Does increased weight lead to degenerative spine disease?

An evaluation with bone scintigraphy in Maadi Military Hospital

Thesis

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Abstract

This study aimed at evaluating the prevalence of degenerative spine disease (DSD) among overweight and obese patients who were referred for bone scintigraphy with or without low back pain.

The study included 100 patients who were classified into two groups; group 1 (60 overweight and obese patients with BMI $\geq$ 25) and group 2 (40 non-obese patients considered as control group with BMI < 25).

All patients performed localized MRI on the degenerative lesions seen on bone scan as a standard procedure to confirm the bone scan results.

The prevalence of degenerative changes in the current study was 100 % in group 1 Compared to only 40% in non-obese patients. All lesions (mainly lumbar) were confirmed by MRI images.

Key Words : degenerative spine disease (DSD) - bone scintigraphy - BMI

List of Abbreviations

AL	**angle of Louis**
AP	**alkaline phosphatase**
BMI	**Body mass index**
C	**Cervical**
Ci	**Curie**
CT	**Computed tomography**
DA	**diamagnetic atoms**
DSD	**Degenerative spine disease**
FDG F-18 -PET	**Flurodeoxy glucose Flourine 18- positron emission tomography**
HEDP	**Hydroxyl ethylene diphosphonates**
HMDP	**Hydroxyl methylene diphosphonates**
L	**lumbar**
LF	**Larmor Frequency**
MAFC	**Maadi armed forces compound**
MBq	**Mega Becquerel**
MCi	**mile Curie**
MDP	**Methylene diphosphonates**
Mev	**Million electron volt**
MHZ	**megahertz**
MM	**Multiple Myeloma**
MRI	**Magnetic Resonance Imaging**
OFC	**Osteitis fibrosacystica**
PD	**Pott’s disease**
PD	**Paget’s disease**
PET	**positron emission tomography**
PMA	**paramagnetic atoms**

PTH	**parathyroid hormones**
PTHrP	**parathyroid hormone related protein**
PYP	**pyrophosphate**
RF	**radiofrequency**
Sr-85	**Strontium-85**
Sr-87m	**Strontium-87m**
T1	**The longitudinal or spin-lattice relaxation time**
T2	**The transverse or spin-spin relaxation time**
Tc-99m	**Technetium-99m**
VC	**Vertebral column**

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Introduction

Degeneration of the spine is universal and involves structural changes in the disc, bone, ligaments, and articular cartilage of the facet joints. Despite the high prevalence of degeneration, the underlying etiology is still only partially understood. There is, however, an interrelationship of the different components of the spine in these changes in one component, such as the disc, will have an effect on another, such as altered biomechanics of the facets. Similarly, alterations in the structure of the vertebral end plate may affect the nutrition of the disc and the viability of the chondrocytes (1).

Degeneration of the spine is a natural aging process and increases in extent and severity with age. Miller and associates(1) reported an increase in disc degeneration from 16% at age of 20 to 98% at age of 70 based on microscopic disc degeneration grades of 600 autopsy specimens. Reduction in disc signal intensity on MRI is one of the degenerative findings most highly associated with age (2).

A Miller and associates study of both cervical and lumbar spine showed heritable estimates were very high for both lumbar and cervical spines after adjusting for age, weight, smoking, occupation, and

physical activity and disc bulging and height, were the primary contributors to the disc degeneration(3).

PREVALENCE AND EPIDEMIOLOGY

Low back and neck pain are common elements in developed countries, with an estimated 40% to 70% of adults having suffered low back pain. Low back and neck pain are a major source of disability and loss of working time. In most cases the pain resolves, but recurrent episodes may occur, ranging from 20% to 44% within 1 year after an episode of acute low back pain, with 80% suffering a recurrence within 10 years. For approximately 5% of the adult population, low back pain becomes persistently disabling and chronic. The incidence and prevalence of symptomatic herniated nucleus pulposus are much lower, with 1% of those between 17 and 64 years reporting discomfort from lumbar intervertebral disc herniation and between 0.1% and 0.5% of the population per year within the age range of 20 to 64 having a new clinically manifest herniated nucleus pulposus, with a peak incidence between 38 and 44 years of age (4).

Aim of the work

The aim of this work was to investigate the influence of patient's body weight on the incidence of degenerative spine disease using Tc-99m MDP bone scan.

Anatomy of the Vertebral Column

The vertebral column (spine) forms the central axis of the skeleton. The great strength of the spine comes from the size and architecture of the vertebrae and the tightness of the ligaments and muscles holding them together. The great strength combined with great flexibility is due to the presence of many joints that are so close together. Finally, the spine contains in its cavity the spinal cord, to which, it gives great protection from external violence (5).

The vertebral column is made up of five parts with individual vertebrae peculiar to each: cervical, thoracic, lumbar, sacral and coccygeal **(Fig.1).**

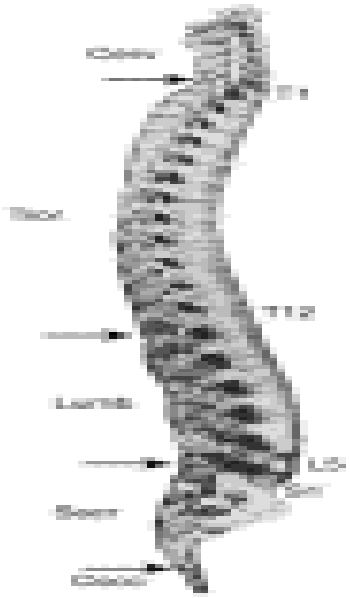

Figure (1): Lateral view of dried preparation of the spine with anterior longitudinal and supraspinous ligaments intact.

General characteristics of the vertebrae

The vertebra consists of a ventral body and dorsal vertebral or neural arch; they enclose between them the vertebral foramen. The collective name given to the whole series of foramina when the vertebrae are strung together as a column is the vertebral canal. From the neural arch three processes diverge; in the posterior midline, the spinous process, and on either side the transverse processes. At the back of the sides of the body are superior and inferior articular facets for articulation with the heads of ribs. That part of the neural arch between spinous process and the transverse process is the lamina, whereas that part between transverse process and body is called the pedicle, which connects the rest of the arch to the body**(Fig.2)**(5).

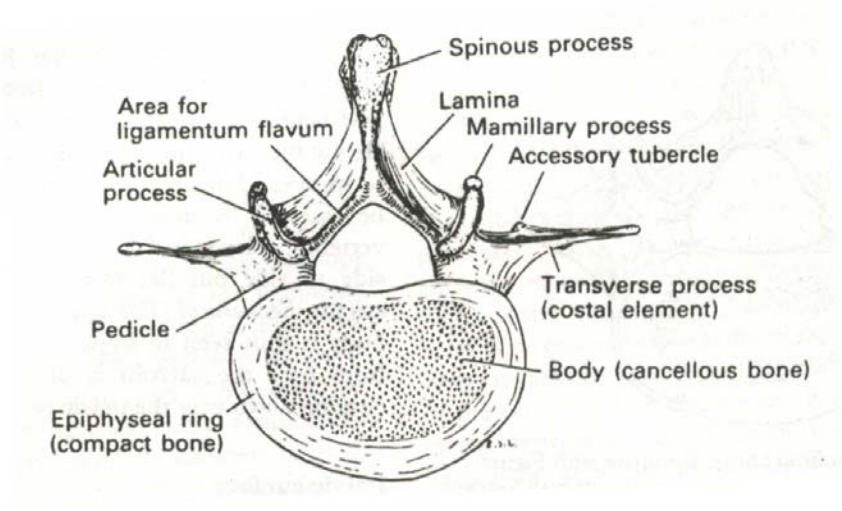

Figure (2): Typical lumbar vertebra from above.

The junctions of lamina and pedicle (i.e., at the root of the transverse process) are articular processes. The superior and inferior articular processes have hyaline cartilage facets for synovial joints between the neural arches. The direction of the facets conforms with and determines the nature of the movement possible between adjacent vertebrae (5).

An intervertebral disc is a secondary cartilaginous joint. The upper and lower surfaces of each vertebral body are covered completely by a thin plate of hyaline cartilage. A peripheral ring of fibrous tissue, the annulus fibrosus, unites these plates (5).

Joints between the arches

The pedicles of adjacent vertebrae are not attached to one another, so leaving a space -the intervertebral foramen- for the emergence of the spinal nerve. All other parts of the neural arch are joined to their adjacent companions: The articular processes by synovial joints, and the remainder by ligaments, of which the most important are the ligamentous flavum and the supraspinous ligament. The joints between the articular facets of the superior articular processes of one vertebra and the inferior facets of the inferior articular processes of the vertebrae above are properly called the zygapophyseal joints, but are more simply known as facet joints. They

are synovial with a simple capsule which blends laterally with a ligamentum flavum. The articular surfaces allow gliding of one on the other; the direction of the surfaces determines the direction of the possible movements between the adjacent vertebrae. Although most of the weight transmitted by the vertebral column takes place via the vertebral bodies and intervening discs, a small amount does occur through these joints. The lowest ones between the inferior facets of L5 vertebra and the sacrum, are important in helping to prevent the vertebral column sliding off the sacrum; if the neural arch is fractured in front of these joints, the body of L5 slips downwards and forwards (spondylolisthesis)(5)(**Fig.3).**

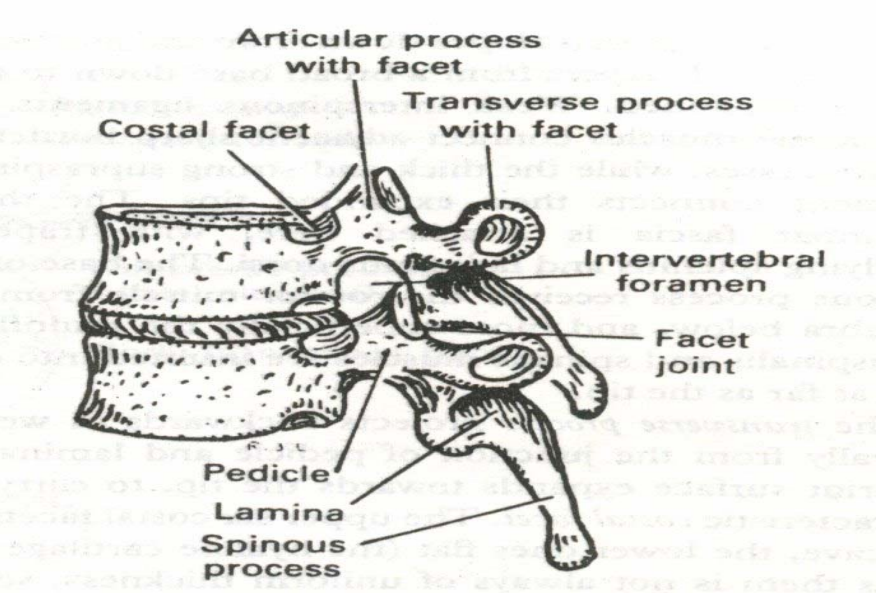

Figure (3): Joints between the arches.