Role of Interventional Radiology in Musculoskeletal System

Essay

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In Radiodiagnosis

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Introduction and aim of work

Therapeutic interventions in musculoskeletal system are becoming an essential part in interventional radiology.
Ultrasonography is a readily available imaging modality useful for guiding interventional procedures of the musculoskeletal system including therapeutic injections, fluid aspirations and soft tissue biopsy.
(Sofka et al., 2001).

C.T. and M.R.I. are preferred for a variety of percutaneous procedures improving both technical and procedural quality and ensuring patient safety **(Weidner et al., 2004).**

C.T. guided procedures include radiofrequency heat ablation which has proven to be an effective method in treatment of benign tumors as well as its role in malignant tumors and bone metastases. C.T. is also useful in guiding vertebroplasty, a minimally invasive procedure used for pain control in bone metastases, as well as stabilization of osteolytic and osteoporotic lesions **(Schaefer et al, 2002)**

MR guided interventional procedures involving bone and soft tissues are also useful in clinical practice **(Genant et al, 2002).**

Aim of work:

To highlight the value of interventional radiology as a safe , effective and less invasive procedure used in the diagnosis and treatment of musculoskeletal diseases.

RELATED ANATOMICAL TOPICS OF THE MUSCULOSKELETAL SYSTEM

-The general framework of the body is built up mainly of a series of bones ,supplemented, however, in certain regions by pieces of cartilage ;the bony part of the framework constitutes the skeleton**(Standring, 2004).**

In the skeleton of the adult there are 206 distinct bones, as follows:-
-Axial skeleton:-
Total:74
-Appendicular skeleton:-
Total:126
-Auditory ossicles:-6
-Total:206
-The patellae are included in this enumeration ,but the smaller sesamoid bones are not**(Standring, 2004).**

-Bones are divided into 4 classes:

1-Long bones:

The long bones are found in the limbs.Each consists of a body or shaft, and 2 extremities.The body is cylindrical, with a central cavity named the medullary canal; the wall consists of dense compact tissue. The extremities are generally expanded ;for the purposes of articulation and muscular attachment.

Examples: The clavicle , humerus ,radius , ulna , femur , tibia , fibula , metacarpals , metatarsals ,and phalanges**(Standring, 2004).**

2-Short bones:

Intended for strength and compactness, combined with limited movement, as in the carpus and tarsus. It consist of cancellous tissue covered by a thin crust of compact substance. The patellae ,together with other sesamoid bones ,are regarded as short bones**(Standring, 2004).**

3-Flat bones:

For extensive protection ,or the provision of broad surfaces for muscular attachment ,as in the skull and the scapula. These bones are composed of 2 thin layers of compact tissue enclosing between them a variable quantity of cancellous tissue**(Standring, 2004).**

4-Irregular bones:

They consist of cancellous tissue ,Enclosed within a thin layer of compact bone. Examples: vertebrae,sacrum and coccyx**(Standring, 2004).**

A)THE AXIAL SKELETON (THE VERTEBRAL COLUMN)

The vertebral column forms the central axis of the skeleton.The greater strength of the column comes from the size and architecture of the bony elements, the vertebrae, and the strength of the ligaments and the muscles that hold them together. This great strength is combined with great flexibility. The vertebrae are thirty three in number. They are seven in the cervical region ,twelve in the thoracic ,five in the lumbar ,five in the sacral ,and four in the coccygeal. The vertebral column is the posterior part of the trunk where its average length in the male is about 71 cm**(Clemente, 2006).**

-General features of a vertebra

A vertebra has basically a ventral body and a dorsal vertebral or neural arch. They enclose between them the vertebral foramen (vertebral canal is the collective name given to the whole series of foramina when the vertebrae are strung together as a column).From the neural arch three processes diverge ;in the posterior midline ,the spinous process or the spine ,and on the either side the transverse processes. The part of the neural arch between the spinous process and transverse process is called the lamina. The part between the transverse process and the body is called the pedicle**(Standring, 2004).**

At the junction of the lamina and pedicle lie the articular processes. The articular processes are paired, superior and

inferior. Articular processes of adjacent vertebrae form a small synovial apophyseal joints. These joints permit limited movements between the vertebrae. The body is composed of cancellous tissue ,covered by a thin coating of compact bone. **(Standring, 2004).**

-Blood supply of the vertebrae

The vertebrae are supplied segmentally by the vertebral, ascending and deep cervical ,intercostals ,lumbar ,and lateral sacral arteries ,which give multiple small branches to the vertebral bodies. Vertebral body drains into the internal vertebral venous plexus ,which lies inside the vertebral canal. It drains into the external vertebral venous plexus which then drains into the regional segmental veins (vertebral, posterior intercostals ,lumbar and sacral veins) **(Standring, 2004).**

-Vertebral joints

Adjacent vertebrae are held together by strong ligaments and small joints.

***Joints between the bodies:**

The bodies of adjacent vertebrae are held together by the strong intervertebral disc,and by the anterior and posterior longitudinal ligaments**(Standring, 2004).**

-Intervertebral disc:

An intervertebral disc is a secondary cartilaginous joint . The intervertebral discs are connected to the anterior and posterior longitudinal ligaments.The normal intervertebral disc can be divided into 2 components: the nucleus pulposus and the annulus fibrosus.These are intimately related to the cartilaginous end plate of the vertebral body.The intervertebral

disc collagen is primarly of type I and type II collagen ,both of which have similar molecular structures**(Sinnatamby, 1998)**.

-Functions of the intervertebral discs:

The two primary functions of the intervertebral disc are weight bearing (especially in the lumbar spine) and flexibility assisting in force distribution and shock absorption (mechanically protecting the vertebrae). Human intervertebral discs are thickest at the cervical and lumbar levels ,where movements of the vertebral column are greatest**(Sinnatamby, 1998).**

***Joints between the arches:**

The pedicles of adjacent vertebrae are not attached to one another ,so leaving a space ,the intervertebral foramen , for the emerge 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 ligamentum flavum and the supraspinous ligament.The joints between the articular facets of the superior articular processes of one vertebra and the articular facets of the inferior articular processes of the vetebra above are termed the apophyseal joints (or simply known as facet joints),they are synovial in nature. Although most of the weight transmission by the vertebral column takes place via the vertebral bodies and intervening discs ,a small amout does occur through these joints **(Clemente, 2006)**.

1)The cervical vertebrae

Are the smallest of the true vertebræ, and can be readily distinguished from those of the thoracic or lumbar regions by the presence of a foramen in each transverse process. The first, second, and seventh present exceptional features**(Standring , 2004).**

The first cervical vertebra is named the **atlas** because it supports the globe of the head. Its chief peculiarity is that it has no body. Its other peculiarities are that it has no spinous process, is ring-like, and consists of an anterior and a posterior arch and two lateral masses**(Standring , 2004).**

The second cervical vertebra is named the **axis** because it form the pivot upon which the first vertebra, carrying the head, rotates. The most distinctive characteristic of this bone is the strong odontoid process which rises perpendicularly from the upper surface of the body**(Standring , 2004).**

The most distinctive characteristic of the seventh vertebra is the existence of a long and prominent spinous process, hence the name **vertebra prominens.** This process is thick, nearly horizontal in direction(**Standring , 2004).**

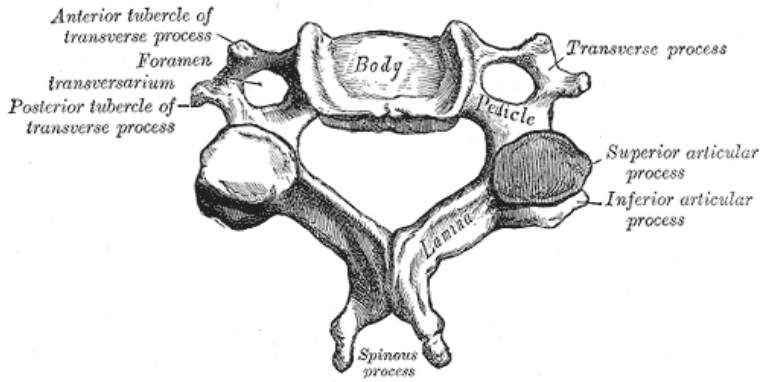

Figure 1. cervical vertebra superior aspect(**Standring , 2004)**

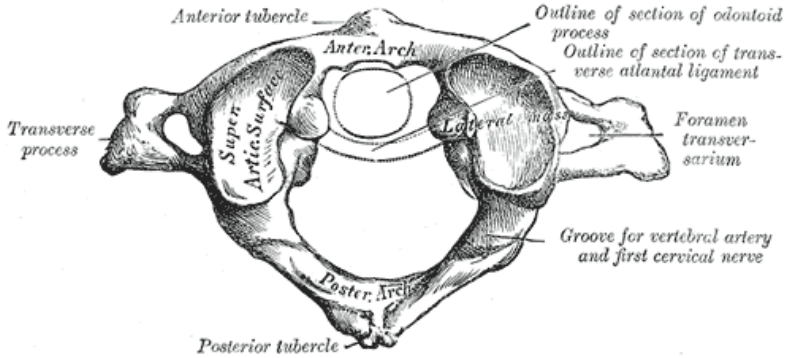

Figure 2. First cervical vertebra superior aspect(**Standring , 2004)**

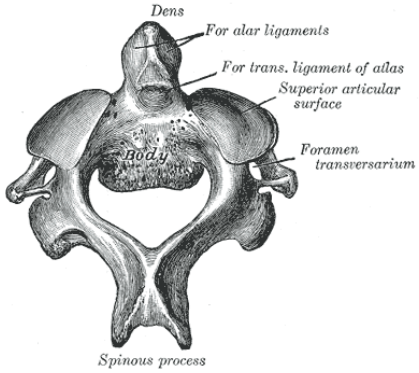

Figure 3. Second cervical vertebra superior aspect **(Standring , 2004)**

2)Thoracic vertebra

The thoracic vertebræ are intermediate in size between those of the cervical and lumbar regions; they increase in size from above downward. . They are distinguished by the presence of facets on the sides of the bodies for articulation with the heads of the ribs,and facets on the transverse processes of all, except the eleventh and twelfth, for articulation with tubercles of the ribs**(Sinnatamby, 1998**).

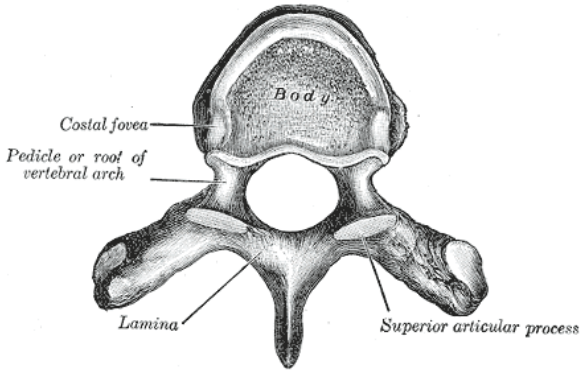

Figure 4. Thoracic vertebra superior aspect(**Standring, 2004)**

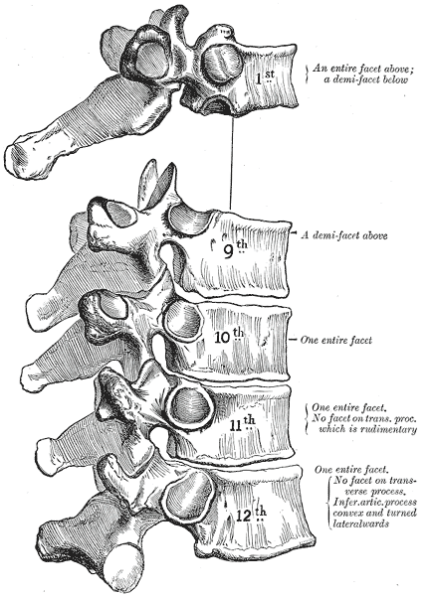

Figure 5. Thoracic vertebrae(**Standring, 2004)**