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Research Paper

Assessment Of Patient's Response On The Use Of Biomedical Equipment In The Rehabilitation Of Spinal Cord Injury In Port Harcourt

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ABSTRACT
The aim of the study was to assess patients' response on the usefulness of biomedical equipment use in the rehabilitation of spinal cord injury in Port Harcourt. The study was carried out in University of Port Harcourt Teaching Hospital (UPTH), Rivers State University Teaching Hospital (RSUTH) and Save-A-Life Mission Hospital, Rivers State. A total of 32 equipments were surveyed and how such treatment affects patients towards recovery was studied. The most prevalent equipment is hospital beds, crutches and wheelchairs with 13.2%, 7.8% and9.8% respectively. Overall, 57 SCI patients presented and the usefulness of biomedical equipment on SCI rehabilitation were surveyed. Majority of the patients agreed and strongly agreed that biomedical equipment is useful in SCI rehabilitation with percentage response of 31.5% and 56.1% for agree, strongly agree and less than 10% for disagree, strongly disagree and indifferent response by SCI patients. This tells of the importance of biomedical equipment to patients with SCI. Also, the response of patients on the level of comfort derived from the use of biomedical equipment showed that a vast majority of the patients are comfortable whilst using biomedical equipment during SCI rehabilitation. Hence, the use of biomedical equipment in SCI rehabilitation is very important and useful in SCI management and recovery process of patients.

KEYWORDS: *Biomedical equipment, Rehabilitation, Spinal Cord Injury (SCI),*

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I. INTRODUCTION

Spinal cord injury (SCI) is the injury of the spinal cord from the foramen magnum to the cauda equina which occurs as a result of compulsion, incision or contusion. The functions of the spinal cord are disrupted at the distal level of the injury as a result of the injury. Patients with SCI are severely disabled (Yildirim and Sengel, 2004). Because it is indiscriminate, costly, life-altering, and difficult to treat, spinal cord injury (SCI) is one of the most terrible conditions that humans face. Every year, around 11,000 new cases (mainly 16-30 year old males) are recorded in the United States, while over 13,000 new cases (18-45 year old males) are reported in Nigeria (Nwankwo and Kachy, 2003; WHO, 2008). Patients may incur annual medical expenses ranging from $20,000 to $200,000, totaling up to $3 million in lifetime care, depending on the extent of the neurological damage. Furthermore, despite the high cost of care, considerable functional recovery is unusual (Carlson, 2007). The spinal cord not only serves as a middleman, passing instructions from the brain to the rest of the body, but it also houses the spinal reflexes, which can guide behavior independently of supra-spinal influence (Carlson, 2007). These reflexes range from simple monosynaptic stretch reflexes, which allow quick and unconscious control of posture and muscle contraction (for example, when lifting a box that appears heavy but is actually light, an automatic adjustment of muscle contraction is required to avoid throwing the box across the room), to more intricate polysynaptic stretch reflexes, which allow rapid motor responses (especially as a result of noxious stim) (Eidelberg, 1981; Carlson, 2007). The loss of reflexive responsiveness has noticeable and serious repercussions. In addition to the typical paralysis and loss of sensation, SCI patients face issues with excretory

control, respiratory regulation, an increased risk of infection, pressure ulcers, and impaired sexual functioning (Carlson, 2007). SCI affects approximately 40 million people worldwide each year. The majority of them are young men between the ages of 20 and 35, with only 1% of the population being children (Yip and Malaspina, 2012). Motor vehicle accidents are the most common cause of injury in children. After children join school and begin participating in organized activities, sports-related injuries account for the majority of spine injuries. Football, out of all sports, is the one that produces the most injuries (Cantu *et al*., 2013). The cervical area accounts for 60 to 80% of all spinal injuries in children. The remaining 20% to 40% is evenly distributed between the thoracic and lumbar regions. Boys are more prone than girls to suffer from spinal injuries (Mahan *et al*., 2009). Traffic accidents, gunshot wounds, knife wounds, and falls and sports injuries are the most common causes of SCI around the world. The most prevalent sport injury was reported to be diving. Flexion, compression, hyperextension, and flexion-rotation processes are the most common causes of injury. The "principal harm" that these systems cause is referred to as "primary damage." Secondary damage refers to the body's countermeasures in order to overcome basic harm, such as hemorrhage, inflammation, and the release of numerous chemicals (Sipski and Richards, 2006).

The treatment and rehabilitation procedure for SCI-related trauma is lengthy, costly, and taxing, resulting in biophysical, psychological, and financial issues (Pickett *et al*., 2007). Patients with spinal cord injuries undergo treatment for many years, beginning with acute care and early surgical interventions shortly after the injury; then treatment for sensory, motor, and autonomic dysfunction in the chronic phase; and lastly, lifetime treatment in the home environment. As a result, determining the cost of therapy in spinal cord injury is challenging for a variety of reasons, including failing to record treatment on a regular basis and failing to compute the total cost of the patient as a whole. According to DeVivo *et al*. (2011), the overall mean first-year expenses were $222,087, with a mean annual cost of $68815 (2009 US $) after one year. The average cost of initial acute care was $76711, and the average cost of rehabilitation was $68543 (in 2009 US dollars). Munce *et al*. (2013) found that between 2003 and 2005, both the average per patient and total direct costs of health care use for traumatic SCI increased. In 2005/06, the average patient cost increased from $102900 in 2003/04 to $123674. SCI treatment and rehabilitation is time-consuming, costly, and necessitates a multidisciplinary approach.

II. MATERIALS AND METHOD

In this study, biomedical equipment used in the rehabilitation of SCI patients were evaluated in various rehabilitation centers/hospitals in order to determine the most commonly used equipment for SCI patient management and to assess the level of comfort experienced by SCI patients when using these equipment. The University of Port Harcourt Teaching Hospital (UPTH), Rivers State University Teaching Hospital (RSUTH), and Save-A-Life Mission Hospital in Rivers State all reviewed a total of 32 different biomedical devices utilized in the rehabilitation of SCI patients. A total of 57 SCI patients were evaluated to see how comfortable they were with the usage of some biomedical devices in their rehabilitation. The results were reported in percentages, and tables were used to display the responses of patients with SCI regarding their level of comfort when utilizing biomedical equipment. For socio-demographic data, frequencies were estimated.

III. RESULT

Table 4.1: Biomedical Equipment used in Rehabilitation of patients with Spinal Cord injury

Biomedical Equipment	No.	%	Status
Hospital Beds	412	13.4	Functional
Crutches	242	7.8	Functional
Walkers	125	4.1	Functional
Wheelchairs	305	9.9	Functional
Cranes	66	2.1	Functional
Transfer boards	91	2.9	Functional
Benches	111	3.6	Functional
Lifts (Leg and hand lifter)	58	1.9	Functional
Adapted Shoes	26	0.8	Not Functional
Cushions	72	2.3	Functional
Splints and braces	82	2.7	Functional
Backrests	96	3.1	Functional
Ventilators	32	1.0	Functional
Shower benches	26	0.8	Functional
Shower Commode	49	1.6	Functional
Dressing sticks	27	0.9	Not Functional
Slings	40	1.3	Functional
Urinary "Foley" Catheter	76	2.5	Functional
Kandells	58	1.9	Functional
Nasogastric Feeding Tubes	105	3.4	Functional
Monitors	66	2.1	Functional

Intravenous Catheter and IV Fluid	205	6.6	Functional
Halo Vests	48	1.6	Functional
Fracture Beds	87	2.8	Functional
Endotracheal tubes	21	0.7	Functional
EKG lead Wires	24	0.8	Functional
Cervical Coller	164	5.3	Functional
Arterial lines	203	6.6	Functional
Anti-Embolism stockings	18	0.6	Functional
Universal cuff	58	1.9	Functional
Reachers	80	2.6	Functional
Adapted Utensils	13	0.4	Functional
Total number of equipment	**3086**	**100**	

Calculation:

Percentage number of biomedical equipment = $\frac{\text{Number of equipment}}{\text{Total number of equipment}} \times 100$

Table 4.1 shows biomedical equipment used in the rehabilitation of patients with SCI in different hospitals/rehabilitation centers and quantity of this equipment as well as their functional status. From the table, the most prevalent equipment was hospital bed, crutches and wheelchair with 13.2%, 7.8% and 9.8% respectively. In addition, 93.8% of all of the equipment were functional while 6.3% were not.

Table 4.2: Personal and Injury characteristics of 57 individuals with SCI

Variables	Number	Percentage (%)
Sex		
Male	34	59.6
Female	23	40.4
Education		
Primary School	18	31.6
Secondary School	22	38.6
University	17	29.8
Marital Status		
Single	21	36.8
Married	30	52.6
Divorced/Widowed	6	10.6
Levels of Injury		
Cervical Cord	18	31.6
Thoracic Cord	31	54.4
Lumbosacral Cord	8	14
Year of Injury		
2010-2015	20	35.1
2015-2020	37	64.9
Etiology		
Non-traumatic	13	22.8
Traumatic	44	77.2

The demographic and injury characteristics of the participants are presented in Table 4.2 above. Among the 57 individuals with SCI, the male to female ratio was 1.47:1.

Table 4.3: Response by SCI patients on the usefulness of biomedical equipment on SCI rehabilitation

Response	Agree	Strongly Agree	Disagree	Strongly Disagree	Indifferent
Biomedical equipment is helpful in SCI rehabilitation	18	32	2	1	4
Percent (%)	**31.5**	**56.1**	**3.5**	**1.8**	**7.0**

Table 4.3 shows the response of 57 SCI patients on the usefulness of biomedical equipment on SCI rehabilitation. Majority of the patients strongly agreed (56.1%) and agreed (31.5%) that biomedical equipment is useful in SCI rehabilitation. On the other hand, only 12.3% of the patients disagreed, strongly disagreed and were indifferent about SCI rehabilitation.

Table 4.4: Response of SCI patients on level of comfort by the use of biomedical equipment for SCI rehabilitation

Response	Comfortable	Very Comfortable	Slightly Not Comfortable	Not Comfortable	Indifferent
The use of biomedical equipment has increased the level of comfort in SCI rehabilitation.	10	40	1	1	5
Percent (%)	**17.5**	**70.2**	**1.8**	**1.8**	**8.7**

Table 4.4 shows the response of 57 SCI patients on how comfortable they were with the use of biomedical equipment on SCI rehabilitation. Majority of the patients responded with higher level of comfort that biomedical equipment is useful in SCI rehabilitation with percentage response of 17.5% and 70.2% for a comfortable and very comfortable respectively. Majority of the patients reported that they were very comfortable (70.2%) and comfortable (17.5%) with the use of biomedical equipment in SCI rehabilitation. On the other hand, a lower percentage (11.6%) reported being indifferent, not being comfortable and slightly not comfortable about the use of biomedical equipment in SCI rehabilitation.

IV. DISCUSSION

Patients with spinal cord injuries, like patients with any other ailment, have the right to a high-quality, self-sufficient life. It is nearly hard to live a happy life without the use of orthotic or biomedical equipment. Biomedical equipment is extremely beneficial to SCI patients, hence all appropriate management, repair, and maintenance strategies should be implemented to ensure that this equipment is always available and in good working order. According to the findings of this study, in the south eastern and southern parts of Nigeria, there are few or no established SCI rehabilitation centers; instead, hospitals manage spinal cord injury victims in orthopedic units, traumatology units, and accident and emergency units. The type of biomedical equipment used for rehabilitation in different hospitals varies in number, grade, and is not readily available at all the various rehabilitation centers at the same time, according to this study. Despite the fact that the hospitals sampled reported having a lot of functional equipment, the majority of these health facilities are lacking in standard and modern adaptive, assistive equipment used in the rehabilitation of SCI patients. According to Fehlings (2017), in order to improve outcomes and reduce morbidity, SCI centers must work hard to promote standardization of care, reduce heterogeneity in management strategies, encourage clinicians to make evidence-based decisions, and influence policy changes for better patient care. The majority of SCI patients believed that the use of biomedical equipment in SCI rehabilitation is extremely beneficial and significant, based on their responses to the question of how valuable biomedical equipment is in SCI rehabilitation. This demonstrates the significance of biomedical devices for SCI patients. Furthermore, patients' responses to the level of comfort derived from the use of biomedical equipment reveal that the vast majority of patients are at ease while using biomedical equipment for SCI rehabilitation. As a result, the use of biomedical equipment in SCI rehabilitation is critical and beneficial to the management and recovery of patients with SCI. In the last century, tremendous advances in knowledge, technology, and rehabilitation care have given SCI survivors more hope for a better quality of life. However, healthcare is currently constrained by resources, and there is no single standard of care across all SCI facilities. The Consortium for Spinal Cord Medicine advocates for the establishment of dedicated SCI centers, which are currently limited in number and only available in a few wealthy nations. Due to the sheer complexities of the problem in SCI patients, highly skilled professionals, a supportive working environment, accurate data management, standard biomedical equipment, and active teamwork are required to provide all types of care: preventive, curative, rehabilitative, and supportive/palliative throughout the client's lifetime. The current state of information technology development has backed biomedical equipment and tele-rehabilitation systems, which promise to deliver active and efficient long-distance services to address unmet medical demands for SCI patients.

V. CONCLUSION

The biomedical equipment accessible at various hospitals and rehabilitation facilities is practical and useful for the treatment of individuals with spinal cord injuries. The existing equipment has improved the patient's recovery and has proven to be quite helpful in the treatment. Although patients have expressed comfort with this equipment for their treatment, there is always need for development in the equipment used to treat SCI. As a result, in Nigeria, biomedical equipment is widely used and beneficial in the treatment of SCI patients. Even for people who have had a lengthy history of SCI, rehabilitation using biomedical devices and training can help them improve basic living skills and their application in family and social situations.

VI. RECOMMENDATION

The following recommendations are based on the findings of this study: a standard SCI rehabilitation center should be created in the southern part of Nigeria and equipped with standard biomedical equipment to better focus on the treatment, management, and rehabilitation of SCI. Funds should be provided to hospitals where SCI patients are being rehabilitated so that they can be equipped with standard biomedical equipment for SCI rehabilitation. Repairs and maintenance of biomedical equipment should be prioritized at most SCI rehabilitation centers/hospitals, as most of this equipment is in poor condition and may not be fully functioning in most cases, preventing it from being used when it is most needed. It is also recommended that more research be done to learn more about the biomedical equipment used in the rehabilitation of patients with spinal cord injuries.

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REFERENCES

[1]. Cantu RC, Li YM, Abdulhamid M, Chin LS. (2013). Return to play after cervical spine injury in sports. *Curr Sports Med Rep* 2013; 12: 14-17
[2]. Carlson, Neil R. (2007). Physiology of Behavior (8th ed.) Boston: Allyn and Bacon.
[3]. DeVivo M. J., Chen Y, Mennemeyer ST, Deutsch A. (2011). Costs of care following spinal cord injury. *Top Spinal Cord InjRehabil*.; 16: 1-9
[4]. Eidelberg, Eduardo (1981). Consequences of spinal cord lesions upon motor function with special reference to locomotor activity. *Progress in Neurobiology*, 17, 185-202.
[5]. Fehlings, M. G., Vaccaro, A., Wilson, J. R., Singh, A., W Cadotte, D., Harrop, J. S., Rampersaud, R. (2012). Early versus delayed decompression for traumatic cervical spinal cord injury: Results of the surgical timing in acute spinal cord injury study (STASCIS). PloS One, 7(2), e32037.
[6]. Mahan ST, Mooney DP, Karlin LI, Hresko MT. (2009). Multiple level injuries in pediatric spinal trauma. *J Trauma* 2009; 67: 537-542
[7]. Munce SE, Wodchis WP, Guilcher SJ, Couris CM, Verrier M Fung K, Craven BC, Jaglal SB. (2013). Direct costs of adult traumatic spinal cord injury in Ontario. *Spinal Cord*; 51: 64-69
[8]. Nwankwo O.E, Kachy A.U. (2003). Outcome of a 12-week programme for management of the spinal cord injured with participation of patient's relation at Hiltop orthopaedic hospital, Enugu, Nigeria. *Spinal Cord;* 41: 129-133
[9]. Pickett GE, Campos-Benitez M, Keller JL, Duggal N. (2006). Epidemiology of traumatic spinal cord injury in Canada. *Spine* (Phila Pa 1976); 31: 799 -805
[10]. Sipski ML, Richards JS. (2006). Spinal cord injury rehabilitation: state of the science. *Am J Phys Med Rehabil*.; 85: 310-342
[11]. World Health Organization (WHO) (2008). International Perspectives on Spinal Cord Injury. Geneva, World Health Organization, 2008, page 34
[12]. Yıldırım K, Şengel K. (2004). Spinal cord injury and Rehabilitation. *KlnkAkt Tıp Derg*; (4): 26-38
[13]. Yip PK, Malaspina A. (2012). Spinal cord trauma and the molecular point of no return. *MolNeurodegener*; 7:6