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Occupational Therapy

EFFECT OF OCCUPATIONAL THERAPY REHABILITATION ON AN ESTABLISHED VOLKMANN ISCHEMIC CONTRACTURE: A CASE REPORT.

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ABSTRACT Volkmann Ischemic Contracture (VIC) is the end result of prolonged ischemia and associated with irreversible tissue necrosis. Objectives of this study were to improve range of motion (ROM), muscle strength, sensations and hand functions in the affected extremity. A 26 year old male right dominant, developed VIC (severe type) over left forearm and hand following tight plaster post-surgery for radial head and proximal ulna fracture. When he reported to occupational therapy department 3 months post injury, vigorous rehabilitation in the form of splinting (static progressive), stretching, light massage, hand function activities and sensory re-education therapy was started. A long term follow up evaluation was taken after 18 months which showed significant improvement in ROM, muscle strength, sensations and hand functions in the left upper extremity. This case study reflects importance of vigorous rehabilitation for improving hand functions and eliminating need for surgical management in a patient with severe type of VIC responding well to conservative management.

KEYWORDS : Occupational therapy, Vigorous rehabilitation, Volkmann Ischemic Contracture

INTRODUCTION

Volkmann ischemic contracture (VIC) is the end result of prolonged ischemia and associated with irreversible tissue necrosis. Established Volkmann contracture has much different presentation than acute compartmental syndrome with deformity and dysfunction resulting from the ischemic event and subsequent muscle scarring and fibrosis. According to Tsuge's (1975) classification of VIC, severe type typically presents with flexion contracture of long flexors of forearm, hand intrinsics and interossei, degeneration of flexors as well as extensors, impaired sensations and hand functions with muscle atrophy and weakness. Various studies on VIC have shown that the moderate and severe type are recalcitrant to therapy and need some surgical management (Stevanovic M et al; 2006). Occupational therapy rehabilitation in VIC cases concentrates on splinting, stretching, light massage, hand function activities and sensory re-education therapy. Aim of this study was to emphasize the effectiveness of these treatment techniques on severe type of VIC.

CASE CONTEXT AND METHOD

Data was gathered from patient and his discharge notes, therapist's clinical assessment records and photographs. Patient has provided informed consent to report this case study in a journal with anonymity.

CASE DESCRIPTION

A 26 year old male, sales manager by occupation and right dominant, presented to occupational therapy outpatient department (OPD) 3 months after injury with inability to use his left hand in daily activities along with flexion contracture of wrist and hand. Patient sustained radial head and proximal ulna fracture due to fall from roof of car managed by reduction of radial head and ulnar plating and immobilised with above elbow plaster cast. Post-surgery, on the same day, he started feeling burning sensations in forearm and hand. Symptoms were ignored till next day when burning increased for which surgeon removed the plaster but patient developed blisters over finger tips and eventually developed flexion contracture of hand with inability to move fingers and thumb. Patient took physiotherapy in the form of neuromuscular electrical stimulation and gentle stretching exercises till 3 months before visiting to occupational therapy department.

Clinical findings: Clinical examination revealed positive Volkmann sign with partially stretchable flexion contracture of left wrist and hand, claw hand without any active movements of fingers and thumb, restricted range of motion (ROM) of elbow and wrist, swelling and sensory loss over forearm and hand, median, ulnar and radial nerves involvement with muscle weakness, muscle wasting observed over thenar, hypothenar, web spaces and in the proximal forearm both volar and dorsally.

CASE FORMULATION AND TREATMENT PLAN

Assessment: Following parameters were assessed pre rehabilitation and after 18 months of therapy. Data computed in **(Table 1)**.

1.Range of motion of elbow and wrist using goniometers

2.Muscle strength of muscles supplied by ulnar, median and radial nerves using Oxford grading system

3.Sensations using cotton swab, pin, hot-cold water test tubes

Hand functions using Upper Extremity Functional Index (UEFI) scale. It is a patient report outcome measure used to assess functionality in the upper extremities.It consists of 20 questions on a 5-point rating scale assessing level of difficulty in performing activities of daily living using the upper extremities including household, work and leisure activities. Item scores range from 0 to 4, 0 indicates extreme difficulty while 4 indicates no difficulty with a task and the total score is a total of the item scores. Possible score range from 0 – 80 with 0 indicating lowest functional status and 80 indicating highest functional status. The minimum amount of change that is considered to be clinically significant is 9 points.

Based on these clinical findings and assessment, various treatment approaches were planned including splinting and exercises.

Expected Outcomes: Improvement in hand function score on

Table 1: Assessment parameters evaluated at pre and post rehabilitation

Serial no.	Assessment parameter	Pre-rehabilitation (3 months post injury)	post-rehabilitation(18 months)
1	**Passive ROM**		
	Pronation	0^0- 10^0	0^0- 50^0
	Supination	0^0- 50^0	0^0- 70^0
	Elbow extension to flexion	20^0- 110^0	10^0 - 130^0
	Wrist extension	0^0 – 20^0	0^0- 60^0
2	**Sensations**		
	Light touch	20% intact	80% intact
	Pain	30% - 40% intact	80% - 90% intact
	Temperature	20% intact	80% intact
	Joint sense	50% intact	90% intact

3	**Upper Extremity Functional Index (UEFI) Score**	07/80	60/80						
4	**Muscle Strength**								
	Median nerve	**Pre**	**Post**	**Ulnar nerve**	**Pre**	**Post**	**Radial nerve**	**Pre**	**Post**
	Pronater teres	2+	4	FCU	2-	2+	Triceps, Anconeus	4	5
	Pronater quadratus	2+	4	FDP-3	2-	4	Brachioradialis	4	5
	FCR	1	2+	FDP-4	2-	4	Supinator	3	4
	Palmaris longus	1	3	AbDM	0	1	ECRL/B	1	4
	FDS-1	2-	4	ODM	0	0	ECU	2-	4
	FDS-2	1	2-	FDM	0	3	EDC	1	4
	FDS-3	1	2+	Palmar interossei (PI)-1	0	3+	EIP	0	3+
	FDS-4	1	2+	PI-2	0	1	EDM	0	3
	FDP-1	1	2+	PI-3	0	0	APL	0	3+
	FDP-2	2-	4	PI-4	0	0	EPB	0	3
	FPL	0	2+	Dorsal interossei (DI)-1	0	1	EPL	0	4
	APB	0	3	DI-2	0	0			
	OPB	0	3	DI-3	0	1			
	FPB(superior head)	0	2+	DI-4	0	0			
	Lumbrical-1	0	4	Lumbrical: 3	0	4			
	Lumbrical-2	0	4	Lumbrical: 4	0	4			
				Add P	0	4			
				FPB(deep head)	0	2+			

UEFI, ROM of elbow and wrist, muscle strength and sensations over forearm and hand were expected.

COURSE OF TREATMENT AND MONITORING OF TREATMENT PROGRESS

Duration of therapy session was around 1 hour for 5 days a week at OPD.

Splint: Initially to correct flexion deformity, static progressive Robert Jones splint was given for full day except during exercises. Wrist could be pulled into extension gradually using the two straps over dorsum of the splint. Care was taken to prevent any blisters over finger tips due to excessive pull of the straps. After 2 months as patient gained some active movements of fingers and thumb, modified MP (metacarpophalangeal) stop splint with thumb spica was given for day time followed by volar resting hand splint for night time **(Finger 2)**. Splint weaned off after 10 months of therapy when the flexion contracture and claw got completely corrected.

Figure 2: Left side Robert Jones splint; right side MP stop splint with thumb spica

Exercises: To begin with, gentle passive stretches started for elbow, forearm rotations, wrist and hand (20 seconds hold, 10 repetitions). Active movements (10 repetitions) were encouraged for improving muscle strength using verbal cues, tapping and active assisted mobilisation. Soft tissue mobilisation in the form of light circular massage with alovera cream for 10 minutes over the forearm and hand, classic sensory re-education program with rough velcro or jute material for 10 minutes, different activities like large cylindrical pegs, foam roll, horizontal sanding, theraputty squeezing, pronation-supination board etc., active ROM exercises for elbow flexion-extension, pronation-supination and wrist flexion-extension were given. After 2 months of therapy, fine motor activities like ball flickering board, finger exercising board were added. After 10 months, resistive exercises in the form of dumbbell, theraband and weighted cuffs for elbow and wrist as well as finger weights, magnets, small rings, finger web, springs and theraputty pinching for fingers and thumb were added. Patient was asked to repeat the exercises and stretches at home twice.

FOLLOW UPS AND OUTCOMES

Patient was very compliant towards therapy. Evaluations were done at every month to check the progress and final follow up was taken after 18 months post rehabilitation. Patient could go back to his occupation at the end of 8 months post rehabilitation. However, there was some residual fibrosis over proximal volar forearm, restricting terminal elbow and pronation ranges.

The results showed significant improvement in ROM of pronation (0^0 - 50^0) and wrist extension (0^0 – 60^0), sensations (around 80%-90% sensory recovery), intrinsic muscles' strength (from grade 0 to grade 2-4) and very importantly hand functions on UEFI scale (from 7/80 to 60/80) post rehabilitation **(Figure 3)**.

Figure 3: patient's left hand showing pre and post rehabilitation status

DISCUSSION

This case study showed the importance of different components of conservative treatment and role of occupational therapist in assessing and treating Volkmann ischemic contracture of forearm and hand. Improvements seen on parameters like ROM, sensations, muscle strength and hand functions could be attributed to factors like static progressive splinting, soft tissue mobilisation, sensory re-education, electrical stimulation, passive and active assisted mobilisation and stretching exercises etc. as stated by Meyerding H and Krusen F in their study (1939) on VIC where they concluded that implication of exercise therapy is must irrespective of surgery in VIC cases.

One more study by Robert Jones (1928) emphasized the importance of conservative management and concluded that conservative splintages should be tried before any surgical procedure.

Mryam Farzad et al. (2010), in their study on *non-surgical treatment of VIC,* stated that *a formal program of splinting and therapy can improve the outcome of later surgical interventions and may result in less extensive surgeries. For moderate to severe involvement, long-term customised splinting may be necessary to augment hand function.* However they did not

document the improvement in hand functions in contrast to our case study where along with ROM, sensations and muscle strengths, hand function score have been documented using UEFI scale.

CONCLUSION

This case study shows significant improvement in range of motion, severity of contracture, muscle strength, sensations and hand functions in a 26 year old male with severe type of VIC. It reflects importance of vigorous rehabilitation for improving hand functions and eliminating need for surgical management in a patient with severe type of VIC responding well to conservative management.

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