DOI:https://doi.org/10.53350/pjmhs202317780

ORIGINAL ARTICLE

Association between Trauma-Induced Vertebral Fractures and Motor Weakness in Patients with Diffuse Idiopathic Skeletal Hyperostosis

MUHAMMAD SAQIB[1], TAUSEEF RAZA[2], USMAN AKMAL[3], AHMED WAQAS[4], ARIF KALEEM[5], MIAN IFTIKHAR UL HAQ[6]
[1]*Associate Professor Department of Orthopedic Gajju Khan Medical College/ Bacha Khan Medical Complex Swabi*
[2]*Assistant Professor Department of Orthopedics KMU Institute of Medical Sciences Kohat*
[3]*Consultant Orthopedic Surgeon Department of Orthopedics THQ Gojra Faisalabad Division*
[4]*Registrar Department of Trauma and orthopaedics Mukhtar A Sheikh Memorial Welfare Hospital Multan*
[5]*Assistant professor Department of Orthopedic Farooq Hospital Bahria Golf City Akhtar Saeed Medical Collage Islamabad*
[6]*Assistant professor Neurosurgery unit Hayathabad medical complex hospital peshawar*
Correspondence to: Mian iftikhar ul haq, Email: drmiulhaq@gmail.com

ABSTRACT

Background: An age-related disorder known as diffuse idiopathic skeletal hyperostosis (DISH) causes aberrant ossification of ligaments, joint capsules, and other soft tissues.

Objective: The purpose of this study was to examine the frequency and features of diffuse idiopathic skeletal hyperostosis (DISH) in patients hospitalized to our hospital due to vertebral fractures.

Methods: The study comprised 115 patients who had just been diagnosed with a vertebral fracture. Radiographs, CT scans, and MRIs were used to confirm a recent spinal fracture and to determine whether DISH was present. We also compared patients with and without DISH based on age, sex, blood test results, treatment, duration of hospital stay, and bone mineral density.

Results: The patients mean age was 68.9 years. Among all, 42 (36.5%) cases were diagnosed with diffuse idiopathic skeletal hyperostosis (DISH), in which majority were males. There was a significant age difference between the patients in the DISH and non-DISH groups (P = 0.007), as well as higher levels of glycated hemoglobin A1c (P< 0.005), bone mineral density (P<0.004), and length of hospital stay (P< 0.001) in the DISH group compared to the non-DISH group.

Conclusion: The percentage of patients with DISH among those who suffered from vertebral fractures in our study was 36.5%. Patients with DISH need to be closely monitored because they might need various treatments.

Keywords: DISH, CT scans, Hospital stay.

INTRODUCTION

One characteristic of the age-related disorder called diffuse idiopathic skeletal hyperostosis (DISH) is the ossification of ligaments and joint capsules. When Forestier and Rotes-Querol first described this disorder in 1950, they called it "senile ankylosing hyperostosis of the spine"[1].

Ossification or calcification of at least four successive spinal levels was originally used to describe the systemic noninflammatory syndrome DISH in 1975 by Resnick and Niwayama et al.[2]. The prevalence of DISH, which ranges from 2.9% to 42.0% based on the group's risk indicators and classification criteria,[3-5].

Since most people with DISH do not have any symptoms whatsoever, it is frequently discovered through radiographs and computed tomography (CT) scans that are done to identify other disorders[6].

People with DISH are known to have a higher risk of breaking bones. Individuals with ankylosed spines have a 58% increased risk of spinal cord injury and a four-fold increased risk of fractures over their lifetimes compared to those without ankylosed spines[7]. This may be because DISH patients are more likely to experience unstable fractures, such as displacement (AO Spine-C)[9] and hyperextension (AO Spine-B3)[8].

One characteristic of the frequent disorder called diffuse idiopathic skeletal hyperostosis (DISH)[10] is bone growth in both axial and extraaxial regions. Most noticeably, this condition is characterized by ossification, legume calcification, and isolated osteophytosis along the anterolateral aspect of the vertebral bodies. Outside of the spinal canal, the most common changes noticed include bony excrescences at ligament and tendon joints, panaarticulan osteophytes, and the calcification and ossification of ligaments and tendons. Symptoms accompanied by abnormalities in the spinal column are rare for this disease. Although it is more common in Japanese patients, ossification of the posterior longitudinal ligament of the cervical spine has been seen in a small number of non-Japanese individuals as well[4–10].

Received on 01-04-2022
Accepted on 05-06-2023

This ossification, which is noticeable on radiographs, may be present in cervical myelopathy even if no apparent symptoms or indications are present[11,12].

The following are the diagnostic criteria for DISH, according to Resnick and Niwayama: AVL ossifications in at least four adjacent vertebral bodies; relatively intact intervertebral disk space in the affected segment free of degenerative disk changes; and the lack of sacroiliac inflammatory changes or apophyseal joint degeneration[14,15]. This entity's radiological diagnosis is still up for controversy[13] since these changes point to a fully formed and evolved stage of the disease rather than its progressing nature.

There is an increased risk of cardiovascular morbidity due to DISH, which is associated with certain metabolic factors[10,19]. As a result, DISH is associated with weight gain, hypertension, cholesterol, type 2 diabetes mellitus (T2DM), increased blood sugar, a bigger waist size, a higher body mass index (BMI), and metabolic syndrome[5,10,19,20].

While the majority of individuals with DISH do not notice any symptoms, a small percentage may mention things like joint pain, swallowing difficulties, limited axial motion, or airway blockage. Patients see a reduction in bone biomechanical characteristics, which increases their risk of vertebral fractures. The reason behind this is that these vertebral fractures are more prone to instability, which raises the risk of neurological complications and even mortality, according to various research. Contrary to expectations, patients with DISH often have high bone mineral density (BMD) levels, which may indicate a reduced risk of fracture. On the other hand, some researches have suggested that this could be overstated due to factors like as ligamentous ossification and other factors that could raise the risk of fracture apart from BMD. The twelfth One such measure that can be utilized to indirectly assess trabecular microarchitecture is the trabecular bone score (TBS), which is a stand-in for bone strength[12]. Bone ossifications have little effect on the texture evaluation used by TBS to determine trabecular structure[14]. When the TBS score is low, the bone quality is reduced, the architecture is poor, and the fracture propensity is significant. Following the elimination of confounding variables, our previous research confirmed that DISH is related with trabecular microstructure deterioration and that men over the age of 50 with DISH had a significantly lower TBS compared to men without

DISH[15]. However, no study has utilized TBS to assess trabecular microstructure in women with DISH that we are aware of.

MATERIALS AND METHODS

We performed this retrospective study at Department of Orthopedic Gajju Khan Medical College/ Bacha Khan Medical Complex Swabi during July 2022 to march 2023. The requirement for informed consent was waived given the retrospective study design.

Variables that were taken into account for this study were: The first group consists of individuals who were treated for spinal fractures surgically between 2015 and 2023 and who fulfilled the Resnick criteria for ossification along the anterolateral surface of four consecutive vertebrae[2]. No one who has ever had spinal surgery or has ankylosing spondylitis could take part. These inclusion criteria were satisfied by 115 patients in total. Body mass index (BMI), age, sex, injury type, time to diagnosis, vertebral fracture severity, AO classification, ossification of the anterior longitudinal ligament (OPLL) condition at fracture site, motor weakness, and sensory disturbance as assessed by the American Spinal Injury Association impairment scale[11] (as defined by Denis[10] were among the information gathered.

A statistically significant result was defined as a p-value of less than 0.05. In order to determine whether there were any differences in continuous variables based on the presence of neurological symptoms, we employed an independent samples t-test after Levine's test of equal variances confirmed variance homogeneity. The mean plus or minus standard deviation represents the data. To determine whether the presence of neurological symptoms affected nominal parameters, we employed chi-square testing.

RESULTS

The patients mean age was 68.9 years and had mean BMI 24.17 kg/m^2. Majority cases were 77 (66.95%) males and 38 (33.05%) were females. Most common cause of injury was fall from the height followed by traffic injury.(table 1)

Table-1: Baseline characteristics of the enrolled cases

Variables	Frequency (115)	Percentage
Mean age (years)	68.9	
Mean BMI (kg/m^2)	24.17	
Gender		
Male	77	66.95
Female	38	33.05
Cause of Injury		
Fall from the height	48	41.7
RTA	41	35.7
Sports	26	22.6

Among all, 42 (36.5%) cases were diagnosed with diffuse idiopathic skeletal hyperostosis (DISH), in which majority were males. (Table 2)

Table-2: Association of DISH

Variables	Frequency	Percentage
DISH		
Yes	42	36.5
No	73	63.5
Gender		
Male	27	64.3
Female	15	35.7

There was a significant age difference between the patients in the DISH and non-DISH groups (P = 0.007), as well as higher levels of glycated hemoglobin A1c (P< 0.005), bone mineral density (P<0.004), and length of hospital stay (P< 0.001) in the DISH group compared to the non-DISH group. (Table 3)

Table-3: Comparison of outcomes among DISH and non-DISH

Variables	DISH (42)	Non-DISH (73)
Age (years)	65.17	57.23
Glycated hemoglobin A1c (elevated)	24 (57.1%)	13 (17.8%)
Bone mineral density (ΔHU)	142.9	121.6
Length of hospital stay (days)	13.7	5.8

DISCUSSION

In the last decades of the twentieth century, researchers identified a number of potential causes of DISH. There is contradictory data regarding them. As a result of being overweight or obese with a high body mass index (BMI), the authors mention the following conditions as risk factors for DISH: type 2 diabetes mellitus, gout, atherosclerosis, coronary heart disease, arterial hypertension, and similar ones. Elevated levels of glucose, cholesterol, triglycerides, uric acid, and other biochemical abnormalities might manifest in a variety of ways.

Our results reveal that being older than 50 is a risk factor for developing DISH, which is in line with the findings of other authors[13] who show that the prevalence of the condition increases with age.

Due to the widespread use of CT scans, the diagnostic rate of DISH has increased, which is a change from earlier studies that revealed an incidence rate of 7-40%[14]. Discomfort in the elderly is common. After extensive spinal fusion with DISH, patients with poor bone density have significantly reduced spinal mobility and are more likely to fracture from even minor trauma[15]. A statewide multi-institutional survey in Japan found that the most common cause of injury was falling while standing or sitting[16]. After a fracture, the lever-arm mechanism is activated, which raises the possibility of the damaged segments being displaced and, in the long run, of spinal cord damage. Spinal cord injuries not only cause physical problems, but also increase the likelihood of mental health concerns including anxiety and sadness. These illnesses require psychiatric care and surveillance[17].

There are currently no known causes for neurological symptoms to manifest. Shortly after the injury, neurological deficits manifest in around 50% of patients, and paralysis ranging from A to C is observed in approximately 33% of patients[13]. Okada et al.[18] found a correlation between spinal cord injuries and neurological symptoms as well as structural instability. Neurological symptoms are more common with injuries to the cervical spine compared to the thoracolumbar spine, and the risk of these symptoms is increased by OPLL sequelae. Previous studies have shown that neurological symptoms are more prevalent after cervical spine injuries and are more severe after posterior column injuries; our findings support these findings. This is one of the few research that examines the correlation between spinal fractures and post-injury neurological damage in individuals with DISH. In this study, paralysis following an injury was significantly linked to a high prevalence of spinal canal stenosis as seen on sagittal CT and MRI scans. Another criterion for paralysis was a stenosis rate of 32% on CT and 55% on MR. When a suspected fracture is associated with DISH, the first diagnostic test requested is a CT scan to evaluate the risk of paralysis. Patients treated with DISH for thoracolumbar fractures have the highest reported incidence of delayed palsy[19]. In patients at high risk of postponed paralysis, prompt surgical intervention can prevent the condition.

It is critical to diagnose and treat patients with DISH-related fractures as soon as possible. The Frankel classification only allowed for a single level of improvement in four out of sixteen patients experiencing neurological symptoms. Neither our findings nor those of Bransford et al.[20] differed significantly from one another. The latter group discovered that only 22% of patients with cervical DISH-related fractures achieved neurological improvement following surgery. When patients suffer from neurological symptoms, the treatment outcomes for DISH-related fractures are less than ideal. On the other hand, surgical treatment has shown promising results in reducing neurological symptoms. Neurological outcomes are better when surgery is performed soon after a fracture, according to research[16]. If spinal cord decompression is performed promptly during surgery following a spinal cord injury, the results may be better.

Like fractures in long bones, those caused by DISH are inherently unstable and can shift around[21]. Even in patients with mild initial displacement and no overt paralysis, this is obvious. Any patient, paralyzed or not, who has suffered a fracture as a

result of DISH should have surgery without delay. Our investigation confirms previous findings that paralysis is more prevalent when the dislocation is more than 32% on CT.

CONCLUSION

The percentage of patients with DISH among those who suffered from vertebral fractures in our study was 36.5%. Patients with DISH need to be closely monitored because they might need various treatments.

REFERENCES

1. Forestier BJ, Rotes-Querol J: Senile ankylosing hyperostosis of the spine. Ann Rheum Dis. 1950, 9:321-30. 10.1136/ard.9.4.321
2. Resnick D, Shaul SR, Robins JM: Diffuse idiopathic skeletal hyperostosis (DISH): Forestier's disease with extraspinal manifestations. Radiology. 1975, 115:513-24. 10.1148/15.3.513
3. Holton KF, Denard PJ, Yoo JU, Kado DM, Barrett-Connor E, Marshall LM: Diffuse idiopathic skeletal hyperostosis and its relation to back pain among older men: the MrOS Study. Semin Arthritis Rheum. 2011, 41:131-8. 10.1016/j.semarthrit.2011.01.001
4. Westerveld LA, van Ufford HM, Verlaan JJ, Oner FC: The prevalence of diffuse idiopathic skeletal hyperostosis in an outpatient population in The Netherlands. J Rheumatol. 2008, 35:1635-8.
5. Kim SK, Choi BR, Kim CG, et al.: The prevalence of diffuse idiopathic skeletal hyperostosis in Korea. J Rheumatol. 2004, 31:2032-5.
6. Mazières B: Diffuse idiopathic skeletal hyperostosis (Forestier-Rotes-Querol disease): what's new?. Joint Bone Spine. 2013, 80:466-70. 10.1016/j.jbspin.2013.02.011
7. Westerveld LA, van Bemmel JC, Dhert WJ, Oner FC, Verlaan JJ: Clinical outcome after traumatic spinal fractures in patients with ankylosing spinal disorders compared with control patients. Spine J. 2014, 14:729-40. 10.1016/j.spinee.2013.06.038
8. Vaccaro AR, Oner C, Kepler CK, et al.: AOSpine thoracolumbar spine injury classification system: fracture description, neurological status, and key modifiers. Spine (Phila Pa 1976). 2013, 38:2028-37. 10.1097/BRS.0b013e3182a8a381
9. Nagashima C: Cervical myelopathy due to ossification of the posterior longitudinal ligament. J Neurosurg 37:653- 660, 1972
10. Yanagi T: Ossification of the posterior longitudinal ligament. A clinical and radiological analysis of forty-six cases. Brain Nerve 22 : 909-921
11. Takahashi M, Kawanami H, Tomonaga M, Kitamura K: Ossification of the posterior longitudinal ligament. A roentgenologic and clinical investigation. Acta Radio! [Diagn] (Stockh) 13:25-36, 1972
12. Bakay L, Cares HL, Smith RJ: Ossification in the region of the posterior longitudinal ligament as a cause of cervical myelopathy. J Neurol Neurosurg Psychiatr 33 : 263-268, 1970
13. Rhotschild B, Grogon D. Diffuse idiopathic skeletal hyperostosis, treatment and management. Medscape 2011; 31.
14. Kim SK, Choi BR, Kim CG, et al.: The prevalence of diffuse idiopathic skeletal hyperostosis in Korea. J Rheumatol. 2004, 31:2032-5.
15. Furukawa M, Okuyama K, Ninomiya K, Yato Y, Miyamoto T, Nakamura M, Matsumoto M: Association of continuous vertebral bone bridges and bone mineral density with the fracture risk in patients with diffuse idiopathic skeletal hyperostosis. Asian Spine J. 2022, 16:75-81.
16. Okada E, Yoshii T, Yamada T, et al.: Spinal fractures in patients with diffuse idiopathic skeletal hyperostosis: A nationwide multi-institution survey. J Orthop Sci. 2019, 24:601-6.
17. Mofatteh M, Mashayekhi MS, Arfaie S, et al.: Anxiety and depression in pediatric-onset traumatic spinal cord injury: a systematic review. World Neurosurg. 2024, 184:267-282.e5.
18. Okada E, Tsuji T, Shimizu K, et al.: CT-based morphological analysis of spinal fractures in patients with diffuse idiopathic skeletal hyperostosis. J Orthop Sci. 2017, 22:3-9.
19. Katoh H, Okada E, Yoshii T, et al.: A comparison of cervical and thoracolumbar fractures associated with diffuse idiopathic skeletal hyperostosis—A nationwide multicenter study. J Clin Med. 2020, 9:208.
20. Bransford RJ, Koller H, Caron T, Zenner J, Hitzl W, Tomasino A, Mayer M: Cervical spine trauma in diffuse idiopathic skeletal hyperostosis: injury characteristics and outcome with surgical treatment. Spine (Phila Pa 1976). 2012, 37:1923-32.
21. Lukasiewicz AM, Bohl DD, Varthi AG, Basques BA, Webb ML, Samuel AM, Grauer JN: Spinal fracture in patients with ankylosing spondylitis: cohort definition, distribution of injuries, and hospital outcomes. Spine (Phila Pa 1976). 2016, 41:191-6.

This article may be cited as: Saqib M, Raza T, Akmal U, Waqas A, Kaleem A, Haq MIU: Association between Trauma-Induced Vertebral Fractures and Motor Weakness in Patients with Diffuse Idiopathic Skeletal Hyperostosis. Pak J Med Health Sci, 2023; 17(7): 80-82.