International Journal of Innovative Healthcare Research 8(1):1-6, Jan.-Mar., 2020

© SEAHI PUBLICATIONS, 2020 **www.seahipaj.org** **ISSN: 2354-2950**

The Importance of Medical Imaging (X-RAY, EEG, PET e.t.c.) In the Understanding of the Effect of Manual Therapy on the Brain

AFOLABI Abiodun Ph. D.

Department of Education for Learners with Physical & Health Impairment,
School Of Special Education,
Federal College Of Education (Special), Oyo, Nigeria

ABSTRACT
The usefulness of medical imaging in the diagnosis of disease conditions in human cannot be overemphasized. It assists the health personnel in locating where the problem is, thereby guiding them on the appropriate treatment. Medical imaging like Electroencephalogram (EEG), X-ray, and Computerized tomography and so on are being used to make proper diagnosis. EEG is generally used to detect effect of manual therapy on the brain in which polyburst spike are always visible. This paper is a literature review that explains the various types of medical images available and shows the understanding of the effect of manual therapy on the brain as revealed by EEG.
Keywords: Imaging, myelograph, myofascial, spondylolisthesis, retrolisthesis, nociceptor

INTRODUCTION

Medical imaging comprises different imaging modalities and processes to image human body for diagnostic and treatment purposes and it therefore has an important role in the improvement of public health in all population groups. Furthermore, medical imaging is justified also to follow the course of a disease already diagnosed and/or treated. Area of medical imaging is very complex and, depending on a context, requires supplementary activities of medical doctors, medical physicists, biomedical engineers as well as technicians.

Medical imaging, especially X-ray based examinations and ultrasonography, is crucial in every medical setting and at all levels of health care. In public health and preventive medicine as well as in curative medicine, effective decisions depend on correct diagnosis. Though medical/clinical judgment may be sufficient in treatment of many conditions, the use of diagnostic imaging services is paramount in confirming, correctly assessing and documenting.

With improved health care policy and increasing number of available medical equipment, the numbers of radiological medical procedures are increasing considerably. Effective and of good quality imaging is important for further medical decision making and can reduce unnecessary procedures. Reports from some countries indicate that a significant portion of all abdominal surgical interventions (explorative laparotomy) may have been avoided if simple diagnostic imaging services such as ultrasound had been available (WHO, 2014)

Imaging or radiology tests create pictures of the chest, abdomen, head, neck and other parts of the body. These tests use different forms of energy (x-rays, sound waves, radioactive particles, or magnetic fields) that are passed through the body.

Examples of imaging tests include:

1. X-rays

2. Ultrasound
3. CT (computed tomography) scans
4. MRI (magnetic resonance imaging)
5. FDG-PET (fluorodeoxyglucose with positron emission tomography) scans.

Manual therapy encompasses the treatment of health ailments of various etiologies through 'hands-on' physical intervention. This form of physical treatment usually refers to hands-on techniques and includes soft tissue mobilization, various connective tissue techniques, myofascial release, craniosacral techniques, mobilization of joints, joint manipulation, mobilization of neural tissue, visceral mobilization, strain and counterstrain, and integrative manual therapy. Manual techniques include massage and muscle stretching of soft tissues, distraction and traction techniques, specific (i.e. specific to one vertebral motion segment such as L4-L5) or general (i.e. specific to a region of the spine such as L1-S1) high velocity manipulation and joint mobilization, and what is called adverse neural tissue mobilization (Ferrell and Jenson, 1992). The process at arriving at a manual therapy diagnosis usually first involves the development of a differential diagnosis, which is the consideration of a number of alternative diagnostic possibilities in light of the history. The list of differential diagnosis is systematically reduced by the results obtained from further tests performed on the patient. The most common tests utilized clinically include the examination procedures that compose the physical examination, laboratory blood or body fluid analysis, diagnostic imaging such as plain film X-rays, Magnetic Resonance Imaging (MRI), fMRI, or PET Scans and electrophysiological evaluations such as EEG, EEG, and EMG (Randy, 2007).

Spinal X-rays (Plain radiographs)

X-ray of the spine, though has limitations in detecting many common lesions which are detected at autopsy as capable of causing pain, but is also very important in making some spinal diagnosis as it can also show osteoarthiritic changes like osteophytes formation and narrowing of disc spaces; changes of spondylolisthesis and retrolisthesis; Schmorl's nodes(which are vertical prolapses of the nucleus pulposus into the adjoining vertebral body), subluxation of the posterior joints; gross irregularity and sclerosis of the joint outlines and forward tilting of the vertebral body and scoliosis, but stretching the sensitive posterior lontidinal ligament are not detectable radiographically. A plain radiograph is then indicated when a spinal manipulation is contemplated following clinical assessment. This is suggested for the following reasons according to (Makanjuola, 2007):

1. This could exclude absolute contraindications before manipulative therapy, for example in the case of inflammatory or malignant diseases or fractures and some other conditions like osteoporosis, paget's disease, rheumatoid arthritis, or ankylosing spondylitis.
2. The initial radiograph can provide a useful baseline study which will show if there is early tubercle infection or metastatic deposits.
3. Though a good clinical assessment often gives far more valuable information than plain radiographs, it is not infallible even in the most experienced hands.
4. In neurotic patient with no pathology, the mere fact of having an X-ray examination could alleviate the symptom i.e. serve as a placebo effect.
5. In requesting the radiograph, essential clinical information should be given, for example, previous trauma, pain improved by stooping, a history of cough (in which chest x-ray should be included) and so on.

Owing to the limitation of the plain radiograph, more specialized investigations of the spine are necessary. These include myelography, radibulography, epidurography, discography, spinal venography, and arteriography. All these involve the use of contrast media. Recently, the use of computerized axial tomography commonly known as CAT scan and Nuclear magnetic Resonance has been introduced (Mokanjuola, 2007). Myelography aims at demonstrating the condition of the membranes and encroachment upon or obstruction of the space between them. Epidurography has some advantages when studying lesions impinging on the epidural space. Discography is more widely used in Europe and the United States than in Britain. This is carried out to mainly to localize the offending disc prior to fusion.

Magnetic Resonance Imaging (MRI)

In contemporary imaging, MRI is the preferred imaging modality for the evaluation of the cervical, thoracic and lumbar myelopathy. It is also unique for the evaluation of diseases of the spinal cord, including tumors, inflammation, infection, trauma, syringohydromyelia and cord compression. It is also valuable in the evaluating discerns of the vertebral intervertebral disc and epidural space. Magnetic resonance imaging (MRI) is a noninvasive medical test that helps physicians diagnose and treat medical conditions.

MRI uses a powerful magnetic field, radio frequency pulses and a computer to produce detailed pictures of organs, soft tissues, bone and virtually all other internal body structures. The images can then be examined on a computer monitor, transmitted electronically, printed or copied to a CD. MRI does not use ionizing radiation (x-rays). Detailed MR images allow physicians to evaluate various parts of the body and determine the presence of certain diseases.

An MRI examination of the spine shows the anatomy of the vertebrae that make up the spine, as well as the disks, spinal cord and the spaces between the vertebrae through which nerves pass (Figure 1). Currently, MRI is the most sensitive imaging test of the spine in routine clinical practice.

Figure 1: An image showing the normal MRI of the spine (www.radiologyinfo.org, 2014).

MR imaging is performed to:

- assess the spinal anatomy and alignment.
- detect congenital anomalies of vertebrae or the spinal cord.
- assess intervertebral disk disease (degenerated, bulging or herniated) and intervertebral joint disease, both frequent causes of severe lower back pain and sciatica (back pain radiating into a leg).
- assess compression of spinal cord and nerves.
- help plan spinal surgical procedures, such as decompression of a pinched nerve or spinal fusion.
- monitor changes in the spine after an operation, such as scarring or infection.
- guide the injection of steroids to relieve spinal pain.
- explore other possible causes of back pain (compression fracture, for example).
- image spinal infection or tumors that arise in, or have spread to, the spine.
- assess inflammation of the spinal cord or nerves (www.radiologyinfo.org, 2014).

Computerized Tomography (CT) and C.T. Myelography are now only used where MRI are unavailable and this is far less accurate and requires less radiation.

Examples of MRI that shows pathology of the spine are seen in figure 2 and 3 below:

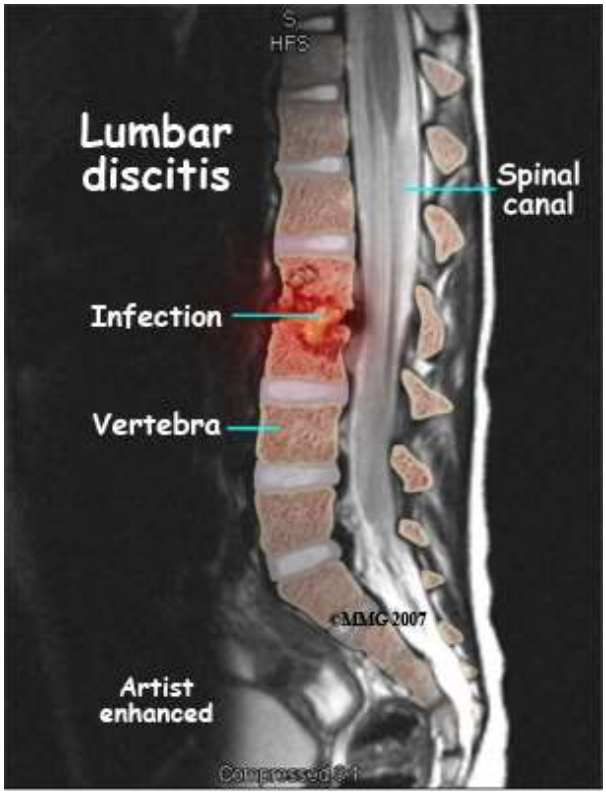

Figure 2: An abnormal MRI showing lumbar discitis (copied online)

Figure 3: Spondylosis of lumbar spine (multiple level disc bulging and degeneration). (www.columbianeurosurgery.org, 2014).

Orthoscan

This is a new machine technology that displays where bone problems are. The patient stand in front and the bones of the limbs will be revealed. It is a digital diagnostic imaging and fluoroscopy, which may make somebody not to consult a radiologist again.

Effect of Manual Therapy on the Brain

Though findings are conflicting, manual therapy of the cervical spine has occasionally been associated with serious adverse events involving compromise of the craniocervical arteries. Ultrasound studies have shown certain neck positions can alter craniocervical arterial blood flow velocities (Thomas et al., 2013). Joint manipulation has been found to produce anti-hyperalgesia via descending inhibitory mechanisms that utilizes serotonin and noradrenaline. Therefore, digital pressure has said by literature may decrease mechanical pressure generated by inflammation and collagen deposits on soft tissues in and around the intervertebral foramen to restore mobility, while decreasing electrical activity in type 111 and 1V fibres through normalization of blood flow and vertebral alignment. Oscillation at the pressure-pain threshold may generate sufficient wide dynamic range neuron modulation of nociceptor specific neurons, down tune the amplitude of sinusoidal-voltage oscillations in the DRG membrane to decrease muscle spasm and hyper-excitation leading to analgesia and recovery of function (Egwu et al., 2007). Also, the analgesic effect of manipulative therapy has long been associated with the well-known fact that soft tissue manipulations such as scratching, vibration and rubbing, facilitate the action of mechanoreceptors to modulate pain intensity (Egwu et al., 2007).

The Importance of Medical Imaging in the understanding of the Effect of Manual Therapy on the Brain

There are myriads of manual techniques being used for the treatment of spinal dysfunction. These include: oscillatory technique, vertical oscillatory pressure (VOP) for the cervical region, transverse oscillatory pressure (TOP), oscillatory rotation, cervical rotatory trust, occipital-atlantal manipulation, atlanto-axial manipulation, cervical manipulation, VOP thoracic region, TOP thoracic region, Lumbar oscillatory rotation (LOR) and so on. Among the myriad manual therapy techniques, VOP (posterior-anterior mobilization) technique is the easiest and most commonly employed when treating the lumbo-scaral region (Egwu et al., 2007, 2012).

In the past, electrophysiological tools such as functional magnetic resonance imaging (fMRI), magnetoencephalography, electroencephalography (EEG) and so on have been used to study blood flow changes and changes in the brain electrical activities (Egwu et al., 2012). The EEG for example is used because it allows noninvasive access to the brain processes at an integrative level of the CNS with high degree of spatiotemporal resolution and these qualities made EEG an appropriate tool for the study of cortical electrical activity associated with Vertical Oscillatory Pressure (VOP).

In a study conducted by Egwu et al. (2012) in which EEG was used to record and compare cortical electric activities of LBP and pain free subjects and examined changes induced by digital pressure and oscillation stages of VOP while noting its effect on LBP intensity using Grade 2 mobilization technique, polyspike burst and positive deflection were induced (Egwu et al., 2012). These positive deflections were seen to appear simultaneously in all the electrodes used in patients with bilateral pain and divide along the line of auricular references in patients with unilateral pain. When pain was elicited, the poly spikes were said to spontaneously appear in 10 to 15 milliseconds preceding the positive deflections. It is also reported that, the spontaneous polyspike burst seen 10 - 15 milliseconds after digital pressure (DP) in LBP subjects reflects the arrival in the cortex of noxious impulse barrage firing synchronously due to the noxious stimulus triggered off by digital pressure (Egwu et al., 2012). It is documented that the increase in pain intensity (from moderate to unbearable pain) induced by DP spinal mechanical dysfunction evokes cortical polyspike complexes correlating with the pain intensity in 10 – 15 milliseconds (Egwu et al., 2012). This view according to them was supported by the fact that spontaneous spikes potentials were localized to the contra lateral hemisphere to the affected side of the spine and only to the area/loci receiving the stimulus (Figure 3).

This normal EEG is brought about because application of VOP causes opiods to be released into the brain. This was confirmed because, when Naloxone was used to block the influence of the opiods on the brain, polyburst strike was found to increase.

CONCLUSION

The importance of medical imaging in the diagnosis of spinal problems cannot be overemphasized. These images produced by the machines enable healthcare professionals to be able to make confirmatory diagnosis that enable them to be able to direct treatment to where the problems are. Medical imaging ranges from plain radiograph (X-ray), MRI, EEG, Discograph, Angiograph, Orthoscan and so on. Among all these, EEG has been used to give us understanding of what happens when VOP is applied to the spine. Polyspike burst and positive deflections have been revealed as normal electrophysiological changes that take place during the application of VOP to LBP patients.

REFERENCES

Egwu M.O., Adeoshun I. O., Olaogun M.O.B., Ikem I.C., Ukponmwan O.E. (2012): Cortical electrophysiological changes during vertical oscillatory pressure therapy in patients with low back pain. *International Journal of Medicine and Medical Sciences* Vol. 2(1). 1-7.

Egwu M.O., Adewale A.O., Olaogun M.O.B. (2007): The effect of vertical oscillatory pressure on youth and elderly adult low back pain intensity and lumbo-sacral mobility. *J. Jpn. Phys.Ther. Assoc.* 10: 17-26.

Ferrell J.P. and Jensen G.M. (1992): Manual therapy: a critical assessment of role in the profession of physical therapy. *Physical Therapy*. Vol 72. No 12.

Mokanjuola D.I. (2007): Radiological investigations in spinal dysfunction. In VCB Nwuga: *Manual treatment of back pain*, 2nd edition. Pp 92-108. Ibadan, Turner Publishing Company.

Randy W. B. (2007): Functional neurology for practitioners of manual therapy. Books.google.com.ng/books?isbn=0443102201. Accessed 20th June, 2007.

Thomas L.C., Rivett D.A., Bateman G., Stanwell P., Levi C.R. (2013): Effect of selected manual therapy interventions for mechanical neck pain on vertebral and internal carotid arterial blood flow and cerebral inflow. *Phys. Ther*. 9(11). 1563-74.

World Health Organization (2014): Imaging modalities. An online article, accessed 14th April, 2014.

www.columbianeurosurgery.org (2014): Low Back Pain. An online article, accessed April 14th, 2014.

www.radiologyinfo.org (2014): Magnetic Resonance Imaging (MRI) – Spine. An Online article, accessed 14th April, 2014.