroplasty or internal fixation; (4) incomplete medical records or MR imaging of thoracic and lumbar spine.

Diagnosis of lumbodorsal fasciitis

Lumbodorsal fasciitis was diagnosed radiologically on the sagittal MR imaging of thoracic and lumbar spine, in which longitudinal hypointense T1, hyperintense T2, and hyperintense T2-weighted fat suppression signals were detected along and dorsal to the thoracolumbar fascia (**Fig.1**). Two radiologists independently reported the diagnose of lumbodorsal fasciitis.

Grouping and data collection

The study population was grouped according to the comorbidity of lumbodorsal fasciitis in OVCF: group of OVCF with lumbodorsal fasciitis (OVCF+LDF) and group of OVCF without lumbodorsal fasciitis (OVCF). In each group the demographic (age, gender) and co-morbidity information (hypertension, diabetes mellitus, coronary heart disease, cerebral infarction, and chronic obstructive pulmonary disease) were summarized. Number of vertebral fractures were counted on MR imaging in vertebra with bone marrow edema and grouped into single, two, and three or more vertebral fractures. Spine trauma was divided into group of apparent trauma: fall on ground or crush injury to the spine, uncertain trauma: heavy lift, lumbar sprain, strenuous cough, and no evident trauma. Duration of back pain symptom was collected from patient's chief complain after hospitalization and grouped into ≤ 1 week, 1-2 weeks (including the 2 weeks), 2-4 weeks, 1-3 months, and > 3 months.

Statistical analysis

Prism software (ver.9.1.2;Graphpad, San Diego, CA, USA) was utilized to perform statistical analysis. Descriptive statistics with Pearson χ^2 were performed to compare the frequencies and percentages of the

categorical variables between the group of OVCF+LDF and OVCF. Statistical significance was defined as P value < 0.05.

Results

Incidence of lumbodorsal fasciitis in OVCF

A total of 1182 OVCF cases without previous vertebroplasty or spine internal fixation were included in this study. Lumbodorsal fasciitis was reported in 532 patients, approximating to an incidence of 45%.

Lumbodorsal fasciitis increased in males and with increasing age

There were 219 males with OVCF and lumbodorsal fasciitis was detected in 125 of them, approximating to an incidence of 57%, which was significantly higher than a rate of 42.26% in females (Table 1). The 1182 patients were aged from 45 to 98 years (yrs) old and averaged to 72.19. The incidence of lumbodorsal fasciitis was 22.2% in the age group < 60 yrs old and was increased to 39.5% in 60–70, 45.1% in 70–80, and 59.4% in > 80 yrs old. An increased comorbidity of lumbodorsal fasciitis with aging was detected in females with OVCF (Table 1).

Lumbodorsal fasciitis increased in non-traumatic and multiple OVCF

Of the 1182 OVCF cases apparent trauma was reported by 679 (57.4%), uncertain trauma by 135 (11.4%), no evident or significant trauma to the spine by 368 (31.1%). Lumbodorsal fasciitis was detected in 53.5% of the non-traumatic OVCF, which was significantly higher than a rate of 40% in the OVCF caused by apparent spine trauma (Table 2). Vertebral fractures totalled 1153 in the 1182 cases of OVCF. The incidence of lumbodorsal fasciitis was 57.1% in multiple OVCF involving two vertebra and 72.7% in that involving three or more vertebra, which was significantly higher than a rate of 40.6% in single OVCF (Table 2).

Lumbodorsal fasciitis was associated with prolonged pre-hospital back pain

The 1182 OVCF patients were hospitalized after complaining back pain for 1 day to more than 6 months. There were 649 hospitalized within 1 week since the onset of back pain, in which 36.8% were diagnosed of lumbodorsal fasciitis. The incidence increased to 43.75% in patients with pre-hospital back pain for 1–2 weeks, 54.09% in that for 2–4 weeks, 69.89% for 1–3 months, and 69.23% for more than 3 months (Table 3).

Lumbodorsal fasciitis was associated with increased comorbidity of cardiovascular and cerebrovascular

diseases

Of the 1182 OVCF patients 559 reported comorbidity of hypertension, 191 of diabetes mellitus, 142 of coronary heart disease, 248 of cerebral infarction, and 48 of chronic obstructive pulmonary disease. Lumbodorsal fasciitis was significantly increased in patients with cardio-cerebrovascular comorbidity such as hypertension, coronary heart disease, and cerebral infarction (Table 3). 465 OVCF patients reported none of the five common geriatric comorbidity, in which 38.49% had lumbodorsal fasciitis. The incidence increased to 45.06% in patients with one comorbidity, 54.54% in that with two, and 55.3% with three comorbidities (Table 3).

Discussion

Until recently, concomitant lumbodorsal fascia edema in OVCF has long been underestimated with a less unified diagnosis of posterior fascia oedema[3, 15], thoracolumbar fascia injury[13, 16], and lumbodorsal fascia contusion[14]. The reported incidence also varied significantly from 7% in 268[3] to 50% in 120 OVCF cases[14]. To date, this was the first study specifically investigating its incidence and risk factors in a large study population of 1182 patients. Based on the increasing evidence of sensory innervation in thoracolumbar fascia and inflammation sensitized dorsal horn neurons[6–12], lumbodorsal fasciitis was used here to unify the radiological detection of edema signal along and dorsal to the thoracolumbar fascia. We showed for the first time that concomitant lumbodorsal fasciitis was high as 45% in OVCF without previous spine surgery. As was reported previously patients with thoracolumbar fascia injury were on average older than those without fascia injury[13], an average age of 72.19 yrs old in this study might contribute to the higher global incidence of lumbodorsal fasciitis than in previous reports[3, 15, 16].

Besides from older age as a risk factor for lumbodorsal fasciitis[13], it remains largely unknown what causes edema in lumbodorsal fascia. Here we showed that increasing age significantly increased lumbodorsal fasciitis in OVCF patients, especially in the females. Besides, males were at higher risk than females to develop edema in lumbodorsal fascia. As paravertebral muscle degeneration is common in aged population[17, 18], the age-related increase of lumbodorsal fasciitis may indicate a degenerative change of multifidus and erector spinae muscle during aging[5], and in males the degeneration is probably accelerated by chronic heavy burdens and lumbar muscle strain[19, 20]. As spine trauma remains the leading cause of vertebral fractures, it is possible the lumbodorsal fasciitis is also caused by the trauma that compressed vertebrae[13]. However, just on the contrary, we found that lumbodorsal fasciitis was significantly increased in the non-traumatic OVCF, suggesting fascia edema might have already occurred prior to or newly developed after vertebral fractures in those with degenerated paravertebral muscle. In support of this notion, lumbodorsal fasciitis was significantly increased in patients with prolonged pre-hospital back pain. Besides, OVCF involving multiple vertebra had higher risk of pre-existing or developing fascia edema, indicating of a reciprocal interaction between paravertebral muscle degeneration and OVCF. Accordingly, we propose a muscle-vertebrae interaction model: lumbodorsal fasciitis tends to occur in aged patients with paravertebral muscle degeneration potentiating

non-traumatic and multiple OVCF, the OVCF in return accelerates the degeneration of paravertebral muscle and lumbodorsal fasciitis probably by reducing vertebral height and inducing kyphosis.

Given that lumbodorsal fascia is innervated and could be a potential source of low back pain[6–12], it is intriguing to understand how lumbodorsal fasciitis will effect on the induction and relief of back pain associated with OVCF. Here we showed that patients with lumbodorsal fasciitis more often complained longer duration of back pain before hospitalization, suggesting a possible contribution of the fascia-originated pain to distract patients from the fracture-induced pain. It has been recently revealed that myofascial pain is associated with decreased fascia mobility and increased stiffness that could be induced in thoracolumbar fascia by injury and movement restriction[21–23]. Therefore, conservative therapy like bracing and bed rest might contribute to the higher incidence of lumbodorsal fasciitis in the OVCF with prolonged pre-hospital back pain. Reasons for delayed hospitalization were not investigated in this study, but may presumably include concern of surgical risk or complications in much aged patients with multiple comorbidities[24, 25]. We found that lumbodorsal fasciitis was significantly increased in those with cardio-cerebrovascular comorbidities such as hypertension, coronary heart disease, and cerebral infarction, but not in those with diabetes or chronic pulmonary disease. The close association between cardio-cerebrovascular disease and lumbodorsal fasciitis may indicate a shared pathophysiological basis, or a possibility of antiplatelet and antithrombotic medication in promoting fascia edema, which requires further prospective studies with long-term follow-up.

This study was limited in its retrospective nature and included OVCF patients from a single center. Secondly, VAS score of back pain was not collected and compared between the group with and without lumbodorsal fasciitis. Based on the high incidence (45%) of fascia edema in OVCF and significant pain relief after vertebroplasty, lumbodorsal fasciitis was expected to cause mild and non-specific pain in the lower back[20]. Thirdly, other related factors such as radiographic parameters of regional or global kyphosis[3, 15], body mass index (BMI)[17], and quantified paravertebral muscle degeneration[17–19] were not evaluated to fully understand the promoter of fascia edema. Further prospective studies with stratified participants and long-term follow-up are warranted for a better understanding of the risk factors and pathogenesis of lumbodorsal fasciitis.

Conclusions

lumbodorsal fasciitis occurs in 45% of OVCF without previous spine surgery. Male gender, increasing age, non-traumatic and multiple OVCF, prolonged symptom of back pain, multiple and cardio-cerebrovascular comorbidities dispose higher risk of lumbodorsal fasciitis.

Abbreviations

OVCF: Osteoporotic vertebral compression fractures;

MR: Magnetic Resonance;

BMI: Body mass index

Declarations

Ethical Approval and consent to participate

This study was approved by Ethic Committee for Clinical Research of Zhongda hospital affiliated to Southeast University (No.2022ZDSYLL016-P01).

Consent for publication

The authors affirm that human research participant provided informed consent for publication of the images in Figure 1a, 1b and 1c.

Availability of data and materials

The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

This study was supported by the National Natural Science Foundation of China (No. 81871810).

Authors' Contributions

All authors contributed to the study conception and design. Materials preparation, data collection and analysis were performed by FW, CZ, and RS. The first draft of manuscript was written by FW and all authors commented on previous version of the manuscript. All authors read and approved the final manuscript.

Acknowledgment

The authors would like to acknowledge Ji-Yang Jin and Zhong-Jiang Wang, from the radiology department of Zhongda Hospital, for their aids in diagnosis and report of lumbodorsal fasciitis.

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Tables

Tables 1 to 3 are available in the Supplementary Files section.

Figures

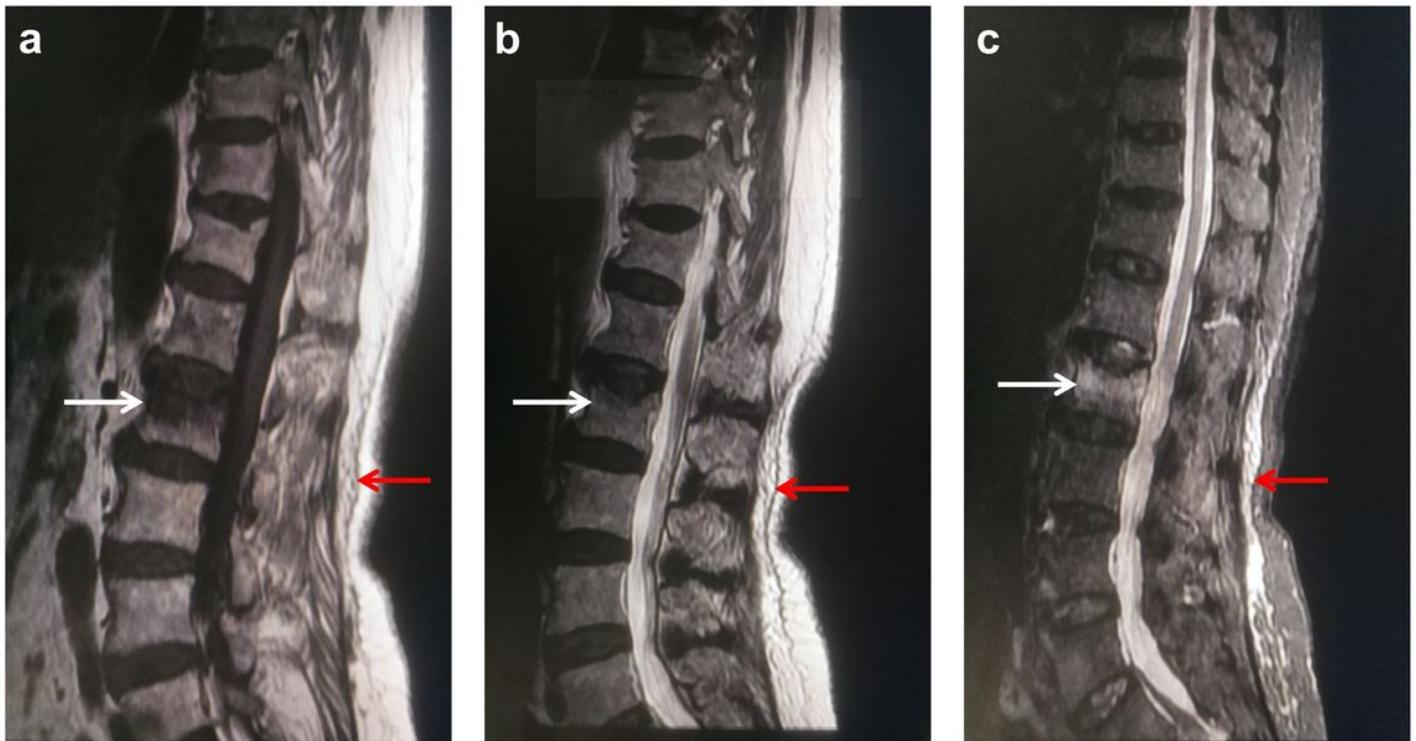


Figure 1

Radiographic diagnosis of lumbodorsal fasciitis in osteoporotic vertebral compression fractures.

The sagittal magnetic resonance (MR) imaging of lumbar spine in a 82 years old female complaining back pain for 2 weeks after fell on ground. The fractured lumbar 2 vertebrae (white arrow) showed hypointense signal on T1 (a), hyperintense on T2 (b), and hyperintense on T2-weighted fat suppression imaging (c). Longitudinal hypointense T1, hyperintense T2, and hyperintense T2-weighted fat suppression signals were also detected along and dorsal to the thoracolumbar fascia (red arrow), supporting a diagnosis of lumbodorsal fasciitis in osteoporotic vertebral compression fracture.

Supplementary Files

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