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## Introduction of radiological diagnostic tool in Shalya tantra

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### Abstract

*Ayurveda* has been serving the mankind with its rich traditional resources. Surgical practice has been an inseparable part of *Ayurveda* and *Sushruta* is considered the ‘father of surgery’ because of his immense contribution towards the development of many fundamental principles and practice of surgery. The concept of diagnosis and treatments of disease is unique in *Ayurveda*. *Acharya Sushruta* describes that for visualization and finding of hidden diseases and *Salyas* in human body “*Nadi Yantra*” and “*Salaka Yantras*” was used such as Probe for finding the direction of Sinus and Fistula, Proctoscope for observation of color, size and site of internal piles. In present era Radiological diagnostic tool are used to provide medical condition of patients and monitor progress or improvement in diseases. In Modern surgery radiology perform two different type of action such as for purpose of diagnosis and purpose of treatment. Diagnostic radiology refers to a group of methods that exploit non-invasive techniques for identification of certain diseases. In present era for diagnosis of disease following tool are uses such as X-rays (Chest and abdomen), Ultrasound, Computed Tomography (CT) Scans, Magnetic Resonance Imaging (MRI) Scans and Nuclear Medicine Scans. This article focuses on Radiological diagnostic tool which help in diagnosis of surgical diseases.

**Keywords:** *Nadi Yantra*, X-rays, ultrasonography, CT Scans, MRI Scans

### Introduction

*Ayurveda* derives its origin from *Atharvaveda* and is also considered as the fifth *Veda* itself. Since the time immortal till today, *Ayurveda* has been serving the mankind with its rich traditional resources. Surgical practice has been an inseparable part of *Ayurveda* and *Sushruta* is considered the ‘father of surgery’ because of his immense contribution towards the development of many fundamental principles and practice of surgery such as plastic and reconstructive surgery and *Trividh Pariksha* <sup>[1]</sup>. In *Ayurveda Roga pariksa* (Diagnosis of diseases) is specified first place and principles of treatment and drugs are given next places in order of importance. *Acharya Sushruta* mentions that in special circumstance the application of instruments (*Yantrani*) to help in diagnosis is also permitted in *shalya tantra*. For visualization and finding of hidden diseases and *Salyas* in human body, *Acharya Sushruta* has described – “*Nadi Yantra*” and “*Salaka Yantras*” such as Probe for finding the direction of Sinus and Fistula, Proctoscope for observation of color, size and site of internal piles. Main function of *Nadi Yantra* describes in *Sushruta samhita* is to remove the *Shalya* / foreign bodies from *Srotas*, to visualize disease and to use as suction device <sup>[2]</sup>. *Acharya Sushruta* described 8 types of wounds produced during fights and burns from various sources <sup>[3]</sup>, *Vidradhi* (abscesses – situated anywhere on the surface or in internal organs) <sup>[4]</sup>, tumors, polyps, fractures, dislocations, stones in the bladder, fistula and piles, mal-presented and monster fetus, dead fetus <sup>[5]</sup> are mentioned to be treated with proper surgical procedures. Traumatic wounds, injuries on head and abdomen required suturing, deformed lips and ears required plastic surgery. Now a day diagnostic radiology is uses for confirmation of these diseases in *Shalya Tantra*.

### Diagnostic radiology

Radiology is medical imaging tests inside of the body they provide medical condition of patients and monitor progress or improvement in diseases. In Modern surgery radiology perform two different type of action such as –

#### 1. Radiology for diagnosis of diseases

Radiology for Diagnosis of diseases includes X-rays, CT (computed tomography) scans, MRI.

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(Magnetic resonance imaging) scans and ultrasonography (USG), as well as nuclear medicine imaging to create medical images. Radiologist gives interpretation of these images to diagnose illness or injury.

**2. Radiology for diagnose and treatment of diseases by imaging equipment (Interventional)**

Interventional radiology use a range of medical images including MRI scans, CT (computed tomography) scans and ultrasound for diagnosis and treatment of diseases. The interventional radiologist insert needles, catheters and wires around the body to perform medical procedures such as treating amoebic liver abscess, carcinoma, kidney stones or blocked arteries. These procedure guided MRI scans, CT (computed tomography) scans and ultrasound.

**Diagnostic Radiology:** Diagnostic radiology refers to a group of methods that exploit non-invasive techniques for identification and observation of certain diseases. In present era for diagnosis of disease following tool are uses:-

1. X-rays (Chest and abdomen)
2. Ultrasound
3. Computed Tomography (CT) Scans
4. Magnetic Resonance Imaging (MRI) Scans
5. Nuclear Medicine Scans

**X-rays**

X-rays is a type of electromagnetic radiation, for produce images of the interior of the body. For diagnosis of diseases two type of X-rays are done [6]

- Plain X-ray
- Contrast X-ray

Plain or straight X-ray are taken without giving any contrast material and contrast x-ray are taken after administrating some contrast material as in barium meal. In AP view of X-ray the x-ray film is kept at the back and X-ray exposure is done from front.

**Chest X-ray:** Important important as to be looked in chest X-ray is -

- Bony age
- The tracheal shadow lies in midline
- The cardiac shadow and assessment of cardiothoracic ratio.
- Diaphragm and costophrenic angles
- Lungs field and bronchovascular markings.
- Hilar region

**Use of chest X- ray**

Chest X- ray are used for diagnosis of pulmonary tuberculosis, pleural effusion, emphysema, accidental chest injury, breast diseases, intestinal perforation and heart

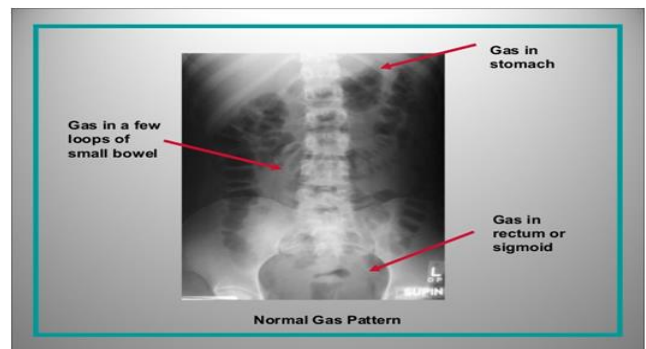
diseases.

**Abdominal X-ray:**-Important object to be looked for normal abdominal X-ray is-

- Bone and Solid organ examination
- Gas pattern
- Air fluid level
- Soft tissue masses
- Calcifications
- Foreign body

**Normal gas pattern in abdominal X-ray is**

| Stomach     | Always present                               |
|-------------|--|
| Small Bowel | Two or three loops of non-distended bowel    |
| Large Bowel | In rectum or sigmoid – almost always present |



(Figure: Normal gas pattern in Abdominal X ray (Source: www.slideshare.net)

**Indication of abdominal X-ray**

- Suspected bowel obstruction or gastrointestinal perforation
- Most cases of bowel obstruction is shown by dilated bowel loops [1].
- Foreign body in the alimentary tract; can be identified if it is radio dense [1].
- Suspected abdominal mass [1].
- For diagnosis of intra-abdominal injury [1].
- Perforated carcinoma
- Ingested foreign body
- Ureter and kidney stones

**5. Ultrasonography (USG)**

Ultrasonography (USG) is also known as diagnostic sonography or ultrasound. It produces an image of internal body organs [7].

**Mode of ultrasound:** In medical imaging ultrasonography work in 4 different modes: [8].

**Table 1:** Type of mode

|               |  |
|---------------|--|
| <b>A-Mode</b> | <ul style="list-style-type: none"> <li>• A-mode is also known as Amplitude-mode in which ultrasound is used to evaluate the depth of an organ</li> <li>• A-mode is the simplest type of ultrasonography and Therapeutic ultrasound is also A-mode that aimed at a specific tumor or calculus.</li> <li>• A-mode scan is also use in detection of fetal heart rate, placental localization and symmetry of the brain.</li> </ul>  |
| <b>B-Mode</b> | <ul style="list-style-type: none"> <li>• B-mode of ultrasound is also known as Brightness-mode and it is the basis of 2D scanning.</li> <li>• Presently B-mode is the most common form of ultrasound imaging and in this form display solid areas show white and fluid areas show black)</li> <li>• The B-mode scan is also known as real-time scanner. In this mode hand-held transducer moved to different positions or angles to get complete picture of body. This mode is used most often to scan abdomen.</li> </ul> |

|                     |  |
|---------------------|--|
| <b>M-Mode</b>       | <ul style="list-style-type: none"> <li>• The M-mode of ultrasound is also known as Motion-mode and used for analyzing moving body parts.</li> <li>• M-mode of ultrasound is commonly use in cardiac and fetal cardiac imaging.</li> <li>• In this mode high sampling frequency is useful for assess rates and motion in cardiac structures.</li> </ul> |
| <b>Doppler-Mode</b> | <ul style="list-style-type: none"> <li>• In this mode Doppler measurement is use for measuring and visualizing blood flow.</li> <li>• This mode play important role in medicine for provides valuable information about the heart condition and cardiac surgeons for provides about critical surgical procedure.</li> </ul>                            |

**Use of ultrasonography (USG)**

It is used in cases of operational review of gastrointestinal, cardiovascular, obstetric, gynecological, urological, breast examination and cerebrovascular examination. In general surgery ultrasound is routinely used in urology to determine the amount of fluid retained in a patient's bladder. Organs of the pelvic region are imaged, in a pelvic sonogram. A pelvic sonogram is done in males to check the condition of their bladder, prostate, or testicles.

**Component of ultrasonography (USG) device**

Main component use in ultrasound is transducer, transmitter pulse generator, control unit for focusing, compensating amplifiers and digital processors.

**Therapeutic applications of ultrasonography (USG)**

- Ultrasonography is uses for drainage of *Yakritvidradhi* (Amoebic liver abscess) (Ultrasound guided drainage)
- Localized heating to treat cysts and *Arbuda* (tumors).
- Ultrasound is use to break up *Ashmari* (Kidney stones) by lithotripsy.

**Table 2:** Advantages and disadvantage of ultrasound

| <b>Advantages</b>   | <b>Disadvantage</b>  |
|---|--|
| Ultrasound is noninvasive and non-ionizing radiation.                       | Bone absorbs ultrasound so that brain images are rarely to get.        |
| Ultrasound is easy-to-use and less expensive than other imaging techniques. | Resolution of images are limited in ultrasound                         |
| Ultrasound gives a clear picture of soft tissues than x-ray images.         | In many condition X-rays produce a much clear picture than ultrasound. |

**Computed tomography (CT) Scans**

In first 40 years of life, most common cause of death is trauma [10]. Computed tomography (CT) scan is the gold standard for diagnosis of trauma [11][12]. Computed Tomography (CT) Scans is also known as Computed Axial Tomography (CAT) scan, which traditionally produces a 2D image of the structures in a thin section of body. CT Scans produce greater ionizing radiation and may be dangerous for health. CT scanning is not recommended in *Garbhini* (pregnancy) because it causes potential risk to the fetus in the womb. CT is based on the same principles as X-Ray projections but in CT Scans patient is enclosed in a surrounding ring of detectors. CT scan two-dimensional (2D) scans which shows different “slice” inside the body.

**Use of computed tomography (CT) scans**

- Surgical condition when (CT) Scans can be advised is head injury, intrathorasic injury, small bowel obstruction, Emphysema, pleural effusion bone fractures, tumors complications of acute appendicitis and Hydrocephalus (Genetic or acquired).
- CT scan provides all sides of an *Arbuda* (tumor) to prepare for an operation.
- CT scan helps to show internal injuries, bleeding, blood

clot, excess fluid and complication of brain infection.

- CT scan is very helpful for diagnosis of congenital malformations of the heart, kidneys and lungs.

**Magnetic resonance imaging (MRI) scans**

Magnetic resonance imaging (MRI), a medical imaging technique is used for taking pictures of the anatomical and physiological processes of the body. MRI scanners use strong magnetic field MRI was originally called NMRI (nuclear magnetic resonance imaging), but "nuclear" was removed to avoid negative associations [13].

**Use of magnetic resonance imaging (MRI) scans:** In present time MRI is uses for diagnosis and treatment in many specialties which help in improved health outcomes.

- MRI is main investigation in preoperative staging of rectal and prostate cancer (*Guda arbuda*) [14].
- MRI has a role in the diagnosis, staging, and follow-up of other tumors in body.
- MRI the best investigation for central nervous system related disorder such as epilepsy, hydrocephalus, demyelinating diseases, cerebrovascular disease, infectious diseases, Alzheimer's disease and cerebral atrophy [15].
- MRI helps in diagnosis of musculoskeletal disorder such as spinal imaging, joint disease/injury and soft tissue tumors [16].
- MRI helps in diagnosis of lesions related to liver, pancreas, and bile ducts. MRI also helps in detection of large polyps which increased risk of colorectal cancer in patients [17].
- Magnetic resonance angiography (MRA) helps in diagnosis of stenosis of arteries to (abnormal narrowing) or aneurysms (dilatations of vessel wall). MRA is mostly used to evaluate the arteries of the neck and brain.

**Nuclear medicine scans**

Nuclear medicine is a medical specialization which involves the function of radioactive substances in the diagnosis and treatment of disease. In nuclear medicine imaging, radiopharmaceuticals are given internally in body for example, intravenously (IV) or orally. It increases risk of carcinoma and damage organs when radiation exposure is more. But when used for diagnosis, purpose, the level of radiation exposure is same as during a routine chest x-ray or a CT scan.

**Use of nuclear medicine scans**

- Nuclear medicine Scans helps in diagnosis of thyroid disease, gall bladder disease, carcinoma, heart conditions and cancer.
- It also helps on diagnose of Brain condition, Alzheimer's disease and other types of dementia.
- Nuclear medicine is use in treatment of thyroid cancer, hyperthyroidism and non-Hodgkin lymphoma.

## Discussion and Conclusion

Surgical practice has been an inseparable part of *Ayurveda* and *Sushruta* is considered the 'father of surgery' because of his immense contribution towards the development of many fundamental principles and practice of surgery. In *Ayurveda* method of examination of a patient advised which includes *Pratyaksha*, *Yukti*, *Prashana* and *Upamana* and another place *Acharya Sushruta* describes *Trividh Pariksha* for the confirmation of surgical diseases.

In present time radiological diagnostic tool is investigation of choice for confirmation of surgical diseases. X-ray abdomen for suspected bowel obstruction or gastrointestinal perforation. X-ray abdomen is also helpful for diagnosis of foreign body in the alimentary tract. Ultrasonography (USG) has routine use by surgeons at the bedside for Gallbladder, mesenteric lymphadenopathy, and stone in ureter, bladder and kidney, DVT scanning and trauma scanning (splenic rupture). There was weaker evidence for hernia, breast and venous scanning. CT Scans are advised in almost all cases of trauma including head injury, intra-thoracic injury, small bowel obstruction, Emphysema, pleural effusion, bone fractures, tumors, complications of acute appendicitis and Hydrocephalus. MRI helps in diagnosis of disorders related to liver, pancreas, and bile ducts. MRI also helps in detection of large polyps which increased risk of colorectal cancer in patients and monitoring of other carcinoma. Nuclear medicine involves the diagnosis and treatment of disease. It is used for diagnosis of thyroid disease, gall bladder disease, carcinoma and heart conditions, and cancer. It has therapeutic role in treatment of thyroid cancer, hyperthyroidism and non-Hodgkin lymphoma.

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