IAMJ

INTERNATIONAL
AYURVEDIC
MEDICAL JOURNAL

Review Article ISSN: 2320-5091 Impact Factor: 6.719

# IMPORTANCE OF RADIOLOGY IN ANATOMY

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https://doi.org/10.46607/iamj1710012022

**(Published Online: January 2022)**

**Open Access**



**Article Received:** 19/10//2021 - **Peer Reviewed:** 30/10/2021 - **Accepted for Publication** 31/10/2021

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## ABSTRACT

The human anatomy (*Sharir Rachana*) is important for allied health sciences. It is one of the fundamental subjects of health science. *Ayurveda* deals with the scientific study of the subject *Sharir Rachana* (Human anatomy) in *Bruhatrayee*. *Sharir Sthan* is illustrated in various parts starting from Embryo developments for human anatomy. Knowledge of the human body is the very foremost step in the world of medical science. The human body is made up of *Sukshma Sharir* & *Sthula Sharir* & both are the site of diseases. Not only a surgeon but also a physician must be well acknowledged with comprehensive details of *Rachana Sharir* (Anatomy). Knowledge of the human body is the very first step in the world of medicine. *Sharir* means human body & *Rachana* means Structure. So *Rachana Sharir* is the branch of *Ayurveda* which deals with the knowledge of the structure of the human body. This branch consists of knowledge about bones, muscles, vessels, joints, ligaments, tendons, vital organs etc. *The ayurvedic* aspect of *Rachana* is also knowing *Marmas, Garbha Sharir* and *Srotas Sharir* etc. Nowadays for the better visual structural study of an internal organ, cavity and bone etc. need *Vikiran Avum Chhaya* (Radiology and Imaging). In the development of Rachana Sharir radio anatomy is one of the most important technologies.

**Keywords**: *Sukshma, Sthula, Srotas, Marma and Garbha*

## INTRODUCTION

The core concepts of *Rachana Sharir* or Anatomy in *Ayurveda* are exemplary. All components, tissues, organs and organ systems of the body fall within this broad group of *Shadangas*. *Sharir Rachana* is the branch of *Ayurveda* which states a detailed description of the structures in the human body. This branch consists of knowledge about bones, muscles, blood vessels, *Strotas*, joints and vital organs etc. It also gives knowledge of *Garbhasharir*, *Kala* and *Marmas*. *Acharyas* like *Sushruta, Charaka* and *Vagbhata* have given importance to the knowledge of *Rachana Sharir*. This Human *Sharir* is mainly made up of six main parts or segments. These six parts are called *Angas*. Thus, the *Sharir* or human body is made up of *Shadanga* or six segments.

*Shadanga* forms the foremost classification of body parts a gross demarcation or surface marking of the body into six large units. *Shadang* = *Shad* (6) + *Anga* (parts, segments). The *Shad Angas* are- 2 upper limbs, 2 lower limbs, 1 head and 1 trunk (central portion of the body)

*Rachana Sharir* is a basic subject of medical science which is known as anatomy in modern medicine. Its study comprises structural, functional and metaphysical aspects of the human body. To deal with this subject a whole-body dissection is performed on the cadaver. Cadaver/dead body preservation technique is taught to the students. Radiological study of the whole body is explained to them. Besides normal anatomy subject deals with congenital anomalies, pathological anatomy, normal and abnormal functioning of every body part.

**Human Anatomy**

The scientific study of the morphology of the adult human is subdivided into gross anatomy and microscopic anatomy. Gross anatomy (also called topographical anatomy) is the study of anatomical structures that can be seen by unaided vision. Microscopic anatomy is the study of minute anatomical structures assisted with microscopes and included histology (the study of the organization of tissues), and cytology (the study of cells).

**Branches of Human Anatomy**

There are some specific branches of human anatomy such as,

1. Gross anatomy- systemic or region-wise study of human body parts and organs. Gross anatomy encompasses cadaveric anatomy and osteology.
2. Microscopic anatomy/histology
3. Cell biology (cytology) and cytogenetics
4. Surface anatomy
5. Developmental anatomy/embryology
6. Radiological anatomy

Above all the branches nowadays Radiological Anatomy more use and most important for knowing.

**Radiological anatomy**

Radio anatomy is an anatomy discipline that involves the study of anatomy through the use of radiographic films. The x-ray film represents a two-dimensional object due to the summary projection of different anatomical structures. Radiological anatomy is where your human anatomy knowledge meets clinical practice. It gathers several non-invasive methods for visualizing the inner body structures. The most frequently used imaging modalities are radiography (X-ray), computed tomography (CT) and magnetic resonance imaging (MRI). X-ray and CT require the use of ionizing radiation while MRI uses a magnetic field to detect body protons. MRI is the safest among the three, although each technique has its benefits. The preferred method depends on the structures we wish to examine. Nowadays mostly uses of imaging modalities are such types I.e.

1. **Ionizing Radiation: -** X-ray, Gamma Rays, Plane radiographs, Contrast Radiograph, Commuted Tomography (CT), PET.
2. **Non- Ionizing Radiation: -** Ultra Sonography (USG), Doppler, Magnetic Resonance Imaging (MRI).

**RADIOGRAPHY**

Radiography is the imaging method that uses x-rays or electromagnetic waves. These waves pass through the person's body, with some rays being absorbed by the tissues and others reaching the radiographic film behind. Thus, creating a two-dimensional (flat) image

called a radiograph. Dense tissues (bone) will absorb most of the rays and come out on the radiograph as white, while air doesn't block any rays and comes out as black. Other issues are somewhere in between i.e., grayscale.

**Radio-Opacities**

The main principle of all radiographic tests that employ X-rays is that different tissues have a different capacity to block or absorb X-rays. The tissue densities which are usually seen on a radiograph are as follows-

**Air**- It is found, in the trachea and lungs, the stomach and intestine and paranasal sinuses.

**Soft Tissues**- e.g., Heart, Kidney, Muscle (These are all approximately the dense water).

**Calcified**- (due to the presence of calcium and phosphorus), for example in the skeletal muscles.

**The enamel of Teeth**-

**Dense foreign bodies**- For example metallic filling in the teeth. Also, radio-opaque contrast media such as barium meal in the stomach or intravascular contrast.

**These rules translate into a basic radiographic language.**

**Density** or opacity refers to bright (white) areas of the graph. E.g., humerus bone.

**Lucency** refers to dark (black) areas of the graph. E.g., the air in the lungs.

X-ray continues to be a highly utilized medical imaging modality as it offers high spatial resolution and enables comprehensive visualization of structures that can be hard to perceive in axial (cross-sectional) perspectives. Radiography is most often used in chest x-rays (cxr), abdominal and skeletal x-rays.

**Plain Radiographs**-

In it no contrast media is used. It is produced by the passage of X-rays through the subject and exposing a radiographic film. The bone absorbs most radiation causing the least film exposure, thus developed film appears white at such region. On the other hand, the air absorbs the least radiation causing maximum exposure, so film appears black on such area. Between these extremes, large differential tissue absorbs radiation-producing greyscale images.

**Types of view**

**Posteroanterior View (PA view)**

The beam of rays enters from the back to the front of the subject. In this view, the structures visible are mostly the anterior-most structures.

**Anteroposterior View (AP view)**

In this view, the beam enters from the front to the back of the subject. In this view, the structures visible are mostly the posterior-most structures.

**Lateral View**

In this view, the beam passes through the lateral part of the body, or it passes through the sideways of the body.

**Oblique View**

In this view, the beam enters any part at a particular angle so that the structures which are not seen in all other 3 views can be visualised.

**Contrast Radiographs**

In this radiograph the density of a structure is too similar to that of adjacent structures, it is more preferable to use contrast media to enhance or outline its contours. It is used to obtain more information about various soft tissues components and also various body cavities. Contrast media are classified as radiolucent (e.g., air) and radio-opaque (e.g., Barium or Iodinated contrast media). The contrast agent is being used here mainly consisting of salts of Barium and Iodine. These by utilization of photoelectric effect absorb X-rays completely resulting in a white film where the beam has met contrast agent.

**COMPUTED TOMOGRAPHY (CT)**

Computed tomography (CT), earlier referred to as computed axial tomography (CAT), is another non-invasive imaging procedure. CT works by using x-rays too, but the machine is more advanced. It rotates around a stationary person creating multiple cross-sectional images, which can then be rendered into a 3D image. This gives us a cross-sectional slice of the specific body region. As CT uses x-rays, the image also depends on tissue density. Density is expressed in the Hounsfield unit (HUs), which spans from +1000 for bones (bright), 0 for water (grey), to -1000 for air (dark). Every tissue in the body has its normal density

familiar to radiologists. If the density is altered, we express that by using basic CT terminology; hyperdense, hypodense or isodense when compared to some other structure. The advantages of CT over x-ray radiography are that it enables a three-dimensional insight into the body, giving a more accurate presentation of the area of interest. There are many CT techniques, such as single slice CT (SSCT), spiral CT and multislice CT (MSCT). These techniques offer variations in the "slice" thickness and the radiation dose used to create the image. CT machines can also switch between the "bone window" and "soft tissue window", depending on which structures we want to observe. Furthermore, CT imaging can be combined with radiological contrasts which act as visualisation aids. It is important to know how to orientate with CT scans. For axial scans, imagine as if you're looking at the person through their feet (viewing the CT slice from below) while both of you are facing opposite directions. Then you can orientate by using the RALP abbreviation for 9, 12, 3 and 6 o'clock positions on the slice.

9 - Right aspect of the patient 12 - anterior aspect

3 - Left aspect 6 - posterior aspect

**MRI** (Magnetic Resonance Imaging)

MRI is an imaging modality that, besides anatomy, can also show physiological processes in the body (functional MRI - fMRI). MRI works by using magnetic fields and radiofrequency pulses to excite protons (hydrogen ions) in our body. Excited hydrogen ions emit signals toward the MRI scanner which, based on the intensity of the signal, creates a grey-scale image. As we're made mostly of fat and water, there's plenty of hydrogen to detect. The density of these protons in our tissues is related to signal magnitude, i.e., increased density = increased signal. High signal intensity is shown as white, intermediate signal intensity as grey and low signal intensity as black. When a structure is brighter than it should be, we say it's hyperintense. If it's darker, then it's hypointense. Proton density is increased in some types of lesions; oedema, infection, inflammation, demyelination, haemorrhage, some tumours and cysts, and decreased in other types of lesions; scar tissue, calcification, some tumours, capsule and membrane formation. MRI offers several modalities between which the radiographers can switch depending on what structure they want to focus on. The basic MRI methods are:

**T1w** - T1 weighted image best shows structures made of mainly fat (fluids are dark/black; fat is bright/white).

**T2w** - T2 weighted image presents structures made of both water and fat (fat and fluids are bright).

**PD** - Proton density is handy for the examination of muscles and bones. **FLAIR** - Fluid-attenuated inversion recovery best shows the brain. It is useful for identifying central nervous system diseases, such as cerebrovascular insults, multiple sclerosis and meningitis.

**DWI** - Diffusion-weighted imaging detects the distribution of fluids (extra- and intra- cellular) within tissues. As the balance between fluid compartments is altered in some conditions (infarctions, tumours), DWI is useful for both structural and functional soft tissue assessment. Flow sensitive - examines the flow of body fluids but without using contrast agents. This method examines if everything is okay with the cerebrospinal fluid flow and blood flow through the vessels. MRI is mostly used for neuroimaging (NMRI), musculoskeletal, gastrointestinal and cardiovascular system assessments.

**ULTRASONOGRAPHY (USG)**

Ultrasonography uses high-frequency sound waves emitted from a transducer through a person's skin. These sounds echo from the contours of the inner body structures bouncing back to the transducer, which then translates them into a pixelated image displayed on the connected monitor. The density of the tissues here defines how echogenic they are, meaning what amount of sound will they resonate back (echo) or pass through themselves. Very solid tissues (bones) are hyperechoic and are shown as white, loose structures are hypoechoic and shown grey, while fluid is anechoic and is shown as black. Ultrasound shows processes in real-time, which is why it is useful for the immediate assessment of certain structures. It has many applications, such as tracking pregnancy progress (obstetric ultrasound), pathology screening (e.g., breast cancer)

and examining the content of hollow organs (e.g., gallbladder). Ultrasonography adjusted for examining blood flow through arteries and veins is called Doppler ultrasonography, of which transcranial ultrasonography and carotid ultrasonography are nice examples. The former examines brain blood flow, and the latter examines flow through the carotid arteries.

## CONCLUSION

In the development of human science, *Vikiran Avum Chhaya* (Radiology and Imaging) is very important and necessary for the diagnosis of disease or from a clinical point of view. Ayurveda is an ancient science, there is no elaborate description about *Vikiran Avum Chhaya*. But nowadays the medical science is highly developed, and this way radiology is developed. Radiology or radio anatomy is used for the study of bone and visceral organs of the human body. Hence this radio anatomy or radio-imaging become easier to live for purpose of the study of human anatomy and clinically.

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**Source of Support: Nil**
**Conflict of Interest: None Declared**

How to cite this URL: Arvind Kumar: Importance Of Radiology In Anatomy. International Ayurvedic Medical Journal {online} 2021 {cited January 2022} Available from: http://www.iamj.in/posts/images/upload/111_115.pdf