IJPMR April 2007; 18 (1): 24-26

Observations on Rehabilitation of Traumatic Paraplegia using Body Weight Support Training and Functional Electrical Stimulation

Dr Ali Mohamad Buhroo, MBBS, MS (Ortho), Additional Professor and Head
Sayed Arshad Hussain, BPT, MPT, Physiotherapist
Mir Shakeel Ahmad, BPO, Senior Orthotist and Prosthetist
Department of Physical Medicine and Rehabilitation, Sher-i-Kashmir Institute of Medical Sciences, Soura, Srinagar, Kashmir

Abstract

Walking is the unthinking transportation of daily life, supporting countless but essential trips within home and beyond, walking holds profound symbolic importance. When a person sustains spinal cord injury the most obvious functional limitation encountered is loss of ambulation. Conventional rehabilitation primarily provides compensatory strategy for accomplishing mobility and strengthening above the level of lesion. Recently new approach to facilitate locomotor recovery and bladder and bowel emptying have been explored, these include:-

1) Body weight support walking (BWS), 2) Functional Electrical Stimulation (FES) and 3) Interferential Therapy (IFT)

To determine whether BWS training, FES and IFT have potential to improve walking function and bladder emptying in individuals with SCI, 20 subjects with spinal cord injury at the level of dorsolumber and lumbosacral regions were studied. Significant improvement in the muscle power of lower limbs and bladder control was seen in patients who received FES and IFT after the injury and at follow up of 6 months. Body support walking proved to be effective in early rehabilitation of patients with SCI. Hence comprehensive management with these gadgets provided early ambulation, bladder and bowel training and overall rehabilitation of patients. Such patients can be made independent for their ADL within the home with orthotic devices, wheel chair etc.

Key words: **Traumatic, SCI, Rehabilitation, Interferential therapy (IFT), Body weight support training (BWS)**

Introduction

The focus of this study was to review recent findings regarding the role of spinal cord in control of movement and evidence that spinal cord can undergo activity dependant plasticity. Moreover the study may provide scientific evidence to support current rehabilitation protocol that emphasize on retraining the spinal motor output.

Material and Methods

20 male patients attending the departmnt of Physical Medicine and Rehabilitation in a multidisciplinary hospital (SKIMS) suffering from spinal cord injury (SCI) at the level of lumbosacral and dorsolumbar region between the age group of 15 to 35 years.

Intervention: After giving initial treatment in the Dept of Neurosurgery, the subjects were taken up for extensive rehabilitation protocol with the follow up of 6 months to 1 year.

IFT with frequency modulation of 50 to 100 Hz was used to treat bladder incontinence. Indifferent electrode was placed on sacrum and the active one over the lower abdomen for a period of 15 to 20 days. Electrical Stimulation (ES) was given to all the motor points in lower limbs to maintain muscle bulk and gain muscular strength.

FES and BWS training was given to rehabilitate the patients in Activities of Daily Living (ADL).

Results

IFT helped to improve the bladder and bowel function in our subjects. 3 patients gained the complete control, 2

Address for correspondence: Dr. Ali Mohamad Buhroo, Department of Physical Medicine and Rehabilitation, Sher-i-Kashmir Institute of Medical Sciences, Post bag 27, Soura, Srinagar, Kashmir, Email. sayedarshad@indiatimes.com

Table I: Initial patient assessment

Mode of injury	*Level of injury*	*Surgery*	*Neuro deficit*	*Bladder /bowel involvement*	*Complications*
FAI	L3L4	L3L4 lamineictomy	Rt. LL sensation upto L1 derma Grade 0 power Rt. LL	None	Entry wound lt. thigh Bed sore sacrum Wound dehesence at L1L2
FAI	L3L4	L3L4 laminectomy	Sensation upto L1 Grade 0 power	Incontinence	Pressure sores Lt. ankle, hip
Hit by log of wood	D12	D12 corpectomy iliac crest graft	Sensation intact Grade III	None	"
RTA	L1	L1 corpectomy with iliac crest graft	L1 dermatome Grade 0	Incontinence	Pressure sore on sacrum
Fall from tree	D12	D12 corpectomy with mesh bone graft, double RC plate	D12 dermatome Grade 0 power	Incontinence	Pressure sores on sacrum

Table II: Showing final results

Level of injury	*Muscle power*		*Bladder/Bowel*		*Sitting balance*		*Ambulation*	
	OA	*LFU*	*OA*	*LFU*	*OA*	*LFU*	*OA*	*LFU*
L3L4	Rt. G-0 Lt. G-3	GIV GV			Bed ridden	without support	Not ambulation	Walking on crutches
L3L4	G-0	GII	Incontinence	Developed control	Bed ridden	Without support	Not ambulatory	Stands with braces on walking
D12	G-III	GIV	Not involved	-	"	"		Walks without support
L1	G0	G0	Incontinent Catheterization Manual Stimulation	Intermittent	"	"	"	Wheel chair based
D12	G0 With manual stimulation	G0	"	Voids with manual stimulation	"	"	"	"

patients needed catheterization while rest of the patients could void with manual stimulation. With ES muscle power improved from Grade II to Grade IV in quadriceps and dorsiflexors in 2 of our patients. In rest of the patients muscle mass was maintained with less wasting in paralyzed muscles**.**

Discussion

Performing clinical research in the area of rehabilitation of traumatic SCI can be a monumental take. Measurement of improvement or outcome after giving ES, BWS training and bladder and bowel management is possible but interpretation of results must be tempered acknowledging the diversity which existed in the level and extent of lesion in our patients.

The results of the study showed that IFT helped to improve the bladder and bowel function in some patients. This finding is not surprising. Healthy subjects are known to have global change in bowel activity with noxious cutaneous stimuli. Frederic Frost and colleagues (1993) in their study on ES of the sacral dermatomes in SCI found that ES can result in a change in the bowel activity of rectosigmoid colon. Medical students are taught to auscultate the abdomen before palpating because palpation is known to alter bowel sounds.

The results also indicate that ES can be a useful treatment for incomplete SCI subjects. Two of the patients with grade II power in dorsiflexor and quadriceps improved to the power of grade V. Muscle mass was maintained with less wasting in the paralyzed muscles. Our findings are consistent with the earlier studies conducted by Liberson and colleagues, 30 years age. He reported that

walking could be assisted by preventing foot drop in hemiplegic subjects with ES and common peroneal nerve. Stein RB et al (1993) in his study on electrical system for improving locomotion after incomplete SCI proved that FES can increase the speed of locomotion by about 4m/min and decrease the oxygen consumption. Nonetheless in our study ES proved to be a useful gadget in hastening the recovery of SCI patients.

Light weight braces used provided stability but were a bit uncomfortable and hindered nonwalking movements such as transfer from wheel chair to bed.

Limitation

We could not certainly infer our results to the interventions given because a control group was necessary to ensure that the observed changes were due to intervention and not due to the natural course of motor recovery.

Conclusion

Rehabilitation interventions have tremendous potential for achieving improvement in functional outcome in individuals with SCI and these patients can be put back to useful life for their ADL.

References

1. Stein RB, Belangar M. Electrical system for improving locomotion after incomplete SCI: An assessment. Arch Phys Med Rehabil 1993; 74: 954-9.
2. Patterson RP, Cranmer HH et al. The impaired response to SCI individuals to repeated surface pressure loads. Arch Phys Med Rehabil 1993; 74: 947-53.
3. Olie MM, Pivarnik JM, Klish WJ. Body composition of secondary and physically active spinal cord injured individuals estimated from total body electrical conductivity. Arch Phys Med Rehabil 1993; 74: 706-10.
4. Clayton KS, Chubon RA. Factors associated with the quality of long term spinal cord injured patients. Arch Phys Med Rehabil 1994; 75: 633-8.
5. Field Fote EC. Spinal cord control of movement: implications for locomotor rehabilitation following SCI. Phys Ther 2000; 80: 477-84.
6. Vilinsky JA, O Connor BL. Stepping in humans with complete spinal cord transaction a physiologic evaluation. Motor Control 1997;1284-92.
7. Yarkong GM, Rath EJ et al. Neuromuscular stimulation in spinal cord injury II. Prevention of secondary complications. Arch Phys Med Rehabil 1992; 73:195-200.
8. Eisenberg MG, Saltz CC. Quality of life among aging spinal cord injured patients. Paraplegia 1991; 29: 514-20.
9. American spinal injury association. Standards for neurological classification of spinal injury patients, Chicago 1989; 9-10.
10. Spung AM, Bauman WA, Wang J, Pierson RN Jr. The relationship between total body potassium and resting energy expenditure in individual with paraplegia. Arch of Phys Med Rehab 1993; 73: 965-8.
13. Spungen AM, Adkins RH, Stewart CA, Wang J, Pierson RN, Waters RL, et al. Factors influencing body composition in persons with spinal cord injury: a cross-sectional study. J Appl Physiol 2003; 95 (6): 2398–407.
14. Brindley GS. Deep scrotal temperature and the effect on it of clothing, air temperature, activity, posture and paraplegia Brit J Urol 1982; 54: 49–55.
15. Cairns DM, Adkins RH, Scott MD. Pain and depression in acute traumatic spinal cord injury: Origins of chronic problematic pain? Arch Phys Med Rehabil 1996; 77(4): 329–35.
16. Demirel G, Yllmaz H, Gencosmanoglu B, Kesiktas N. Painfollowing spinal cord injury. Spinal Cord 1998; 36(1): 25–28.
17. Kennedy P, Frankel H, Gardner B, Nuseibeh I. Factors associated with acute and chronic pain following traumatic spinal cord injuries. Spinal Cord 1997; 35(12): 814–7.