JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

ASSESSMENT OF POWER PARAMETERS USING REHABILITATION EQUIPMENT IN STROKE- A CONCEPTUAL STUDY

Dr Varuna T[1] Dr. Padmakiran C[2] Dr. Vasudev Prabhu

1. **PG Scholar Dept. of PG & PhD studies in panchakarma SDMCA, Udupi**
2. **Associate professor Dept. of PG & PhD studies in panchakarma SDMCA, Udupi**
3. **Consultant Physiotherapist , SDM Ayurvedic Hospital, Udupi**

Abstract – Stroke is one common disease caused by abnormal blood supply, accounting to about 15% hemorrhagic and 85% ischemic. Rehabilitation equipment are used extensively in restoration of muscle power and functions in cases of post stroke management. They are the equipment designed for exercise to aid muscle stretching, flexibility, strength training and balance training. These equipment render maximum power to the specific group of muscles that they act upon. Hence, their utility can be extended from mere exercise purpose to even assessing the ability and disability of the affected muscles.

Key words- stroke, power parameters, rehabilitation equipment, muscle power assessment

Introduction-

Stroke is one common disease caused by abnormal blood supply, accounting to about 15% hemorrhagic and 85% ischemic.[1] Management of stroke is an enigma because, to stabilize the patient's vitals and to revive the basic motor and sensory functions itself is a challenge. The recovery in any stroke patient depends on the type of stroke, area of lesion & extent of damage caused by it. In patients, who have survived the initial phase of stroke with use of necessary resuscitation measures and by meticulous and prompt drug therapy; comes the newer challenge i.e., to restore the lost functions and their original activity. As stroke is the leading cause of disability worldwide and results in muscle performance deficits and limits activities, they require specialized rehabilitation programs aiming for functional recovery and to facilitate reintegration into community. Rehabilitation equipment are used extensively in restoration of muscle power and functions in cases of post stroke management. They are the equipment designed for exercise to aid muscle stretching, flexibility, strength training and balance training. These equipment render maximum power to the specific group of muscles that they act upon. Hence, their utility can be extended from mere exercise purpose to even assessing the ability and disability of the affected muscles.

Stroke –

Acute stroke is defined as the acute onset of focal neurological findings in a vascular territory as a result of underlying cerebrovascular disease.[2] There are two main types of stroke- the commoner type is an ischemic stroke, caused by interruption of blood flow to a certain area of brain. Ischemic stroke accounts for 85% of all acute stroke, the rest 15% are hemorrhagic stroke, caused by bursting of blood vessels.[1] In hemorrhagic, intracerebral and sub-arachnoid hemorrhage accounts for 5% of all stroke.

According to toast classification there are 4 main types of ischemic strokes[3], these are –

1. large vessel atherosclerosis
2. small vessel disease (lacunar infarcts)
3. cardioembolic strokes
4. cryptogenic strokes.

Etiology-

There is a multitude of risk factors for causing stroke such as hypertension, diabetes mellitus, hypercholesterolemia, physical inactivity, obesity, genetics and smoking and alcohol consumption.[4]

1. Cerebral emboli commonly originate from heart, especially in patients with pre-existing cardiac arrythmias, valvular disease, structural defects like- atrial and ventricular septal defects and chronic RHD[5]. Emboli may lodge in areas of pre-existing stenosis.

2. Strokes that occur in small vessel (lacunar infarcts) are most commonly caused by chronic uncontrolled hypertension resulting in pathological entity of lipohyalinosis and arteriolosclerosis[6]. These strokes occur in the basal ganglia, internal capsule, thalamus and pons.

About 15% of all strokes are hemorrhagic[2], with etiology being the most commonly uncontrolled hypertension.

Clinical features as per site of lesion[7]-

CORTICAL LESION:-
Cortical-corticospinal lesions produces monoplegia or paralysis of even
smaller muscle group, aphasia (if dominant cortex is involved), cortical sensory loss.
Jacksonian fits may occur if the lesion is in or near the cortex.
SUBCORTICAL LESION:-
Weakness predominates in one limb but the whole of the opposite side is
affected, impairment of postural sensibility and tactile discrimination by involvement
of thalamocortical sensory fibres
LESION IN THE INTERNAL CAPSULE:-
It is the commonest site and presents with a pure motor and isolated
hemiplegia, hemianesthesia if lesion is in the posterior one-third of internal capsule.
LESION IN THE MIDBRAIN: - Lesion in the midbrain produces;
Weber's Syndrome: - palsy of the 3rd with crossed hemiplegia.
Benedict's Syndrome: - 3rd nerve affection on the side of lesion with tremors,
Hypertonia and ataxia on opposite side.
Facial diplegia of the supranuclear type.
LESION IN THE PONS: - It produces;
Millard- Gubbler Syndrome: Paralysis of lateral rectus, with or without LMN
type of facial paralysis on one side with crossed hemiplegia.
Foville's Syndrome: Similar to Millard-Gubbler syndrome except that instead
of lateral rectus paralysis, there is conjugate ocular deviation to side of the
lesion.
Horner's Syndrome: Paralysis of the ocular sympathetic may result from a
lesion in the tegmentum of the pons.

LESION IN THE MEDULLA: - It produces;
Many varieties of crossed hemiplegia in unilateral medullary lesion.
In midline lesion: Unilateral paralysis of half of the tongue, crossed
hemiplegia, loss of postural sensibility is found.
Lesion in lateral part of medulla: Vocal cord paralysis, Horner's syndrome,
trigeminal analgesia, thermo anaesthesia and some cerebellar deficiency - all on
the side of the lesion with loss of appreciation of pain, heat and cold in the
limbs and trunk on the opposite side.
LESION IN THALAMUS: - It produces Thalamic Syndrome characterized by;
Fleeting hemiparesis or hemiplegia on the opposite side of the lesion.
Impairment of superficial & loss of deep sensation on opposite side.
Elevation of threshold to cutaneous, tactile, and painful stimuli.
Intolerable, spontaneous pains & hyperpathia on the opposite side.
Ataxia, tremor and / or choreoathetoid movements on the opposite side.
LESION IN THE SPINAL CORD: -
Unilateral lesion of the cortico-spinal tract below the medulla and 5th cervical
spine produces spinal hemiplegia without paralysis of muscles innervated by cranial
nerves.
LESION IN THE TEMPORAL LOBE: -
Deep posterior temporal lobe: - Here the pyramidal fibres pass in close
proximity to visual fibres; hence hemiplegia is usually associated with
homonymous hemianopia.
Anterior temporal lobe: - On the dominant hemisphere the pyramidal system

lies just medial to the speech fibres, hence hemiparesis associated with
excessive aphasia manifest in the lesion of this region.

Necessity of assessing power parameters-

The ability of the function of extremities is inevitably affected in stroke. Due to the loss of neurological stimulation for an invariable duration of time, the muscles undergo either wasting or rigidity of some degree in the post stroke period. These changes results in loss of muscle power in them. One standard assessment method for analysing muscle power in extremities in stroke patients is MRC Scale. Where in, we grade the power of a particular muscle group on a scale of 0-5 based on the ability of the patient to perform the movements of each joint.[8] For quantifying the extent to which the muscle power is lost in that specific group of muscles or in a limb, there are no standard assessment tools available. Hence, we came up with the idea of assessing the muscle power of post stroke cases with the use of rehabilitation equipment which are used in physiotherapy to treat post stroke cases.

Equipment used-

1. **Finger flexion exercise (with 4 standard weight bar)[9]-**

Method- Leather bands attached to nylon cords which are fitted with 4 standard weight bars weighing 20 gm each through pulleys (fig no.1). These bands are worn on each finger and the patient is asked to pull the bands against the force of weights hung on them. The distance of bands pulled is measured and noted for evaluation.

This helps in assessing the muscle power of - intrinsic group of muscles like abductor pollicis, flexor pollicis brevis, opponens pollicis and abductor polices brevis.

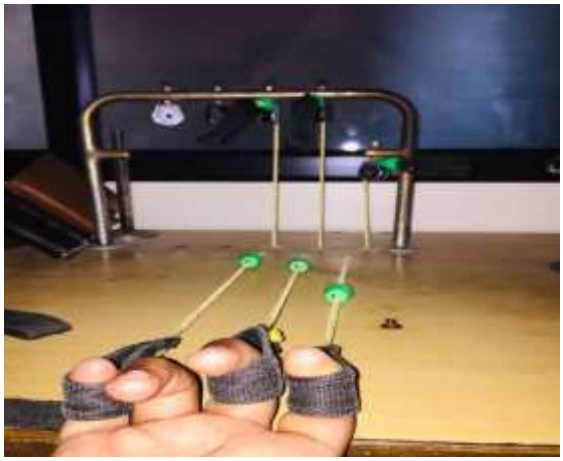

Figure no. 1- Finger flexion exercise

2. **Wrist rotator (based on degree of rotation)[10]-**

Method – Graduated (360 degree) Metallic beams fitted on walls with a rotator (Fig no.2). The patient is asked to hold the grip with the hand and rotate the handle. The degree of rotation in both supination and pronation actions is noted.

This helps in assessing the muscle power of - flexor carpi radialis, extensor crapi radialis longus and brevis, brachioradialis, supinator muscles.

Figure no. 2-Wrist rotator exercise

3. **Axial shoulder wheel (based on degree of rotation of wheel)[11]**

Method- a wall mount exercise unit with a liver that rotates 360 degree (fig no.3). there will be the markings on the instrument which shows the degree of rotation of wheel. Patient is asked to rotate the wheel and the degree of rotation performed is noted for evaluation.

This helps in assessing the muscle power of - shoulder girdle, abductor and adductor muscles

like supra spinatus, infra spinatus, teres minor and deltoid muscles.

Figure no.3-Axial shoulder wheel

4. Spring pulling exercise (based on distance of spring pulled)

Method- It is an rectangular instrument with 2 metallic bars and two wooden handles. An instrument with graduated scales over the sides of the frame ranging from 1 to 8 cm with spring which measures the distance pulled (fig no.4). The patient is asked to pull the handles of spring against its tension and the distance pulled is measured on the scale in cms.

This helps in assessing the muscle power of -intrinsic group of muscles like abductor pollicis, flexor pollicis brevis and longus, opponens pollicis and abductor polices brevis. And flexor group of muscles of fore arm like- flexor carpi radialis and ulnaris, palmaris longus, pronator teres.

Figure no. 4-spring exercise

5. Dynometric test[12]

Method- a calibrated 360 degree scale unit (fig no. 5). Here the patient is asked to press the lever of the instrument against the tension of the instrument and the amount of pressure exerted is noted on the basis of rotation of marker present on the instrument.

This helps in assessing the muscle power of -flexor group of muscles of hand and forearm like flexor carpi radialis and ulnaris, palmaris longus, pronator teres etc.

Figure no. 5- hand grip dynometer

6. Foot pressure test[13]

Method- Tension scale equipment (fig no.6). Where the patient is asked to press the sole pad against the tension of the instrument, and the distance pressed by the patient is noted from the graduated scale on the instrument ranging from 1-5 inch .

This helps in assessing the muscle power of -flexor and extensor group of muscles of the leg and foot like extensor digitorum longus and halluces, tibialis anterior, peroneus tertius etc.

Figure no.6 -Foot pressure exercise

7. Heel exercise test-[14]

Method- a rotator axis instrument having graduated markings on the sides ranging from 0-90 degree (fig no.7). The patient asked to flex or extend the foot placed on sole pad, while sitting on a chair. The degree of rotation performed is noted.

This helps in assessing the muscle power of -flexor and extensor group of muscle of foot like-flexor halluces brevis, flexor digiti minimi brevis, adductor halluces muscles.

Figure no.7- heel exercise test

8. Exercise table

Method- An instrument designed in such a way that it can be used for both upper and lower limb exercise. The chair is fitted with two levers for arms and legs each, the other end of these levers is attached to a progressive weight bar (fig no.8). The patient is asked to lift the lower lever against the weight with his leg behind it and hold for as long as he can. The duration of this steady phase is measured. Similarly he is asked to push back the lever with his heal & the same measures are done. This similar process is carried out for upper limb as-well.

Acts upon- hamstring and quadriceps group of muscle in lower limb and flexor and extensor group of muscles of fore arm and arm in upper limb.

Figure No. 8- Exercise table

Discussion and conclusion-

On retrospection of the stroke pathology, there is no direct and obvious injury or damage caused on any skeletal muscles, yet the end effect found in every stroke case is loss of function due to loss of muscle power. The derangement caused in the functions is disheartening to the patients as it is the only visible presentation for them. The actual cause may be haemorrhage, ischemia or what so ever is corrected at an emergency outset, but the presentation persists. Each affected skeletal muscle due to loss of neurologic stimulus to them result in either rigidity or wasting of muscles. The proper assessment and intervention based on the extent of damage is the need of the hour owing to the increasing stats of stroke population in these days. Before we head to the intervention proper it is even more important to quantify the damage caused, because only then will we be able to improve the quality of life in stroke patients with proper intervention. But as we have seen, for quantifying the extent to which the muscle power is lost in that specific group of muscles or in a limb, there are no standard assessment tools available. Hence, we planned on using the instruments used in rehabilitation and post stroke exercise therapy as assessment tools of muscle power. Based on the idea we are conducting a study on assessing the muscle power with these instruments before and after our intervention.

References-

1. Harrisson's Principal of Internal Medicine Part 2, Mc Graw Hill Publishers, NY, 16th Edition, 2005, pp 2607, page no 2373.
2. Harrisson's Principal of Internal Medicine Part 2, Mc Graw Hill Publishers, NY, 16th Edition, 2005, pp 2607, page no 2372.
3. https://www.researchgate.net/figure/subtypes-of-acute-ischemic-stroke-after-surgical-aortic-valve-replacement-with-a_tbl1_321855295.
4. Harrisson's Principal of Internal Medicine Part 2, Mc Graw Hill Publishers, NY, 16th Edition, 2005, pp 2607, page no 2380.
5. Harrisson's Principal of Internal Medicine Part 2, Mc Graw Hill Publishers, NY, 16th Edition, 2005, pp 2607, page no 2376.
6. Harrisson's Principal of Internal Medicine Part 2, Mc Graw Hill Publishers, NY, 16th Edition, 2005, pp 2607, page no 2379.
7. Anjali RK, 'Clinical study to evaluate the effect of navaprasrutika basti in pakshaghata,Udupi: SDM College of Ayurveda;2015-16.
8. G Douglas, F Nicol, C Ribertson, Macleod's Clinical Examination; Churchhill Livingstone Elsevier, London,13th Edition, 2013, PP-451, Pg No.259-60.
9. N J Vyaas, M S Sheth, S S Sharma, Priyasingh B R, Principles and practices of physical rehabilitation, Jaypee Publishers: New Delhi, 2020, Pg no.-289.
10. N J Vyaas, M S Sheth, S S Sharma, Priyasingh B R, Principles and practices of physical rehabilitation, Jaypee Publishers: New Delhi, 2020, Pg no.-295.

11. https://www.physio-pedia.com/therapuetic_exercise_for_the_Shoulder.
12. H C Robert, et al. A review of the measurement of grip strength in clinical and epidemiological studies:towards a standardised approach. Age aging (2011) 40 (4): 423-429.
13. J Vyaas, M S Sheth, S S Sharma, Priyasingh B R, Principles and practices of physical rehabilitation, Jaypee Publishers: New Delhi, 2020, Pg no.-298.
14. J Vyaas, M S Sheth, S S Sharma, Priyasingh B R, Principles and practices of physical rehabilitation, Jaypee Publishers: New Delhi, 2020, Pg no.-298.