Indian Journal of
Physical Medicine and Rehabilitation

IJPMR 2004 April; Volume 15

CONTENTS

Original Papers

1. Rehabilitation Following Arthroscopic Partial Meniscectomy –A Neglected Issue. Dr Ak. Jay Singh, Dr. Nilachandra L, Dr Y.Nandabir Singh, Dr. Brogen Ak

2. Effect Of Circumferential Pneumatic Compression On Orthostatic Hypotension Among People With Disorders Of Spinal Cord. Selvaganapathy, Sujoe Thomas, Dr K.P.Sivaraman Nair, Dr A.B. Taly, Dr BM Maheshwarsppa

3. PWD Act: Awareness Among Beneficiaries and Members of Rehabilitation Team. Dr. Sindhu V, Dr U.Singh

4. A Study of Efficiency of Breathing Exercises to Improve Pulmonary Function in Tetraplegic and High Paraplegic Subjects. Dr. Suresh.R, Dr. U.Singh, Dr. S. Wadhwa, Dr. S.L.Yadav, Dr. Pallab Das, Dr. Diganta Borah, Dr. M.M. Araf, Dr. N. Ajit Singh

5.Cardiac Rehabilitation For CABG Patients in South Indian Setup: A Prospective Study. Dr AJ Rajendran, Dr S Manoj, D. Karthikeyan, Sheeba Davis

6. Heterotopic Ossification at Unusual Site in Traumatic Brain Injury. Dr Maheswarappa, Dr Nair KPS, Dr Taly AB, Dr Shanthi S, Dr. Murali T

7. Prevalence of Medical Complications vis-à-vis Psycho-social Complications in Spinal Cord Injury Patients. Dr. Sindhu Vijayakumar, Dr. U Singh

8. Chronic Planter Ulcer: A New Technique of Management. DrAshesh Ray Chaudhury, Dr Samir Das

Case Reports

9. Hypokalemic Thyrotoxic Periodic Paralysis in Female - A Report of 2 Cases with Review. Dr. L. Nilachandra, Dr. Ak. Jay Singh, Dr. N.B. Singh, Dr. Brogen AK

10. Swelling of the Thigh &Adductor Muscle Ruptue -A Case Report. Dr Poonnoose P.M, Dr Suranjan Bhattacharji, Dr.Shyamkumar, Dr. Raji Thomas, Dr.George Tharion, Dr Venugopal K

Abstracts

11. Aetiology and clinical profile of osteomalacia in adolescent girls in northern India. Dr. J. Rajeswari, Dr. K. Balasubramanian, Dr. V. Bhatia, Dr. V.P. Sharma, Dr. A.K. Agarwal. National Medical Journal of India 2003, 16 (3)

12. Varying Role of Vitamin D Deficiency in the Etiology of Rickets in Young Children vs. Adolescents in Northern India. Dr. K.Balasubramanian, Dr. J. Rajeswari, Dr. Gulab, Dr. Y.C.Gavil, Dr. A.K. Agarwal, Dr. A. Kumar, nd Dr.V. Bhatia. Journal of Tropical Pediatrics 2003, 49 (4)

Editorial board

Editorial Board 2004

Print Edition

Editor:
Dr U Singh

ISSN
0973-2209

IJPMR 15, April 2004; 1-6

"Rehabilitation Following Arthroscopic Partial Meniscectomy –A Neglected Issue"

Dr Ak. Joy Singh, Assistant Professor, **Dr Nilachandra L,** Registrar,
Dr Y.Nandabir Singh, Assistant Professor, **Dr Brogen Ak**, Assistant Professor.
Department of Physical Medicine & Rehabilitation
Regional Institute of Medical Sciences, Imphal

Abstract

Meniscus injury is common in sports. Arthroscopic partial meniscectomy has been the gold standard treatment in symptomatic cases. This procedure is associated with minimal morbidity, though early return to sport and performance are questionable issues. The Department of Physical Medicine and Rehabilitation, Regional Institute of Medical Sciences had organised a rehabilitation protocol and instituted of the same starting from the early postoperative period with the aim to minimise early complications and help early return to sports. During early phase of rehabilitation, knee effusions were noted in two, lower lateral scar adhesion in one and restricted mobility of patello-femoral joint in another. Two cases of lateral compartment pain and another case of infrapatellar tendinitis were recorded as late complications. The need of a supervised rehabilitation programme is emphasised in this paper.

Key Words: meniscal injury, arthrosopic partial meniscectomy, rehabilitation

Introduction:

Manipur is a leading sporting state in the country. Recent hosting and performance in the 5th National games and 58th Santosh trophy have proven the state's credibility. Sport related injuries are also very common. Proper and timely management of sport injury is critical. Many promising sportspersons are disabled due to improper management. One such problem is management of meniscus injury.

Meniscus injury represents one third of all athletic injury[1]. Treatment options for meniscal injuries include nonoperative management, meniscectomy, meniscal repair and meniscal replacement. For patient with frequently symptomatic and irreparable tear, partial meniscectomy removes unstable fragments that may cause symptoms of locking and catching.

Address for Correspondence: Dr Ak Joy Singh, Department of Physical Medicine and Rehabilitation, Regional Institute of Medical Sciences, Imphal 795004, Manipur Email: joyakoijam2@yahoo.com

Arthroscopic partial meniscetomy is the gold standard procedure for the symptomatic cases. It gives less morbidity, lesser risk for major complications, rapid return to sports and a better long-term result when compared with the open meniscectomy procedure. However importance of a defined rehabilitation programme following such an important procedure is often underestimated. This common procedure is associated with problems that may hamper early return to sport. Common findings include a knee that is warm to touch, joint effusion, muscle atrophy, decrease in muscle tone and strength especially quadriceps, adhesion and scar tissue over the arthroscopic incisions, loss of range of mobility and tenderness of medial or lateral compartments of knee[2]. Such morbidity however minimal it may be will surely affect performance of the athletes. Institution of a proper rehabilitation programme shall help in early detection of such problems and help smooth return to sport. The

Department of Physical Medicine has developed a rehabilitation protocol and instituted the same starting from the early postoperative period with the aim to minimise early complications and help smooth and early return to sports. The results are analysed in this paper.

Material and methods

Eighteen active sportspersons who underwent arthroscopic partial meniscectomy for isolated meniscus injury by different orthopaedic surgeons during the period of October 2001 to July 2003 were selected. Sportspersons with both meniscus injury or associated chondromalacia patellae or cruciate ligament injury detected during arthroscopy, instability of opposite knee joint or any other associated problem that will hamper the rehabilitation programme, more than six month of injury before operation were excluded from the study. A rehabilitation protocol developed in the Department of Physical Medicine and Rehabilitation, Regional Institute of Medical Sciences was instituted immediately following the arthroscopic procedure.

Rehabilitation goals

1. To control pain and swelling, 2. To regain a pain free active range of motion, 3. Graduated weight bearing, 4. Progressive strengthening within the available range of motion, 5. Return to functional activities/sport

Rehabilitation programme –

first week

- Compression bandage/knee sleeve immediate and early post operative period
- Partial weight bearing as tolerated starting from day of surgery
- Full weight bearing from the third day
- Active and active assistive range of motion, patello-femoral joint mobilisation exercises started immediate post operative
- Strengthening of quadriceps (from 2nd post operative day)and hamstring muscles (from 5th post operative day)
- Strengthening of hip extensor and abductor, ankle dorsiflexors
- Ice, ultrasound therapy, electrical stimulation, interferrential therapy
- Stationary bike from 4th postoperative day

Second week

- Isotonic and isokinetic (mild and faster speed) strengthening exercises for quadriceps and hamstrings
- Closed kinetic chain exercises
- Balance or propioception training using a rocker board
- Jogging or swimming from 10th post operative days
- Strengthening of muscles around hip, ankle and other limb

Third week

- Continued strengthening exercises with increase speed
- High speed isokinetic strengthening exercises for quadriceps and hamstrings
- Sports specific drills – jump, hop, skip
- Jogging on soft surface with progressive increase in speed and distance

Fourth week

- Progressive agility drills(backward and lateral running, vertical jumping, cross over, figure 8 running, etc.) with increasing speed and complexity
- Progressive introduction of sprinting, acceleration and deceleration
- Return to sports

Criteria for returning to sports

1. Absence of effusion, 2. Full range of motion of knee joint, 3. Normal quadriceps/hamstrings

strength, 4. Normal hip external rotator function, 5. Good propioception, 6. Functional exercises performed without difficulties, 7. Simulated match situation (continuous cycling for 30 minutes) without subsequent knee pain

Results

All eighteen sportspersons were in the age group of 17 to 28 years. Fifteen were males and three were females. Medial meniscus was involved in 14 and lateral in four cases. Highest numbers of sportspersons were from football (11), followed by basketball (2), fencing (2), athletics (1), taekwondo (1), and hockey (1).

Knee effusion lasting more than 10 days was noted in 2 patients. Lower lateral scar adhesion and restricted mobility of patello-femoral joint was also noted in 1 patient each. Two patients reported continued tenderness of lateral compartment of knee even after the completion of rehabilitation programme. One patient with continued knee effusion during the rehabilitation programme was treated with additional intra-articular injection of methly prednisolone. Another patient (fencer) developed infra-patellar tendinitis within one month of joining the main sport. All patients returned to sports within 34+ 3.2 days. Follow up period ranged from 8 months to 2 years. Maximum performance of two patients was inhibited, one due to continued lateral compartment pain and another due to infra-patellar tendinitis. MRI of the knee for the first patient showed osteonecrosis of the lateral femoral condyle. Ultrasonography of the second case showed features suggestive of infra-patellar tendinitis, which was later co-related with the training scheduled and found to be overuse injury not related with the surgery.

Discussion

The menisci of knee play an important role in joint congruence, stability and absorption. They thus contribute to cartilage preservation. Biomechanical testing has shown that the medial and lateral menisci transmit at least 50 to 70% of the weight bearing load when knee is extended and upto 85 to 90% when knee is flexed. This is why current treatment of meniscal lesions is based on the notion of maximum preservation of menisci: meniscectomy as partial as possible, but also whenever possible, meniscal repair, or abstention from surgery. In the case of meniscal lesion on an otherwise intact knee, the usual approach is very partial arthroscopic meniscectomy. Arthroscopy has shortened postsurgical effect, but long-term results still show a certain percentage of narrowing of joint's space, in particular on the lateral meniscus[3].

Our common experience is that majority of the patients who underwent partial meniscectomy do not undergo a supervised rehabilitation programme. They are usually discharge following surgery with ROM and quadriceps strengthening exercises. Subsequently, we have come across patients developing reflex sympathetic dystrophy, severely restricted mobility of patello-femoral joint following arthroscopic surgery. Such morbidity though minimal, frequently questioned the future of the sportsperson. A supervised rehabilitation programme can prevent these complications during the early postoperative period.

In the present study, males are more frequently involved (15:3) than females. Medial meniscus was more commonly injured than the lateral meniscus (14:4). Footballers were most commonly involved. Marc R. Safran [1] reported male: female ratio of 2.5:1 and medial to lateral meniscus tear ratio of 3:1. He identified football and basketball as main sports associated with meniscal injury. Otherwise a meniscal tear is usually encountered in any sport which necessitate twisting force with knee semi-flexed

or flexed. Lateral meniscus injuries are not common as this meniscus is more mobile and therefore escapes injury.

Smillie[4] reported 17% delayed recovery in his own series and 34% from other series due to complications following open meniscectomy. Complications are associated with long pre-operative history, rupture anterior cruciate ligament, retained posterior segment, osteochondritis dissicans, neuroma of infrapatellar branch of saphenous nerve, congenital discoid meniscus, osteoarthrosis, multiple meniscectomies, para-articular ossification, postoperative infection. Presently available literature mostly focus on late complications like osteoarthritis and joint instability changes not on early postoperative complications. Moreover, a definite projection on the need of a follow up rehabilitation programme is lacking.

In 1988 Small [5]presented the largest prospective arthroscopy complication review. In this study, estimated complications of arthroscopic meniscectomy ranged from 1.5% for lateral meniscus to 1.7% for medial meniscus with an overall complication rate of 1.68%. Thrombophlebitis, hemarthrosis, infection, persistent effusion, and synovitis dominates post operative complications.

Arthroscopic partial meniscectomy is usually a straightforward procedure followed by a fairly rapid return to sport after four weeks of rehabilitation. The rehabilitation process usually takes longer if there has been a more complicated tear of the meniscus, especially if the lateral meniscus is injured. The presence of articular cartilage damage or ligament (MCL, ACL) tears, will necessary slow down the rehabilitation process[1]. Probably this explains why one patient continues to have pain in the lateral compartment due to articular damage that was not detected during the arthroscopic procedure.

Where there is persistent effusion some causes should be sought and, where possible eliminated. Postoperative effusion is more easily prevented than cured. It is important that an efficient compression bandage be maintained in the early stages of weight bearing[4]. Ogilvie- Harris[6] and Metcalf [7]discussed persistent post operative effusion and synovitis. If effusion persist for more than 3 to 4 weeks, NSAID therapy may be innitiated. If effusion is large, aspiration with installation of a corticosteroid may be carried out. If the effusion continue for several months postoperatively, additional or subsequent intraarticular pathology should be considered. If the athlete returns to play before the knee is properly rehabilitated, he or she may not experience difficulty during the first competition but may be prone to develop recurrent effusion and persistent pain. Persistent effusion in two cases in the present study may be due to overactivity with the aim to return to sport early during the early postoperative period or due to inadequate surgery or failure to detect other injuries during the procedure. Close monitoring is essential during post meniscectomy rehabilitation as the remaining meniscus and underlying articular cartilage slowly increase their tolerance to weight bearing. The development of increased pain and swelling should result in the programme being slowed down or revised accordingly.

Infection has become a more frequent complication as arthroscopy becomes more widely used. Scar adhesion may be seen when arthroscopic wounds are infected. This is associated with poor aseptic and antiseptic techniques. It may lead to restricted mobility of the patello-femoral joint and pain due to stretching of scar during knee movements. In both situations, return to sport may be delayed or patient return to sport with limitations.

Bonneus[8] evaluated thirty-one knees following arthroscopic partial meniscectomy of the lateral meniscus in athletes after an average follow up of 8 years. 48.4% had excellent/good IKDC scores and 64.5% excellent/good Lysholm score. The Tegner activity score dropped from 7.2 (competitive sports) to 5.7 (recreational sports). Fairbank changes were noted in 92.9% of the radiographs. Deterioration of results after arthroscopic partial meniscectomy is obvious. The extent of resection is a significant factor. Burks RT[9] followed up 146 patients who had undergone arthroscopic partial meniscectomy about 14.7 years before. There were 88% good and excellent results in the anterior cruciate stable knees. The radiographic grade side-to-side difference showed the operative knee to be only a 0.23 grade worse than the nonoperative knee. Age at the time of meniscectomy was not found to be a factor. Male patients had better radiographic results than female patients, but not better functional score. Medial and lateral meniscus results were not significantly different. Knees with a femoral-tibial anatomic alignment of more than 0 degree valgus compared with less than or equal to 0 degree and that had undergone medial meniscectomy had significantly better radiographic results. In patients with anterior cruciate ligament tears, outcome after meniscectomy was significantly poorer than stable knee in regards to radiographic grade change, Lysholm, Tegner and medial joint space narrowing. Schimmer RC[10] reported results of the two steps evaluation following arthroscopic partial meniscectomy with a 12 years follow up. He reported that 91.7% had an excellent or good result 4 years after surgery and 78.1% rated excellent or good 12 years after surgery. Early results therefore were mostly representative and did not change significantly during the long-term course for the isolated meniscal lesion. The factor with the highest impact on long-term results was damage to the articular cartilage, which did not influence knee function for several years after surgery but become increasingly symptomatic over time after 5 years or more. Only 62% of patients with additional cartilage damage rated excellent and good 12 years after surgery, in contrast with 94.8% good and excellent results in patients with isolated meniscal tear.

Return to sports following arthroscopic partial meniscectomy is considered when the quadriceps and hamstring muscles have regained their strength, endurance and synchrony, usually at approximately 6 to 8 weeks[11]. In the present series, return to sport took around 34+ 3.2 days. Parry et al [12] in his series of 1723 cases from Royal Air Force rehabilitation units reported that average time for return to duty after open meniscectomy was 62 days and no difference in the time of recovery from medial as opposed to lateral meniscus injury. In their series, 74% cases were discharged to full duty; 21% discharged to modified duty and 3.9% returned to hospital. Although knee arthroscopy and more specifically, meniscectomy have relatively low morbidity, complications do certainly occur. Thorough patient evaluation, proper use of arthroscopic equipments, gentle and correct surgical technique, meticulous intra- and post-operative monitoring, and patient education will help in reducing the incidence of such complications. Above all, a supervised rehabilitation programme will certainly help in minimising morbidity due to such complications.

Conclusion

Meniscus injury is a common sports related injury. Arthroscopic partial meniscectomy has been a standard treatment for the symptomatic cases. However this procedure is not the ultimate in their treatment,

rather it should be viewed as the beginning of a supervised rehabilitation programme for early and smooth return to sports without complications.

References

1. Christopher D. Harner, Ronald A. Navarro. Knee cartilage. In: Marc R. Safran, Douglas B. McKeag, Steven P. Van Camp (editors). Manual of Sports Medicine. Philadelphia: Lipincott-Raven;1998. p440-441.
2. Norman F. Sprague III. Arthroscopic Meniscal resection. In : W. Norman Scott (editor).The Knee. St. Louis: Mosby;1994.p 527-57.
3. Beaufils P. Meniscal lesions. Rev Trat 1998;48(16):1773-79.
4. Smillie. Injuries of knee joint. Fifth edition. Edinburgh: Churchill Livingstone; 1978.
5. Small NC. Complications of arthroscopic surgery performed by experienced arthroscopists. Arthroscopy 1988;4(3):215-21.
6. Ogilvie-Harris DJ, Bauer M, Corey P. Prostaglandin inhibition and the rate of recovery after arthroscopic meniscectomy: a randomised double-blind control study. J Bone Joint Surg 1985;67B: 567-71.
7. Metcalf RW. Arthrocopic meniscal surgery. In: Shahriace J(editor). Arthroscopic surgery. Philadelphia; JB Lipincott;1984.p93-97.
8. Bonneux I, Vandekerchove B. Arthroscopic lateral meniscectomy long term result in athletes. Acta orthop Belg 2002;68(4):356-61.
9. Burks RT, Metcaff MH, Metcalf RW. Fifteen years follow up of arthroscopic partial meniscectomy. Arthroscopy 1997;13(6):673-79.
10. Schimmer RC, Brulhart KB, Duff C, Glinz W. Arthroscopic partial meniscectomy: a 12 years follow up and two steps evaluation of the long term course. Arthroscopy1998;14(2).136-42.
11. Michael GC, Clarence LS, Neal SEA. Meniscectomy. In : Freddie HF,Christopher DH, Kelly GV (editors). Knee Surgery. Baltimore:Williams and Wilkins;1994.p591-63.
12. Parry CBW, Nicols PJR, Lewis NR. Meniscectomy: a review 1723 cases. Annals of Physical Medicine 1958;4: 201.

IJPMR 15, April 2004; 7-11

Effect Of Circumferential Pneumatic Compression On Orthostatic Hypotension Among People With Disorders Of Spinal Cord

Selvaganapathy BPT, Physiotherapist* **Sujoe Thomas** BPT, Physiotherapist*
Dr K.P.Sivaraman Nair MD, DM, Associate Professor*
Dr A.B. Taly MD, DM, Professor**
Dr BM Maheshwarappa MD, Senior Resident*
*Department of Psychiatric and Neurological Rehabilitation
**Department of Neurology National Institute of Mental Health and Neurosciences
Bangalore 560 029 India

Abstract

Background and purpose: Orthostatic hypotension is a frequent problem interfering with physiotherapy among people with disorders of Spinal cord. Purpose of this study is to determine effect of circumferential pneumatic compression on orthostatic hypotension during standing in subjects with spinal cord injury.

Subjects and methods: Ten subjects with spinal cord lesions at or above 6th thoracic spinal cord segment and with Orthostatic hypotension were included in this study. Subjects were kept in the supine position on a tilt table. Blood pressure was measured manually using standard sphygmomanometer in the supine position and 3 minutes after tilting up to 90°. Measurements were done initially without any interventions and were repeated after application of circumferential pneumatic compression of 30 mmHg for 10 minutes.

Results: Circumferential pneumatic compression of 30 mmHg abolished Orthostatic hypotension in five subjects. There was an increase in standing systolic BP by 21mmHg at 90° of elevation after application of circumferential compression (P=0.029). No significant change was noted in diastolic BP. There were no complications.

Conclusion : Circumferential pneumatic compression was effective in management of orthostatic hypotension during passive standing in subjects with spinal cord lesions.

Key words : Blood pressure, Circumferential pneumatic compression, Orthostatic hypotension Spinal cord injury, passive standing.

Introduction:

Disorders of Spinal cord often causes weakness of lower limbs, resulting in osteoporosis, hypercalciuria, pressure ulcers, hypostatic pneumonia and constipation. Passive standing helps in preventing some of these complications, but may not be possible in these subjects due to orthostatic hypotension (OH). Prevalence of OH following SCI varies between 37 % and 57%[1,2]. OH interferes with therapy, hinders rehabilitation process, delays achievement of treatment goals and increases hospital stay [3].

Circumferential Pneumatic Compression

Address for correspondence Dr K.P.Sivaraman Nair, Associate Professor, Department of Psychiatric and Neurological Rehabilitation, National Institute of Mental Health and Neurosciences Hosur road Bangalore 560 029 India Telephone: 91-80-6995281 Fax:91-80-6564830 e-mail: kpsnair @hotmail.com

(CPC) of extremities is used as a treatment of pain, dysautonomia, contractures, spasticity, edema and deep venous thrombosis [4,5]. CPC of lower limbs is useful in the treatment of hypotension during spinal anesthesia [6]. Moiseev noted that compression with an inflatable antioverexertion gear (AOG) helped in treatment of OH [7]. Objective of current study is to assess efficacy of CPC in treatment of OH in subjects with disorders of Spinal cord during passive standing.

Subjects and Methods

Ten subjects, 8 men and 2 women with disorders of Spinal cord and OH, attending physiotherapy and who gave consent to participate were included in the study. Clinical evaluation was done according to "The international standards booklet for neurological and functional classification of Spinal Cord Injury[8]. OH was defined as a reduction in systolic BP of at least 20mmHg or diastolic BP of at least 10mmHg within 3 minutes of standing on being raised by greater than 60^0 on a tilt table [9]. The lowest caudal segment with normal sensations and motor power was taken as the level of the lesion[8]. Details of all subjects including age, sex, clinical diagnosis, level of lesion, completeness of the lesion, total motor and total sensory score, current medications and duration of injury were noted. Subjects who were on medications for OH like fludrocoristone and medications with cardiovascular effects were excluded from the study. Pneumatic splints fabricated with polythene material were connected to the sphygmomanometer and inflated with an air pump with a pressure of 30 mmHg. The design and fabrication of this splint have been published earlier [10].

Subjects were kept in the supine position on the tilt table without any tilt and were fastened with straps, one over the chest region and one over both knees. After 10 minutes, BP was recorded from the right upper limb using standard manual sphygmomanometer held at the level of subject's apex beat. A standard adult pneumatic cuff was applied over the upper arm just above the elbow. Appearance of Korotkoff sounds on auscultation over brachial artery at the elbow was taken as systolic blood pressure and its total disappearance as diastolic BP. The table was then tilted to 90^0 in 50 seconds and the BP recording was repeated at 3minutes after achievement of 90^0 tilt. Subjects were asked to report any symptoms appearing on tilting. On report of any symptoms the procedure was stopped, and the subject was immediately brought back to supine position and BP was recorded again. A pneumatic splint was fastened to both lower limbs from mid thigh to ankle. CPC was applied by inflating the splint to 30 mmHg using the air pump of sphygmomanometer. Supine BP was recorded 10 minutes after application of CPC. The subject was tilted to 90^0 and BP was recorded after three minutes. Pulsation of dorsalis pedis artery and color of the limbs were checked at 10 minutes interval through out the procedure after application of CPC. In patients who developed symptoms such as giddiness, nausea, vertigo, blurring of vision, feeble pulse and low BP the procedure was stopped and the tilt table was lowered to 0^0 immediately.

Results

Age, severity, etiology, duration of symptoms and level of the lesion of 10 subjects are shown in table 1. While there was increase in tone in lower limbs in two subjects, the rest had flaccid lower limbs. Reduction in systolic BP on passive standing at 90^0 without any intervention varied from 156 mmHg to 24 mmHg (Mean = 77.8 mmHg + 67.8, median= 50 mmHg). After application of CPC mean reduction in standing systolic BP at 90^0 was 33.4 + 47.1 mmHg (median = 20 mmHg). The

Table - 1 : Orthostatic hypotension in Spinal cord disorders: Response to Circumferential Pneumatic compression

Patient No.	Age	Sex	Level of Lesion	Asia Serverity grade	Diagnosis	Systolic BP		
						0^0	90^0	90^0 With CPI
1	31	M	T2	B	Neuro Syphilis	130	Not recordable	120^0
2	38	M	C7	A	Trauma	156	Not recordable	Not recordable
3	26	M	C5	A	Tuberculosis with spinal arachnoiditis	130	Not recordable	128*
4	21	M	T2	B	Trauma	120	76	78
5	30	M	T7	A	Transverse myelits	118	62	70
6	40	W	C3	C	Tuberculosis of	130	Not	120*
					spine		recordable	
7	46	W	C5	B	Multiple Selerosis	134	90	100
8	40	M	C3	A	Prolapsed	130	90	100
9	65	M	T2	B	Cervical	120	80	80
10	62	M	T6	C	Transverse myelits	124	96	124*

CPC-Circumferential pneumatic complication. ASIA-American Spinal Injury Association M=Men, W-women, C=cervical, T=Thoracic, *Responders

increase in systolic BP with CPC ranged from 0 mmHg to 128 mm Hg (Mean 44.4 + 54.9 mmHg median –19mmHg). This difference was statistically significant (paired t test - 2.856, df =9, p = 0.029). Overall five subjects did not have OH (fall in systolic BP of < 20 mmHg on standing) with CPC (Table 1). With CPC, systolic BP on standing increased in three other subjects, but they continued to have OH (a reduction of systolic BP of <20 mm Hg on standing). CPC did not change standing systolic BP in two subjects. The mean diastolic BP at 90^0 without and with CPC were 73.5-+12.4 mmHg and 79.1+19.4 mmHg respectively. This difference was not statistically significant. None of the patients had any complications including ischemia or autonomic dysreflexia due to application of CPC.

Discussion

Standing is an important therapeutic activity for subjects with disorders of Spinal cord. Benefits of standing include prevention or reversal of osteoporosis and resultant hypercalciuria, prevention of contractures and improvement in joint range of motion [11]. OH is a frequent problem limiting standing during physiotherapy in subjects with disorders of Spinal Cord [3] .To achieve early weight bearing and standing, it is essential to control OH.

Treatment of OH includes administration of drugs such as ephedrine, fludrocoristone and ergrotamine. But the effect of drugs on OH is unpredictable and unsatisfactory [12]. Non-pharmacological approaches by using abdominal binders and elastic stockings have been tried to increase venous pressure and reduce pooling of blood. Tanaka et al reported improvement in OH with inflatable abdominal binders[13]. Elastic compression hosiery has also been reported to be an effective in preventing OH by enhancing venous return and cardiac

out put in the standing posture [14]. Another technique useful in control of OH is functional neuromuscular stimulation (FNS). Elkoda etal noted that FNS of knee extensors and foot plantar flexors to minimize cardiovascular changes during postural changes in individuals with Spinal Cord Injury[15]. In a similar study Sampson et al observed that subjects with Spinal Cord Injury could tolerate higher angles of incline with FNS[16].

CPC has been used to prevent DVT, correct and prevention deformities, control bleeding and treat edema, shock, spasticity and pain [4,5,10]. Lower limb compression using inflatable splints can be used to prevent hypotension during spinal anesthesia for caesarian section [6]. Moiseev used a special AOG gear consisting of an abdominal, two thigh, and two knee inflatable rubber cuffs to treat OH in 10 patients with Spinal cord injury. This AOG prevented OH enabling the patients to maintain an erect position for 10 minutes and longer[7]. In the present study we noted that CPC over lower limbs to helped control OH during passive standing in 5 of 10 subjects with disorders of Spinal cord.

Elastic hosiery and compression stockings are used in the treatment of OH**.** Henry et al noted that seven out of 10 subjects from a geriatric falls clinic, benefited from compression hosiery, which applied pressure over abdomen and lower limbs [14]. In our study, OH during passive standing could be abolished in five patients of 10 subjects with disorders of Spinal cord, with CPC. We applied compression only over lower limbs. Application of compression over abdomen may result in better response.

CPC improves venous return and thus increases stroke volume and systolic BP [13]. We noted that while CPC improved systolic BP, it did not have any significant effect on diastolic BP. This may be because diastolic BP is more dependent on peripheral arterial resistance, on which CPC did not have any significant effect.

This study has several limitations. The sample size is small. There is a possibility of investigator bias as it was not a blind study. The second tilt is less likely to be associated with OH due to adaptation and angiotensin release during the initial tilt. In the present study, the second tilt was given 30 minutes after the initial tilt. A double blind study with larger sample size and random application of CPC may help in further validating our results.

Complications of CPC include limb ischaemia and compartment syndrome. Pneumatic pressure applied to lower limb can stop microcirculation and produce anoxia [17, 18]. In our study none of the subjects had this complication. Frequent monitoring of dorsalis pedis pulse, color of the limb and evidence of swelling may help in preventing complications of CPC. Incorporation of blow-off valves and continuous monitoring of inflation pressure are other safety measures.

Conclusion

CPC resulted in a significant reduction OH during passive standing in subjects with SCI. None of the subjects developed any complications. Further studies with larger number of patients may establish the usefulness of this technique in treatment of OH.

Acknowledgement

Authors acknowledge help of Mr. Richard Bartley, Physiotherapist, Cymru, United Kingdom in planning of the study, Mr O. Chellappan, Plastic molding technician for fabrication in the splints, Dr Thennarasu, Department of Biostatistics in analysis of data and Ms Manjula Sharman for secretarial assistance.

References

1. McKinley WO, Tewksbury MA, Godbout CJ. Comparison of medical complications following

nontraumatic and traumatic spinal cord injury. J Spinal Cord Med 2002; 25: 88-93.

2. Cariga P, Ahmed S, Mathias CJ, Gardner BP. The prevalence and association of neck (coat-hanger) pain and Orthostatic (postural) hypotension in human spinal cord injury. Spinal Cord 2002; 40: 77-82.
3. Illman A, Stiller K, Williams M. The prevalence of Orthostaic hypotension during physiotherapy treatment in patients with acute spinal cord injury. Spinal Cord 2000; 38: 741-747.
4. Aito S, Pieri A, Andrea MD, etal. Primary prevention of deep venous thrombosis and pulmonary embolism in acute spinal cord injured patients. Spinal Cord 2002; 40: 300-303.
5. McKnight PT, Schomburg FL. Air pressure splint effects on hand symptoms of patients with rheumatoid arthritis. Arch Phys Med Rehabil 1982; 63: 560-564
6. GoudieTA, Winter AW, Ferguson DJ; Lower limb compression using inflatable splints to prevent hypo tension during spinal anesthesia for caesarian section. Acta Ansesthesial Scand 1968;32:541-544.
7. Moiseev VA. Possibility of controlling orthostatic instability in spinal cord injuries. Zh Vopr Neirokhir Im N N Burdenko. 1984;3:45-8 (Russian).
8. Ditunno JF, Young W, Donovan WH, Creasey G. The International standards for neurological and functional classification of spinal cord injury. Paraplegia 1994; 32: 70-80.
9. Consensus committee of the American Autonomic society and American Academy of Neurology. Consensus statement of the definition of orthostatic hypotension, pure autonomic failure and multisystem atrophy. Neurology1996; 46: 1470-1473.
10. Taly AB, Nair KPS, Murali T, Wankade M. Pneumatic Splints: Fabrication and use in Neurorehabilitation setting. Neurology India 2002;50:68-70
11. Kaplan PE, Roden W, Gilbert E, etal. Reduction of hypercalciuria in tetraplegia after weight bearing and strengthening exercise. Paraplgia1981; 19:289-293.
12. Mathias CJ, Frankel HL. Autonomic disturbance in spinal cord lesion: In Mathias CJ, Bannister R (eds) Autonomic failure: A Text book of clinical disorders of the autonomic Nervous System.4th edn. Oxford university press, 1999 pp 494-513
13. Tanaka H, Yamaguchi H, Tamai H. Treatment of Orthostatic intolerance with inflatable abdominal band. Lancet 1997; 349: 175.
14. Henry R, Rowe J, O' Mahony D. Haemodynamic analysis of efficacy of compression hosiery in elderly fallers with Orthostatic hypotension. Lancet 1999; 354: 45-46.
15. Elokda AS, Nielsen DH, Shields RK. Effect of functional neuromuscular stimulation on postural related orthostatic stress in individuals with acute spinal cord injury. J Rehabil Res Dev. 2000;37:535-42.
16. Sampson EE, Burnham RS, Andrews BJ. Functional electrical stimulation effect on orthostatic hypotension after spinal cord injury. Arch Phys Med Rehabil. 2000 ;81:139-43.
17. Sloan JP, Dove AF. Inflatable splints- what are they doing? Arch Emerg Med 1984; 1: 151-155.
18. Christensen KS, Trautner S, Stockel M, Nielsen JF. Inflatable splints: do they cause tissue ischaemia? Injury 1986; 17: 167-170.

IJPMR 15, April 2004; 12-16

PWD Act: Awareness Among Beneficiaries and Members of Rehabilitation Team

Dr. Sindhu Vijayakumar, MBBS, MD (PMR), Senior Resident
Dr. U Singh, MBBS, DPMR, DNB (PMR), Professor and Head
Department of Physical Medicine and Rehabilitation
All India Institute of Medical Sciences, New Delhi 110029

Abstract

Estimated 70 million people are disabled in India (~7% of population). "The Persons with Disabilities (Equal Opportunities, Protection of Rights & Full Participation) Act, 1995" (PWD Act) is a landmark legislation for the disabled in India. Certification of orthopaedic and neurologic disability is a part of a spectrum of activities conducted by a rehabilitation team. It decides whether a person comes under the preview of PWD Act or not. The effective utilization of various provisions of this Act plays an integral part in ultimate socio-vocational rehabilitation of its beneficiary. This is possible only if the concerned person is aware of his rights and knows how to go about it. Therefore it is necessary to frequently assess the awareness of any program among its beneficiaries, implementers and any contact persons to assess the success of effectiveness of it. Here, an attempt is made to assess the level of awareness of PWD Act beneficiaries through a short survey. Rehabilitation Team Members are also surveyed, who are frequent contact personnel for people with these special needs. Though many people are aware of educational and employment benefits under the Act, very few know the details and how to avail them. Every one knows about Travel concessions in public transport system but none is aware of the facilities to be provided in it. Some suggestions are pointed which are applicable at department or hospital level to increase the awareness of people attending hospitals and of staff members.

Introduction

Approximately 7% (70 million) of India's population comprises of people with special needs. "The Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation) Act, 1995" (PWD Act) is a landmark legislation for the welfare of these people. It is published by notification of Ministry of Welfare, in the Gazette of India, Extraordinary, Part II - Section 3.

"Disability" means-

Blindness Low vision Leprosy-cured Hearing impairment Locomotor disability Mental retardation Mental illness

Address for Correspondence: Dr. Sindhu V, Department of Physical Medicine and Rehabilitation, All India Institute of Medical Sciences, New Delhi 110029

"Person with Disability" means a person suffering from not less than forty per cent of any disability as certified by a medical authorityThe Main Provisions of PWD Act (Scope)

I. Prevention and Early Detection of Disabilities
II. Education
III. Employment
IV. Affirmative Action
V. Non-Discrimination
VI. Research and Manpower Development
VII. Recognition of Institutions for Persons with Disabilities
VIII. Institution for Persons with Severe Disabilities

IX. Social Security

X. Miscellaneous

I. Prevention and Early Detection of Disabilities

1. Surveys, investigations and research
2. Promote prevention of disabilities
3. Screening of children and awareness campaigns

II. Education

1. Free education till the age of 18 years
2. Appropriate transportation, removal of architectural barriers and modifications in the examination system
3. Right to free books, uniforms and other learning materials
4. Special school for children with disabilities
5. Scholarships
6. Non-formal education
7. Teacher's training institutions

III. Employment

1. Not less than 3% vacancies in government employment reserved for persons with disabilities
2. Suitable schemes for training and welfare of persons, rel0000axation of upper age limit and regulating the employment
3. Health and safety measures at place of employment
4. Reservation in poverty alleviation schemes

IV. Affirmative Action

1. Schemes to provide aids and appliances
2. Allotment of land at concessional rates for house, business, special recreational centers, special schools, research schools, factories by entrepreneurs with disability

V. Non-Discrimination

1. Adapt public buildings, rail compartments, buses, ships and aircrafts to permit easy access to persons with disabilities
2. Adapt toilets in rail compartments, vessels, aircrafts and waiting rooms in such a way as to permit the wheel chair users to use them conveniently.
3. Braille and sound symbols in lifts
4. All the places of public utility shall be made barrier-free
5. No employee can be sacked or demoted if they become disabled during service, although they can be moved to another post with the same pay scale. No promotion can be denied because of impairment

VI. Research and Manpower Development

Research in the following areas may be sponsored and promoted

1. Prevention of disability
2. Rehabilitation including Community Based Rehabilitation (CBR)
3. Development of assistive devices
4. Job identification
5. On site modifications of offices and factories
6. Financial assistance for undertaking research

IX. Social Security

1. Financial assistance to Non-governmental organizations (NGO)
2. Insurance coverage
3. Unemployment allowance

X. Miscellaneous

1. Grievance redressal
2. Chief Commissioner – Centre
3. Commissioner for persons with disabilities – States

A Medical Board (consisting of at least three members out of which at least one shall be a specialist in the particular field for assessing locomotor/visual including low vision/hearing and speech disability, mental retardation and leprosy cured, as the case may be) issues permanent disability certificate. Thus it becomes a part of a spectrum of activities conducted by

a rehabilitation team.

Awareness is the most important factor that decides the effective utilization of any program intended for welfare of community. It plays an essential part in the ultimate psycho-socio-vocational rehabilitation of its beneficiary. Therefore it is necessary to frequently assess the awareness of any program among its beneficiaries, implementers and any contact persons to know the success or effectiveness of it.

Objectives of the survey

1. To assess the degree and level of awareness of main provisions of the "Persons With Disabilities Act" (PWD Act) in its beneficiaries.
2. To assess the level of awareness of the same Act among various members of Rehabilitation Team who are in frequent contact with the beneficiaries.

Survey Protocol

Thirty six (36) persons who attended Physical Medicine and Rehabilitation (PMR) OPD, AIIMS for procuring Disability Certificate (DC), Railway Concession Certificate (RCC) or for renewing old DC were interviewed. After taking consent, relevant data was obtained. Children less than 5 years of age and those persons unwilling to participate in the survey were excluded. For children and those with cognitive impairment, information was obtained from guardian.

Thirty (30) Rehabilitation Team Members including Resident Doctors, Physiotherapists, Occupational therapists, Medical Social Services Officers (MSSO), Staff Nurse, Public Health Nurse (PHN) and Prosthetic and Orthotic Engineers were given questionnaires to fill up. There was no compulsion to take part in the study and anonymity was maintained.

Table 1. Characteristics noted in beneficiaries

Characteristics of beneficiaries		Number
Educational status	Illiterate	3
	Can read & write but no formal education	0
	Primary	4
	Middle	14
	Higher secondary	7
	Graduate/postgraduate	8
	Professional	0
Socio-economic status	Low	22
	Middle	11
	High	3
Possessed a DC	Yes	23
	No	13
Ever used DC	Yes	10/23
	No	13/23

Outcome of the survey

Total of 66 persons, 36 PWD Act beneficiaries and 30 Rehabilitation Team Members were interviewed.

Out of 36 beneficiaries of PWD Act, only 3 were illiterate and 22 belonged to low socio-economic status (Table 1). Out of 23 persons who had a disability certificate (DC), only 10 (43.5%) used it at least once.

Whereas 83% (30/36) of beneficiaries of PWD Act had not heard of the Act, 83% (25/30) of rehabilitation team members were aware of it (Table 2). Though many staff members were aware of most of the main provisions of the Act, few knew the details. Same was the case with beneficiaries. The provisions which both groups

expressed are given in Table 2. None of the persons in either group had mentioned anything other than this.

Table 2. Awareness in beneficiaries and staff members

Awareness of Subdivisions of Main Provisions		Number-Beneficiaries	Number Staff
Heard of PWD Act?	Yes 6	25	
	No 30	5	
Education	Free education till 18 years	2	6
	Special schools	0	4
	Part-time classes	1	0
	Scholarships	0	6
	Free of cost books, uniforms etc.	1	0
Employment	3% reservation in employment 3% reservation in Govt.	10	14
	educational institutions	2	5
	Relaxation of upper age limit	1	0
	Health & safety measures at job	1	0
	3% reservation in poverty alleviation schemes	0	1
Affirmative action	Schemes for aids & appliances	2	12
	Preferential land allotment	11	6
Social security	Financial assistance to NGO	0	2
	Insurance schemes	4	2
	Unemployment allowance	6	0
Miscellaneous	Travel concessions	36	30
	Income Tax Rebate	3	28

Discussion

No such study has been conducted in the past. Awareness of PWD Act is incomplete in Rehabilitation Team Members and is negligible in beneficiaries. The deficiency or lack of awareness may be due to less stress on this topic in day-to-day practice. Beneficiaries often come to know about the Act by word of mouth and have a distorted picture.

Misconception expressed by some of the beneficiaries was that illegal encroachment is allowed for persons with disabilities.

Striking facts and Conclusions

Eighty three percent of persons with disabilities included in this survey did not know that there is an Act of Parliament for protection of their rights.

Many people knew about provisions related to employment. All responders surveyed knew about travel concessions and all beneficiaries availed the same. Three beneficiaries (8.3%) in high socio-economic category and 93% of staff members were aware of Income tax rebate.

There was nominal response to the provision of non-discrimination in both categories. None in either groups mentioned anything related to prevention and early detection of disabilities or about grievance redressal.

Proposed suggestions and Recommendations

Beneficiaries: Expression of knowledge and awareness can be encouraged in day-to-day practice. Reinforcing correct information by various team members during hospital visits may be welcome. Peer group discussions moderated by MSSO or PHN is practical and especially preferred after the medical board assessment.

Rehabilitation Team Members: Departmental meetings and group discussions help sharing of knowledge and increasing awareness and latest provisions.

Public awareness lectures gather attention especially on such days like Independence Day or International Disability Day.

"Promoting Awareness: Supporting Freedom"

Table 2. Awareness in beneficiaries and staff members

Awareness of Subdivisions of Main Provisions		Number-Beneficiaries	Number Staff
Heard of PWD Act?	Yes 6	25	
	No 30	5	
Education	Free education till 18 years	2	6
	Special schools	0	4
	Part-time classes	1	0
	Scholarships	0	6
	Free of cost books, uniforms etc.	1	0
Employment	3% reservation in employment 3% reservation in Govt.	10	14
	educational institutions	2	5
	Relaxation of upper age limit	1	0
	Health & safety measures at job	1	0
	3% reservation in poverty alleviation schemes	0	1
Affirmative action	Schemes for aids & appliances	2	12
	Preferential land allotment	11	6
Social security	Financial assistance to NGO	0	2
	Insurance schemes	4	2
	Unemployment allowance	6	0
Miscellaneous	Travel concessions	36	30
	Income Tax Rebate	3	28

IJPMR 15, April 2004; 17-22

A Study of Efficiency of Breathing exercises to improve Pulmonary function in Tetraplegic and High Paraplegic subjects

Dr. Suresh.R, M.B.B.S, MD(PMR), DNB(PMR), Junior Resident
Dr. U.Singh, M.B.B.S, DPMR, DNB(PMR), Professor and Head
Dr. S. Wadhwa, M.B.B.S, DPMR, DNB(PMR), Additional Professor
Dr. S.L.Yadav, M.B.B.S, MD(PMR),DNB(PMR), Associate Professor
Dr. Pallab Das, M.B.B.S, MD(PMR), Junior Resident
Dr. Diganta Borah, M.B.B.S, MD(PMR), Junior Resident
Dr. M.M Araf, M.B.B.S, Junior Resident
Dr. N. Ajit Singh, M.B.B.S, Junior Resident
Dept of Physical Medicine & Rehabilitation,
All India Institute of Medical Sciences, New Delhi - 16, India.

Abstract

Spinal cord injury lesions above D_5 disable respiratory muscles, resulting in restriction of total lung capacity and vital capacity, increasing markedly at high thoracic and cervical lesion.[2]

Thirty tetraplegic and high paraplegic subjects who fulfilled the inclusion criteria were studied prospectively. Their pulmonary function was measured using Pony spirometer and breathing exercises were advised, which were done thrice a day for 6 weeks and reviewed.

Restrictive type of pulmonary function in the quadriplegics and high paraplegics were found in initial assessment. Following rehabilitation therapy with breathing exercise, we found significant improvement in FVC. FEV_1, PEF, PIF and $FEF_{25-75\%}$, improvement was significant, signifying more effective clearance of the respiratory secretions. Vital capacity and ERV improved in high paraplegic. Respiratory rate showed trend towards reduction. Significant improvement in cough PEF and maximum voluntary ventilation signifies the effectiveness of assisted cough technique, which helps in decreasing the mucus plugging and accumulation of secretions.

We concluded that the rehabilitation therapy with breathing exercise, is a simple and an effective therapy resulted in significant improvement of the pulmonary function.

Key words: Tetraplegia, Paraplegia, pulmonary function, Forced vital capacity, Vital capacity, Maximum voluntary ventilation.

Introduction

People with spinal cord injury are at increased risk of chronic respiratory symptoms, added disability and early death from respiratory complication.[1] Lesions above D_5 disable respiratory muscles, resulting in restriction of total lung capacity and vital capacity, increasing markedly at high thoracic and cervical lesion levels. Restriction may lead to atelectasis and chronic infection, which in turn may lead to chronic airway obstruction,

Address for correspondence: Dr.Suresh.R, Lecturer, Dept of PMR, CMC, Vellore-632004, India

with reduced expiratory flow rates and added disability due to breathlessness. Bronchial hyperreactivity also may result from higher-level SCI,[2,3] further increasing the risk of obstructive dysfunction. Nevertheless, most people with SCI retain reasonable normal expiratory lung volumes.[4,5] Thus, restrictive dysfunction is predominant respiratory manifestation of SCI.

Various types of breathing exercises, including abdominal weight (AW) and inspiratory resistance (IR) breathing have been used to train tetraplegic patients to improve their respiratory muscle functions.[7, 8] Efficiency of respiration is reduced because of paradoxical movement of the chest wall inspiration and reduced lung and chest wall compliance.[9,10] Thus, as a result of respiratory muscle dysfunction and intrapulmonary abnormalities, breathing patterns become altered; breaths are more shallow and rapid with a shorter expiratory time, predisposing individuals to ventilatory muscle fatigue.[4, 11]

The primary interest of the study was to observe how pulmonary rehabilitation programs lead to change in pulmonary function in Indian patients without using any sophisticated instruments, as there were not enough studies in the literature. The main objective of the study was to see the effect of breathing exercise on pulmonary function in tetraplegic and high paraplegic patients.

Materials and Method

In this prospective study all patients with tetraplegia or high paraplegia (D_6 or higher neurological level) of any sex, age above 12 years, who attended Dept of PMR, at AIIMS, New Delhi between Dec 2000 to Aug 2002, who satisfied the inclusion criteria, were included in the study. Inclusion Criteria**:** Tetraplegia, high paraplegia (D6 and above), without altered consciousness, after 6 weeks of injury and informed consent. Pony Spirometer, which satisfied the American Thoracic Society (ATS) regulations, was used to evaluate static and dynamic lung functionality.

Accordingly 36 subjects were available to be included in the study. However, thirty cases successfully completed the study. At the beginning of the study all subjects pulmonary function test were measured in sitting position using Pony spirometer identically. Subjects were instructed on the performance of the Forced vital capacity test , Slow vital test and Maximum voluntary ventilation test as demonstrated by the tester. The test was performed a maximum of three times with 1-2 minutes rest between each test.. The tester gave standardized verbal encouragement to each subject. The Pony spirometer reports predicted, actual and percent-predicted values for each subject.

The breathing exercises 1.Diaphragmatic breathing, 2.Use of Weights for strengthening the diaphragm, 3. Manual assisted cough, 4. Inspiratory resistance training was demonstrated to the patient and the attendees of the patient. Patients did these breathings exercise regularly thrice daily for a period of maximum 30 min as tolerated for 6 week in home or ward. At the end of 6 weeks pulmonary function was measure and values obtained were compared with the baseline values.

Statistical method

Descriptive statistics were found out for each quantitative variable. For comparing clinical variables Paired t test/Wilcoxon Sign Rank test was applied. The result was considered significant at 5% level of significance, that is, $p<0.05$. SPSS -10 statistical Software was used for statistical analysis.

Observations and Results

When analyzing the 30 subjects who completed the study, the male and female ratio

as was 7.5:1. In Tetraplegic (37 %) there were 10 males and 1 female.and in high paraplegics (63%) there were 16 males and 3 females. The age distribution of the subjects was varying from 18 to 48 years. The mean age was 29.53±7.84 years. Neurologically there were C5 and C6 i.e. 13.3% each, and D5 & D6 is 20% and 16.6% respectively in the study. 70 % of subjects belonged to ASIA group B. Mean duration at which the study was done from the date of spinal cord injury was 12.10±6.91 months. 19 patients (63 %) had spasticity grade of 2 on Ashworth modified scale and were medicated for that. About 11 patients had secondary complications of pressure sore and two had heterotropic ossification. Six subjects who were smokers had discontinued after the injury.

i.e. the % of predicted vital capacity <60% and >34% and reduction in maximum voluntary ventilation.(Table 1) Out come to the exercise was quantified in terms of change is the clinical measured variables from that of the baseline measured value of the subjects.. A statistical significance ($p< 0.05$) improvement was found in forced vital capacity -FVC, FEV_1, PEF, PIF, FEF_{25-75}, Slow vital capacity- VC, ERV, Maximum Voluntary ventilation and Cough PEF. at 6 weeks,(Table 1) There was a trend in reduction of post therapy Rf, which signifies that our subjects could take slow and deep respiration. Among the tetraplegics it was observed that highly statistically significant ($p<0.005$) improvement was present in FVC,

Table 1:Over the time comparison in the clinical variables in all subjects(n =30)

variable	Baseline	6 weeks	p value
mean±SD	mean±SD		
FVC	1.94±0.54	2.22±0.56	0.000*
FEV1	1.83±0.54	2.17±0.56	0.000*
PEF	3.64±1.82	4.01±1.41	0.049*
PIF	2.73±1.23	2.80±1.45	0.779
FEV1/FCV	94.3±9.00	96.15±3.88	0.306
FEF25-75	2.59±0.78	2.95±0.77	0.001*
FEV1/VC	94.5±14.78	100.01±14.69	0.097
Cough PEF	4.86±1.04	6.03±1.40	0.000*
VC	1.93±0.82	2.13±0.51	0.136
ERV	0.33±0.16	0.44±0.21	0.045*
Rf	24.20±11.42	21.71±8.44	0.100
MVV	61.36±19.65	79.72±23.04	0.000*

*** p<0.05 significant**

All the subjects were having moderate to severe restrictive type of pulmonary function

Cough PEF, and MVV (Table 2). High paraplegic showed statistically significant ($p<0.05$) improvement in FVC, FEV_1 PEF, FEF_{25-75}, Cough PEF, VC, ERV and MVV

Table 2:Over the time comparison of variable in Tetraplegic patients (n=11).

Variable	Base line	6-weeks	p value
mean±SD	mean±SD		
FVC	2.02± 0.50	2.26±0.54	0.003*
FEV1	1.87± 0.52	2.21±0 .51	0.022*
PEF	4.01±2.28	3.95±1.78	0.872
PIF	3.13±1.06	3.20±1.69	0.880
FEV1/FCV	92.90±13.84	94.70±4.74	0.713
FEF25-75	2.56± 0.51	2.80± 0.68	0.228
FEV1/VC	91.60±17.19	99.32±17.54	0.291
Cough PEF	4.97± 0.96	6.36±1.52	0.000*
VC	2.15±1.17	2.17± 0.54	0.949
ERV	0.34± 0.17	0.39± 0.18	0.549
Rf	24.49±8.02	19.32±7.31	0.066
MVV	67.03±16.64	83.49±25.16	0.003*

*** p<0.05 significant**

Table 3:Over the time comparison of clinical variables in High paraplegic (n=19).

variable	baseline	6 weeks	p value
	mean±SD	mean±SD	
FVC	1.89±0.56	2.19±0.58	0.000*
FEV1	1.81±0.56	2.14±0.59	0.001*
PEF	3.42±1.51	4.04±1.19	0.003*
PIF	2.49±1.28	2.56±1.28	0.815
FEV1/FCV	95.05±4.62	96.98±3.11	0.069
FEF25-75	2.61±0.91	3.02±0.81	0.001*
FEV1/VC	96.16±13.40	100.41±13.28	0.210
Cough PEF	4.78±1.10	5.84±1.32	0.000*
VC	1.79±0.52	2.10±0.51	0.000*
ERV	0.32±0.16	0.46±0.22	0.047*
Rf	24.04±13.21	23.09±8.91	0.694
MVV	58.08±20.92	77.53±22.13	0.000*

*** p<0.05 significant**

(Table 3). Six subjects were excluded from our study as they did not came for follow up.

Discussion

The main objective of our study was to see any quantified improvement in the pulmonary function in our study group following the rehabilitation exercise protocol. It is well known that patients of tetraplegia and high paraplegia are having restrictive type of respiratory dysfunction, which is observed in many studies.[2-6,11.] In our study group, we found the pulmonary function was pronounced restrictive type, without any sign of obstructive dysfunction. FEV_1/FVC % was more that 75% in our subjects, which rules out any kind of obstructive airway disease. Reines & Harris [12] studied pulmonary function and incidence of respiratory infection of individuals with SCI ranging from C_1-L_5 and it was concluded that FVC was an important predictor of respiratory difficulties. A reduced PEFR, FEF_{25-75}, may occur due to large airway obstruction, as well as lack of sufficient effect to inhale maximally and exhale forcibly.[13] Reduced FEF_{25-75} may occur due to small airway obstruction as well as lack of effort to sustain maximal exhalation. Vital capacity and ERV were severely reduced in almost all subjects. Which confirms those of other study [8]. A reduction of vital capacity occurs in restrictive lung diseases because the subject's inhaled volume is reduced and there is a reduction in TLC.[14] Normally ERV depends on the action of abdominal muscles in co-ordination with expirationally active intercostal muscles.[14]

It is well known that tidal volume is within normal limits and increase in the respiratory rate is present, this is in confirmation with other findings.[11] In our study, MVV was reduced to more than 50% predicted. MVV reflects both the dimensions of the pulmonary system and the ability to use respiratory muscle to generate flow.[15]

. All our subjects underwent a rehabilitation exercise protocol, which was to improve the strength and endurance of the diaphragm, intercostal muscles and assisted coughing. Respiratory muscle training has been studied in several different populations, including patients with chronic obstructive pulmonary disease, muscular dystrophy, and SCI. The most successful findings, however, have been attained using a resistive device in the SCI populations, consisting of both acute and chronic tetraplegia, in which several investigators have demonstrated significant and progressive increase in respiratory muscle strength and endurance while improving lung volumes.

We observed that after exercises a statistically significant improvement ($p<0.05$) was present in the FVC, FEV_1, PEF, $FEF_{25-75\%}$, Cough PEF, ERV, and MVV (table 1). It is consistent with the finding of previous researchers,[8] but they did not measure all these variables in their study. Derrikson [8] study involved 6 patients with cervical cord injury indicated that FVC, MVV, PEF, and MIP significantly increased after 7 weeks of exercises. High paraplegic subjects showed significant post therapy improvement in FVC, FEV_1, PEF, FEF_{25-75}, Cough PEF, VC, ERV and MVV (table 3). Crane LD[16], in a study on paraplegic after endurance exercise, found a significant improvement of FEV_1 and MVV, which supports the findings of our study.

Completeness of the injury had no greater out come on the study similar observation was done by Almenoff et al,[4] Cough PEF was significantly improved in our study (table-1, 2 and 3), which was a proof that the method of coughing used was very effective in both quadriplegic and high paraplegic. Technique of "assisted cough" was used in traditional methods of rehabilitation for patients with inadequate cough[17]. Studies have shown

that a significant improvement of cough can be achieved by this method, with a range of improvement of 0% to 57%. We observed a trend in reduction of respiratory rate, which signifies that they were able to breath a slow and deeper.

Conclusions

We conclude that pulmonary rehabilitation exercise protocol prescribed to the SCI patients with reduced pulmonary functions is very much effective to provide a positive outcome. Pulmonary exercises were simple and effective therapy without any need for purchase of any sophisticated instrument. It should be emphasized, nevertheless, that such a training program must be regular and continuous and, thus incorporated into a lifestyle change. Only when such respiratory muscle training is chronically sustained will it induce changes that may help protect against both the development of respiratory muscle fatigue and recurrent respiratory infections.

References

1. Jackson AB, Groomes TE. Incidence of respiratory complications following spinal cord injury.Arch Phys Med Rehab 1994; 75: 270-5.
2. Spungen AM, Dicpinigaitis PV, Almenoff PL, Bauman WA. Pulmonary obstruction in individuals with cervical spinal cord lesions unmasked by bronchodilator administration. Paraplegia 1993; 31:404-407.
3. Fein ED et al. Effects of ipratropium bromide on histamine-induced bronchoconstriction in subjects with cervical spinal cord injury. J Asthma 1998; 35:49-55.
4. Almenoff PL, Spungen AM, Lesser M and Bauman WA. Pulmonary function survey in spinal cord injury: influences of smoking and level and completeness of injury. Lung 1995; 173:297-306.
5. William S Linn, Rodney H Adkins, Henry Gong, Robert L Waters. Pulmonary function in chronic spinal cord injury. A crossectional survey of 222 Southern California Adult out patients. Arch Phys Med Rehab 2000; 81:757-763.
6. Crane L, Klerk K, Ruhl A, Warner P, Ruchl C, Roach KE. The effect of exercise training on pulmonary function in person with quadriplegia. Paraplegia 1994; 32:435-441.
7. Gross D, Ladd HW, Riley EJ, Macklem PT, Grassino A. The effect of training on strength and endurance of the diaphragm in quadriplegic. Am J Med 1980; 68:27-35.
8. Janice Derrickson, Nancy Clesia, Nancy Simpson, P Cristina Imle. A comparison of two breathings exercises programs for patients with quadriplegia. Phys Ther 1992; 72:763-9.
9. De Troyer A, Estenne M, Vincken W. Rib cage motion and muscle use in high tetraplegics. Am Rev Respir Dis 1986; 133:1115-9.
10. De Troyer A,Heilporn A. Respiratory mechanics in tetraplegia: The respiratory function of the intercostal muscles. Am Rev Respir Dis 1980; 122:591-600.
11. Loverdige BM, Dubo HI. Breathing pattern in chronic tetraplegia. Arch Phys Med Rehabil 1990; 71:495-9.
12. Scanlan CL, Spearman C, Sheldon RL. Egan's Fundamentals of Respiratory Care.6th edition; Mosby 1995:407-432.
13. Reines HD, Harris RC. Pulmonary complications of acute spinal cord injuries. Neurosurgery 1987;21:193-196.
14. George RB, Ligh RW, Matthay MA, Matthay RA. Chest Medicine: Essentials of Pulmonary And Critical Care Medicine.4th edition; Williams and Wilkins 2000: 91-116.
15. Anke A, Aksnes AK, Stanghelle JK, Hjeltnes N.Lung volumes in tetraplegic patients according to cervical spinal cord injury level. Scand J Rehabil Med. 1993 Jun; 25(2): 73-77.
16. Crane L, Klerk K, Ruhl A Warner P Ruhl C, Roach KE. The effect of exercise training on pulmonary function in persons with quadriplegia. Paraplegia 1994; 32:435-441.
17. Jaeger RJ, Turba RM, Yarkony GM, Roth EJ. Cough in spinal cord injured patients: comparison of three methods to produce cough. Arch Phys Med Rehabil 1993 Dec; 74(12):1358-61.

IJPMR 15, April 2004; 23-33

Cardiac Rehabilitation For CABG Patients in South Indian Setup : A Prospective Study

Dr AJ Rajendran, MBBS, DPMR, DNB (PMR)
Dr S.Manoj, MBBS, MD, DM (Cardio)
D.Karthikeyan, BPT,
Sheeba Davis BPT
Departments of Cardiac Rehabilitation, Cardiology and Cardio-Thoracic Surgery,
Apollo Hospitals, Chennai.

Abstract

Objective: **To evaluate the effectiveness of structured cardiac rehabilitation program in Indian setup**

Methods: **The study was carried out in an institutional setup involving seventy four patients who underwent coronary artery bypass surgery (CABG). The patients were evaluated prior to surgery and were initiated into lifestyle changes based on Diet, Relaxation, Exercise, Attitude and Motivation (DREAM) concept on discharge post operatively. The patients were advised unsupervised walking exercise based on target heart rate of 60 – 75% based on age. The follow-up was made every fifteen days.**

The outcomes were functional capacity as measured by treadmill test 3 months post-operatively, lipid and glucose profiles and anthropometric indices viz. body mass index (BMI) and waist to hip ratio (WHR). The measures were compared for pre- and 3 months post- operatively. The results were analysed for significance using student t-test by SPSS 10.0 for windows.

Results & Conclusion : **There was a favourable change in functional capacity (11.4 + 1.59 METS), resting rate pressure double product, fasting blood sugar, total cholesterol, triglycerides and anthropometric indices. These changes achieved 3-months post-operatively are in conformity with the existing data on westernpatients who undergo supervised exercises.**

The results suggest an encouraging pattern for effective cardiac rehabilitation program that can also be used for secondary prevention of Coronary Artery Disease in India.

Key words : Coronary artery disease, cardiac rehabilitation, diet, exercise, attitude, motivation, relaxation, prevention.

Introduction

Health as defined by WHO[1] is a state of mental, physical and social well-being and not merely the absence of disease or infirmity and this applies as a whole to rehabilitation of cardiac patients. Cardiac rehabilitation (CR) is the enhancement and maintenance of cardiovascular health through individualized programs designed to optimize physical, psychological, social, vocational and emotional status [2]. CR aims to improve QOL, correction of risk factors and assistance to social and professional reintegration [3, 4]

India has a large population of Coronary Artery Disease (CAD) patients [5]. At one point of time CAD patients undergo Coronary Artery Bypass Graft (CABG) surgery. This gives the

Address for Correspondence: Dr AJ Rajendran, Deptt. of Cardiac Rehabilitation, Cardiology and Cardio Thoracei Surgery, Appollo Hospitals Chennai. E-mail :ajrajendran@hotmail.com

scenario for effective cardiac rehabilitation [6] and improved health care delivery to such patients. CR is widely practiced all over the world as secondary prevention [7], for health promotion and rehabilitation as well. But the concept has not gained full acceptance in India. To give a comprehensive rehabilitation to coronary patients a prospective study was done at Apollo Hospitals.

Traditional concepts revolved around exercise [7] and did not really help in making people change the lifestyle habits. The study was conducted to look into the efficacy of a comprehensive CR program encompassing the psychological, social and physical well being of the patient [7,8]. The program was carried out on CABG patients to bring out the limitations/ difficulties of a CR program in Indian setup and to evolve a structured program that could be followed by all patients in the community setup without being supervised. The program was named DREAM (Diet, Relaxation, Exercise, Attitude and Motivation), which incorporated the essentials of cardiac rehabilitation and health and to derive maximum benefit for the patient [8,9,10]. The program was conceived so that people could adopt and maintain lifestyle changes with persistence being emphasized.

Methods Subjects

Seventy-four (Males – 72, Females – 2) patients who underwent CABG from Chennai were enrolled into the study. All patients were preoperatively evaluated for risk factors [11], Fasting Blood Glucose (FBS), lipid profile and anthropometric indices [12] namely Body Mass Index (BMI) and Waist / Hip Ratio (WHR). Preoperative briefings about the risk factors, coronary artery disease and about the surgery were done.

Study Design

The 74 patients who underwent CABG surgery were enrolled for the program and did not have any control group. The study was an intention to treat design. Patients were screened for congenital deformities, severe LV dysfunction, and musculoskeletal problems that might hinder them from doing exercises. No such patients formed part of the study. The patients who underwent surgery were given phase I and II rehabilitation in the in-patient setup [8]. Upon discharge the patients were given the DREAM program.

Dream Program

The program was administered to patients in phase II in the form of progressive ambulation, Range Of Motion (ROM) exercises and energy conservation techniques. The patients were given the program upon discharge and were given educational material consisting of the components of the program. A briefing session with audio-visual presentation and patient group interaction was done. A self-evaluation chart consisting of all the components of the program were given to the patients so that the caretakers and the patients could keep track of the changes they undertake. At the end of three months Cardiac Stress Analysis (CSA) with Treadmill Test, FBS, fasting lipid profile and anthropometric measures were evaluated.

Diet

Dietary advices [9,10,14,15] were focused on secondary prevention [7,8] and also accounted for the risk factors of the individual patients. The patients were given personalized diet charts and advices. The briefing session educated the patients about the benefits of maintaining desirable levels of Serum Cholesterol, glucose and good dietary practices [13]. The audiovisual aids emphasized the desirable changes to be adopted enlightening the scientific reasons. The patients were asked to manage and monitor their

BMI and WHR on a weekly basis. The handout containing the dietary guidelines had the patients' ideal weight listed in it.

Relaxation

Stress is an important factor leading to CAD [9,10,16,17]. Also there is general anxiety before and after the surgery among the patients. Anxiety pertaining to health, activity and Activities of Daily Living (ADL) were the main concerns. To overcome stress and anxiety, relaxation techniques [17] were taught to the patients. The techniques that included deep breathing exercises, visualization and meditation appeared more practical solutions to patients to help incorporate easily into their lifestyle without need for any special environment or equipment. The patients were taught visualization and meditation during the briefing session and were asked to practice them on a daily basis.

Exercise

Exercise [2,8,9,10,18,19,20] or structured physical activity was started in Phase II. Progressive ambulation to minimize fatigue was emphasized and exercises to reduce edema, improve lung function and prevent stiffness in joints were also done. In phase III, walking was advised to improve the aerobic capacity. The protocol was based to attain 50 - 60% of target heart rate [20] with 5 minutes each of warm up and cool down periods. The walking program was graded with weekly increments of 2-3 minutes in the peak exercise period. The exercises were unsupervised and patients were asked to attain 30 minutes by the third month review. Energy conservation methods were also taught to the patients during their ambulation particularly climbing stairs.

Attitude

Attitude is the way we look at things or life. In other words it is behavior. Modification of behavior [16,21,22] underlies lifestyle modifications and this needs to be changed favorably if we need to have any results. The program identified anxiety / hurried nature, smoking, short temper, alcoholism and worries for modification. By changing these behavioral tendencies we can bring about a change in the patients' lifestyle and general health. These were the essential components in reducing stress and thereby the secondary event risk of CAD.

Motivation

Motivation [21,22,23] is an important factor, which determines the outcomes of any intervention. Without the patient being motivated, adherence to CR will be a major limiting problem. To have the patients motivated and make them follow the program properly, a frequent follow up on every 15th day was emphasized. If the patients had any queries regarding the program they were clarified. The follow up were done till the third month review after surgery.

To reinforce the program a feed back form (self appraisal forms) were given to the patients. The form consisted of all the components of the DREAM. The patients have to score in the colour codes given to check out if they had followed the program or not. The chart was to be filled by the patient every day before sleep.

Statistical Methodology

Preoperative and postoperative third month FBS, lipid profile and the average of anthropometric measures, heart rate and blood pressure were tabulated. The baseline and subset values were analysed for any significant variations using independent t-test and there was no significant differences. The comparative data was analysed for significance using student t-test using SPSS 10.0 for windows.

The subsets of diabetics and nondiabetics, statins and non-statin group in dyslipidaemics, obese and non-obese based on preoperative BMI and the variation between follow-ups below and above 3 visits were analysed for the same set of variables. The variances were tested for significance using student t-test.

Outcome Measures

The outcome measures 3 months following CABG surgery, were

1. CSA (by treadmill test) - > 10 METS
2. FBS < 100 mg / dL
3. TC < 150 mg / dL
4. LDL < 100 mg / dL
5. HDL > 40 mg / dL
6. TGL < 150 mg / dL
7. LDL / HDL < 2.5
8. TC / HDL < 4.0
9. BMI < 23
10. WHR < 0.9 for males, 0.8 for females

VARIABLES	N = 74	
	NUMBER	%
AGE (YEARS)	53.2 + 8.09 (33 – 68)	
SEX		
MALE	72	97.3
FEMALE	2	2.7
DIABETES MELLITUS	19	25.67
DYSLIPIDEMIA	49	66.21
HYPERTENSION	34	45.94
SMOKING	15	20.27
OBESITY	27	36.48
CENTRAL OBESITY	64	86.48
FAMILY HISTORY OF CAD	40	54.05
PRIOR MI	39	52.70
VESSELS		
1	3	4.05
2	15	20.27
3	56	75.67
LV FUNCTION	64	86.48
NORMAL	4	5.40
MILD DYSFUNCTION		
MODERATE DYSFUNCTION	6	8.10

TABLE 1 : BASELINE CHARACTERISTICS

Results

In Table 1, the baseline characteristics of the study groups are shown. Mean age of the group was 53.20 (+ 8.09) years with age range of 33 – 68 years. Majority of patients were in their fifth and sixth decades of life (74%) [<40 years- 3 (4%); 41 – 50 years – 24 (32%); 51-60 years – 31 (42%); >60 years – 31 (42%)].

Male gender preponderance was noted to the order of 97.3%. About a quarter of the patients studied were diabetics and two thirds of the patient's revealed dyslipidaemia. Systemic hypertension as a risk factor was noted in 46% of the patients. Interestingly only about one-fifth of the study group had smoked earlier or were current smokers. Nearly about a third was either overweight or obese. About 52.7% of the group had prior MI before surgery indicating a higher risk group. However only <15% of the 74 patients had evidence of LV dysfunction of mild or moderate nature. Severe LV dysfunction group of patients did not form part of the study.

Angiographic characteristics showed nearly 75% of the patients had multi-vessel involvement. Mean number of visits for the cardiac rehabilitation programme was 4.375 + 0.926. Figure 1 shows the distribution of follow up visits. 84% of the patients had visited the cardiac rehabilitation unit in the hospital for 4

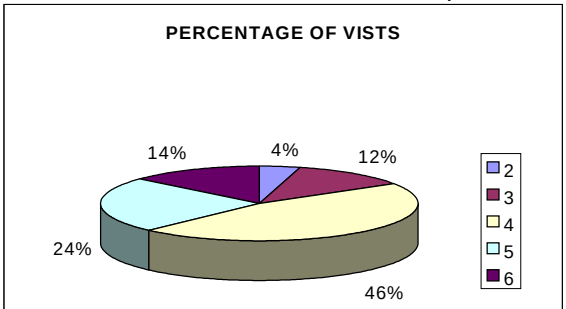

FIG1. PIE CHART FOR VISIT DISTRIBUTION (MEAN FOLLOW-UP VISITS: 4.37 + 0.926)

or more number of visits in the first three months following CABG surgery.

3-months of postoperative cardiac rehabilitation results were analysed with regard to biochemical, anthropometric, rate pressure double product at rest and tolerance to treadmill cardiac stress analysis. These figures were compared for statistically significant variation to indicate any favourable impact of the CR programme on the parameters considered.

Table 2 gives the comparative analysis among the various pre-operative and post-operative variables. Statistically significant favourable deviation was noted in the overall postoperative FBS (P = 0.002), TC (P = 0.037), TC / HDL ratio (P = 0.007) and fasting TGL (P = 0.003) levels. Despite a significant reduction in the TC level at 3rd month postoperative follow-up, the mean TC level was however above the desired ideal value and was noted to be 159.49 + 41.61 mg / dL. However, no statistically significant deviation was noted with regard to mean LDL, HDL levels and the LDL/ HDL ratio. There was a definite trend for lower post-operative LDL level. Mean HDL cholesterol did not change significantly and was

VARIABLES		**N = 74**	
	PREOP #	POSTOP#	p = *
FBS	109.73 + 40.72	97.55 + 19.79	0.002
TCL	173.03 + 41.14	159.49 + 41.61	0.037
LDL	99.54 + 34.23	92.07 + 30.65	0.148
HDL	43.65 + 7.02	42.80 + 8	0.457
TGL	164.96 + 84.93	134.6 + 57.62	0.003
LDL / HDL	2.26 + 0.61	2.11 + 0.47	0.117
TCL / HDL	3.94 + 0.54	3.7 + 0.55	0.007
W / H	0.96 + 0.046	0.92 + 0.054	0.000
BMI	24.66 + 2.90	23.73 + 2.39	0.000
RPP	9615.94 + 1409.92	8840.56 + 1370.07	0.000

TABLE 2: COMPARISON OF PREOP AND POSTOP VALUES
*** p Value at 95% confidence level using paired** *t*-Test
# MEAN + SD

being maintained without any fall.

On the anthropometric indices, a significant reduction was noted in the WHR ratio as well as BMI (P = 0.000 for both parameters). Physical fitness level and conditioning effect were noted during cardiac stress analysis with an average workload attained being 11.4 + 1.59 METs compared to preoperative mean of 3.62 + 0.82. A statistically significant lower RPP (P = 0.000) at rest was also observed, indicating the physical conditioning effect due to the rehabilitation.

Interesting observations were noted during various subset analyses, which are elaborated herein.

Diabetics and Non-Diabetics

Pre- and post-operative comparative analysis among this subset group (Table 3) showed statistically significant favourable deviation in the FBS levels and TC / HDL ratio, WHR and BMI in both groups. A trend for lower post-operative values was noted with regard to TC, TGL and LDL / HDL ratio. Non-Diabetic patients maintained a higher mean TC and LDL levels both pre- and post-operatively which was much higher than the desired level of 150 mg/ dL. The diabetic patients showed a post-operative mean TC value closer to the desired figure. Again an interesting observation was a higher mean pre- & post-operative serum TGL levels among non-diabetics which is quite contrary to the expectations. In view of relatively lower post-op LDL cholesterol levels (85.5 + 28.63 mg / dL) among the diabetic groups, the LDL / HDL was creeping towards the desirable figure. In tune with the expectation among the diabetic group the mean WHR and BMI were higher as compared to non-diabetic patients preoperatively and postoperatively indicating greater prevalence of obesity among the diabetic group. However both groups

VARIABLES	DIABETICS N = 19			NON DIABETICS N = 55		
	PREOP[#]	POSTOP[#]	*p* =	*MEAN[#]	ST. DEV.[#]	*p* =*
FBS	132.21+48.14	108.68+23.82	0.047	99.78+33.62	91.55+12.89	0.021
TCL	167.16+41.58	151+38.69	0.176	172.67+39.19	162.94+43.32	0.204
LDL	99.17+39.43	85.5+28.63	0.214	97.78+31.17	94.4+31.84	0.562
HDL	42.44+6.94	41.33+7.75	0.625	43.78+7.05	43.35+8.26	0.751
TGL	151.06+54.97	120.89+63.58	0.096	168.61+94.53	141.25+55.49	0.3
LDL / HDL	2.27+0.57	2.03+0.4	0.13	2.23+0.62	2.14+0.5	0.434
TCL / HDL	3.9+0.43	3.62+0.48	0.05	3.93+0.55	3.73+0.58	0.077
W / H	0.97+0.04	0.94+0.05	0.033	0.95+0.04	0.91+0.05	0.000
BMI	25.42+2.14	24.47+2.44	0.046	24.47+3.13	23.51+2.38	0.000

TABLE 3: COMPARISON BETWEEN DIABETICS AND NON-DIABETICS

*** p Value at 95% confidence level using paired** *t*-Test

[#] MEAN + SD

showed statistically significant reduction in post-op BMI & WHR, which was considerably more in nondiabetic subjects.

Dyslipidaemics and Non-Dyslipidaemics

the aimed objective to reach the target of < 150 mg / dL. 22.45 % of dyslipidaemics were diabetic as compared to 32 % among non-dyslipidaemic group. Among the study group only 28.38 % had received statins post operatively.

VARIABLES	DYSLIPIDAEMICS (N = 49)			NONDYSLIPIDAEMICS (N = 25)		
	PREOP[#]	POSTOP[#]	**p =***	PREOP[#]	POSTOP[#]	*p* =*
FBS	111.31 +42.49	97.41 +21.40	0.006	103.57 +35.42	95.96 +13.94	0.232
TCL	192.86 +34.37	165.73 +40.79	0.001	130.78 +12.04	146.17 +41.07	0.062
LDL	114.59 +31.10	95.05 +29.41	0.002	68.11 +11.61	85.87 +32.89	0.025
HDL	46.58 +5.90	43.52 +7.81	0.009	37.52 +4.97	41.3 +8.37	0.035
TGL	179.08 +91.62	138.48 +64.45	0.004	135.48 +60.62	126.61 +39.88	0.386
LDL / HDL	2.45 +0.61	2.15 +0.43	0.006	1.84 +0.36	2.04 +0.54	0.207
TCL / HDL	4.15 +0.48	3.7886 +0.51	0.002	3.51 +0.36	3.52 +0.59	0.935
W / H	0.96 +0.04	0.93 +0.05	0.001	0.96 +0.047	0.92 +2.94	0.000
BMI	24.88 +2.96	23.86 +2.17	0.000	24.22 +2.80	23.48 +2.94	0.006

TABLE 4: COMPARISON BETWEEN DYSLIPIDAEMICS AND NONDYSLIPIDAEMICS
*** p Value at 95% confidence level using paired** *t*-Test
[#] MEAN + SD

A comparison of the above subset of patients (Table 4) yielded the following observation.

Mean FBS, HDL, TGL and BMI were higher among the dyslipidaemics. Similar WHR was noted in the two groups. Post-operative follow-up analysis showed significant reduction in TC, LDL, TGL, TC/ HDL ratio, WHR and BMI values among the dyslipidaemics. There was 6.6 % fall in HDL levels post-operatively in dyslipidaemic group contrary to 10 % rise in post-op HDL levels in non-dyslipidaemic group [20]. The latter also showed significant rise in LDL level post-op though the absolute level of LDL was well within the desirable level of 100 mg / dL. The mean post-op TC levels in dyslipidaemia groups was however, higher than

Obesity and No-Obesity:

Obesity showed prevalence in 36.5% among the study group (table 5). The obese group showed higher mean pre-operative FBS, TGL and the non-obese group had higher preoperative mean LDL. Both groups did not show any significant change in the TC, HDL and TC/HDL ratio postoperatively. Postoperatively there was a significant reduction in FBS levels and WHR in both the groups. BMI reduced significantly in the obese group postoperatively. Dyslipidaemia was prevalent equally between both the groups.

Discussion

CAD is a leading cause of mortality and

morbidity among the non-communicable disease in developing countries like India. In the recent times the health care delivery in India has been significantly advanced with many tertiary level health care institutions offering effective therapeutic management for patients with CAD. There is a steady rise in the figures of CABG surgery and Percutaneous Transluminal Coronary Angioplasty (PTCA) carried out in this country. Greater awareness through the media educational programmes and adopting the current accepted standards of treatment has greatly contributed to the patients undergoing revascularization procedures. Notwithstanding these facts the importance of pursuing an effective CR program to adopt favourable or desirable therapeutic lifestyle changes (TLC) by patients with CAD with a view to rehabilitate and prevent future fatal / non-fatal cardiovascular events is often ignored by the healthcare professionals in many a institution. There are very few institutions that offer an effective CR program to those suffering form CAD. The culturally diverse social scenario in India and lack of motivation has been hurdles in delivering CR programs and its effective performance.

VARIABLES	OBESITY (N= 27)			NO OBESITY N = 47		
	PREOP[#]	POSTOP[#]	**p =***	PREOP[#]	POSTOP[#]	*p* =*
FBS	117.19+52.39	98.89+23.26	0.021	105.35+31.85	96.76+17.68	0.045
TCL	172.46+37.27	159.62+42.21	0.274	173.35+43.58	159.41+41.74	0.075
LDL	94.26+22.82	92.01+29.42	0.754	102.58+39.27	92.11+31.67	0.139
HDL	43.54+7.03	42.38+8.26	0.608	43.71+7.1	43.04+7.94	0.598
TGL	178.12+96.57	125.08+57.42	0.003	157.36+77.56	140.16+57.65	0.160
LDL / HDL	2.15+0.31	2.14+0.45	0.934	2.32+0.73	2.1+0.48	0.093
TCL / HDL	3.94+0.42	3.73+0.52	0.128	3.94+0.6	3.68+0.57	0.300
W / H	0.97+0.47	0.94+0.6	0.012	0.96+0.04	0.92+0.04	0.000
BMI	27.67+1.86	25.67+1.98	0.000	22.94+1.74	22.62+1.85	0.079

TABLE 5: COMPARISON BETWEEN OBESE AND NON-OBESE PATIENTS

*** p Value at 95% confidence level using paired** *t*-Test

[#] MEAN + SD

Within the limitations prevalent ubiquitously in the culturally diverse setting of India, we could conduct a comprehensively structured CR program in south Indian patients undergoing CABG surgery. A concept that involved no investment and that could be practiced in out-of the hospital or community level was adopted. The DREAM program was furthered to this effect.

In this study cohort, vast majority of subjects undergoing CABG surgery were males.

This probably is a reflection of the lack of motivation among the womenfolk with CAD to accept to undergo surgical revascularization. It is evident that women with CAD require to be offered a comprehensive CR program of which motivation leading to adoption of desirable attitudes ensuring to undergo revascularization and subsequent greater fitness level and healthy state of staying wholly well. Prevalence of dyslipidaemia is high to the order of 66% among the cohort studied indicating higher susceptibility among the south Indian patients' with CAD. Asian Indians have been known to run greater risk of CAD due to prevalence of dyslipidaemia that promotes acceleration of atherosclerosis. Majority of subjects undergoing CABG surgery were in the age group 40 – 60 yrs. CR through DREAM concept would be a very effective platform to help them adopt healthy lifestyle practices directed at primary and secondary prevention level.

Prevalence of diabetes is well known in India that is projected to be the global diabetic capital. 25% of the cohorts were diabetic and specific measures through CR directed at balanced diet, appropriate physical activity schedule help them to maintain well-being. Smoking was the least prevalent risk factor noted and shows a definite encouraging trend to not to adopt tobacco smoking. Family history of CAD ranked second highest prevalent CAD risk factor that emphasize the adoption of TLC should be initiated very early in the life of such high risk subject on identification. Obesity is prevalent among 36% of the subjects pointing to the poor lifestyle habit cultivation. A comprehensive CR that is DREAM is an effective method to address all these issues and is evident in the adherence of the study cohort in our programme. Nearly 84% of subjects attended the follow-up at the CR unit reflecting a great deal of motivation and attitude adoption towards well-being despite limitation in Indian setup.

The results of CR indicate a definite favourable change in the various risk profile of the subjects considered. There was overall achievement of the target goals aimed. The facts that this could be achieved at 12 weeks follow-up program following CABG surgery proves the importance of a sustained comprehensive CR programme in a structured manner. This is a highly emerging trend.

The diabetic subset of patients showed a remarkably significant reduction in the FBS levels and anthropometric indices namely WHR ratio and BMI by following the TLC that included desirable dietary practices, regular physical activity program and behavioral patterns. The mean level of TC in this group at the end of 12 weeks program was very close to the target value of 150 mg/dL and attained a favourable TC/HDL ratio levels. The non-significant trend of reduction in the lipid fractions noted among the non-diabetics could be possible explained by non-usage of statins.

The obese patients had significant reduction in their BMI at 12 weeks of following the CR program. The study also showed a significant and desirable change in the central obesity pattern among the obese and non-obese subjects. Therefore specific measures should be considered to identify those with central obesity as compared to generally obese subjects. A larger study looking into the above comparative subjects would throw more information on the cardiovascular-dysmetabolic syndrome that is seen among centrally obese persons.

Acceptance and practice of the DREAM concept of CR is evident in the study where the study cohort had a mean number of visits of over 4 (84% of the cohort), Fig.1. Greater the adherence to the program, greater the beneficial effects on the various metabolic indices,

physical conditioning state and anthropometric values. Significantly lower RPP at rest observed in the most frequent attendees reflect their good physical conditioning state achieved through rehabilitation. All the patients attained a good effort tolerance and a high level of workload – more than 11 METS – that could be achieved only through regular motivation, desirable attitude and behavioral changes through rehabilitative efforts.

As longevity improves with proper health care delivery, measures through CR with comprehensive community based methods should be emphasized to direct to achieve well-being of the whole community. Need to remain healthy should be understood in its presence and not during its absence. This is possible only by regular practice of TLC, which can be effectively delivered through the DREAM concept of CR. The greatest hurdle in this context is certainly an impermeable mind to perceive the importance of TLC to stay healthy throughout.

Limitations of the study were the size of the cohort. However the authors conducted the study on a pilot feasibility basis. Also there was a lack of pharmacological data collected preoperatively. It is planned to study a larger cohort involving patients across the geographical confines and to know the adherence to a community based CR program in reality. The present cohort comprised only of patients from the city of Chennai where the study was conducted.

Acknowledgements

We thank the staff at our department for helping us conduct the study and also giving us inputs during the study for improvement. We also acknowledge the help rendered by Mrs. Anitha, Bio-Statistician in making meaning out of our data.

References

1. WHO, Preamble to the WHO constitution, 1948.
2. Stone J.A. et al, “Canadian guidelines for cardiac rehabilitation and atherosclerotic heart disease prevention: A Summary”, Can J Cardiol Jun 2000000001; 17 Suppl B: 3B-30B.
3. Vom Orde A. et al, “Outcomes of Cardiac Rehabilitation treatment and cost effectiveness relations – A comparison between in-patient and out-patient rehabilitation programs”, Rehabilitation (Stuttg), Apr-Jun 2002; 41(2-3): 719-29.
4. Mital A. and Mital A., “Returning Coronary Heart Disease patients to work: a modified perspective”, J Occup Rehabil Mar 2002; 12(1): 3-42.
5. S. Padmavati, “Prevention of Heart Disease in India in the 21st Century: Need for a Concerted Effort”, Indian Heart J, 2002; 54: 99–102.
6. Hedbck B et al., “Cardiac Rehabilitation after CABG: 10 year results on morbidity, mortality and readmissions to hospital”, Journal of Cardiovascular Risk 2001; 8 (3): 153 – 158.
7. Philip A. Ades, “Cardiac rehabilitation and Secondary prevention of Coronary heart disease”, N Engl J Med, 2001; 345 (12): 892-902.
8. Gary J. Balady, “Core Components of Cardiac Rehabilitation/Secondary Prevention Programs: A Statement for Healthcare Professionals From the American Heart Association and the American Association of Cardiovascular and Pulmonary Rehabilitation”, Circulation. 2000; 102: 1069-1073.
9. Ornish, Dean, “Intensive Lifestyle Changes for Reversal of Coronary Heart Disease”, JAMA 1998; 280: 2001-2007,
10. Ornish, Dean, “Can lifestyle changes reverse Coronary Heart Disease”, Lancet

1990; 336: 129 – 133.

11. Peter W.F. Wilson MD, et al., "Prediction of Coronary Heart Disease Using Risk Factor Categories", Circulation 1998; 97:1837-1847.
12. F. Xavier Pi-Sunyer, M.D., et al., Clinical guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in adults - The evidence report, NIH publication No. 98-4083, National Institutes Of Health, USA, Sep 1998.
13. Adult Treatment Panel III, Final Report, National Cholesterol Education Program, NHLBI, NIH publication No. 02-5215, National Institutes of Health, USA, Sep 2002.
14. Alice H. Lichtenstein, DSc and Linda Van Horn, PhD, " Very Low Fat Diets", Circulation 1998; 98:935-939.
15. Ronald M. Krauss et al, "AHA Dietary guidelines – Revision 2000: A statement for health care professionals from American Heart Association", Circulation 2000; 102: 2284 – 2299.
16. Willem Johan Kop, "Chronic and Acute Psychological Risk Factors for Clinical Manifestations of Coronary Artery Disease", Psychosomatic Medicine 1999; 61:476–487.
17. Wilk, C. and Turkoski, " Progressive Muscle relaxation in Cardiac Rehabilitation – A pilot study", Rehabilitation Nursing 2001; 26 (6): 238 – 242, Discussion 243.
18. Roy J. Shepard and Gary J. Balady, "Exercise as Cardiovascular Therapy", Circulation 1999; 99: 963 – 972
19. Gerald F. Fletcher, "Exercise standards for testing and training – A statement for healthcare professionals from AHA", Circulation 2001; 104: 1694 – 1740.
20. Stephen F. Crouse, "Training intensity, blood lipids and apolipoproteins in men with high cholesterol", Journal of Applied Physiology 1997; 82(1): 270 – 277.
21. Claude Lenfant, "Task force on behavioral research in Cardiovascular, Lung and Blood Health and Disease", Circulation 1998; 98: 281 – 286.
22. Bergman and Bertero C, "You can do it if you set your mind to it - A qualitative study of patients with coronary artery disease", Journal of Advanced Nursing 2002; 26(6): 733 – 734.
23. Clark AM et al., "Preparing for change in the secondary prevention of Coronary Heart Disease – A Qualitative evaluation of cardiac rehabilitation within a region of Scotland", Journal of Advanced Nursing 2002; 39 (6): 589 – 598.
24. Carlson J.J. et al, "Self-efficacy, psychological factors and exercise behavior in traditional versus modified cardiac rehabilitation", Journal of Cardio Pulmonary Rehabilitation 2001; 21(6): 363 – 373.

IJPMR 15, April 2004; 34-37

Heterotopic Ossification at Unusual Site in Traumatic Brain Injury

Dr Maheswarappa BM, MBBS, MD(PMR), Senior Resident, DPNR, NIMHANS, Bangalore
Dr Nair KPS, MBBS, MD(Medicine) DM (Neurology),
Associate Professor, DPNR, NIMHANS, Bangalore
Dr Taly AB, MBBS, MD (Medicine) DM (Neurology),
Professor, Dept. of Neurology, NIMHANS, Bangalore
Dr Shanthi S, MBBS, Junior Resident, DPNR, NIMHANS, Bangalore
Dr Murali T, MBBS, MD (Psychiatry), Addl. Prof and Head, DPNR NIMHANS, Bangalore

Abstract

Heterotopic ossification(HO) is a common complication among patients with spinal cord and head injury. Common sites in traumatic brain injury(TBI) are hip, shoulder and elbow joints. In the hip joints it is commonly observed around anterior, inferomedial and posterior aspect.

A six year old girl sustained head injury following a fall from the height and underwent emergency decompressive craniotomy and duraplasty. There was no evidence of injury to thigh muscles. She was referred for rehabilitation after one month of treatment at intensive care unit . Child was noted to have diffuse swelling of both thigh extending from hip to knee, and severe restriction of range of motion at both the knee joints.

Initial blood investigation showed ESR of 80 mm1st hour and elevated alkaline phosphatase of 601U/L and follow up investigation of decrease in ESR to 3mm 1st hour and alkaline phosphates 461U/L at 4 months. After 14 months ESR was 4mm and alkaline phosphates was 171U/L. Child was given indomethacin 25 mg thrice daily, gentle range of motion exercises and proper positioning of extremities. Range of motion at both knees completely recovered.

Initial X-ray showed early extensive ossification at middle third of both thighs, In the follow up X-ray done after 14 months there was significant maturation of HO and osteoporosis. Heterotopic ossification can rarely develop away from the joints in patients with TBI.

Key Words : Heterotopic ossification, Traumatic Brain Injury, Range of Motion (ROM)

Introduction:

Heterotypic Ossification(HO) is the formation of mature lamellar bone in soft tissues. It is indistinguishable histologically from normal bone. HO does not grow out of bone, is not connected to periosteum and is not formed intra-articularly. Incidence of HO in TBI ranges from 3 to 20 percent and preferred sites are hip, shoulder and elbow joints. In the hip joints it is commonly found around anterior, inferomedial and posterior aspect[1]. Since HO occurs around the joint, involvement of middle third of thighs is very unusual. Review literature and Medline search did not find HO involving middle third of both thighs in TBI. Hence we would like to report a case of unusual presentation of HO at middle third of both thighs following TBI.

Address of correspondence: Dr. Maheswarappa BM Senior Resident, Department of Psychiatric and Neurological Rehabilitation, NIMHANS, Bangalore Phone Number: 08026995281 (O) Email: maheshbm12@rediffmail.com

Case Report:

A six year girl sustained head injury following a fall and underwent emergency decompressive craniotomy and duraplasty. Her Glasgow Coma Scale (GCS) was three and there were no features of spinal injury, polytrauma, fracture of femur and evidence of injury to thighs. She was kept in intensive care unit for 60 days and no intramuscular injection was given to thighs. She was referred for rehabilitation after one month of initial care. On examination she had cognitive dysfunction, aphasia, and hypertonia of all the four limbs. After a month, child had diffuse swelling of both thigh extending from hip to knee, and severe restriction of range of motion at both

Fig.1 Swelling both thighs extending from hip to knee and knee flexion was 15 degree

the knee joints (fig1 and 2). Knee flexion was possible to only 15 degree from neutral position both side. Investigations revealed an ESR of 80 mm during 1st hour and alkaline phosphatase of 601U/L (n = 130 IU). X-ray showed early HO in the middle one third of anterior aspect of both thighs. She was given indomethacin 25 mg thrice daily, gentle range of motion exercises and proper positioning of extremities. She remained in vegetative stage for two months and cognitive function did not improve. Follow up investigations showed decrease in ESR to 3mm during 1st hour (Chart 1) and alkaline phosphatase of 461U/L at 4 months and a further decrease in alkaline

Fig.2 X-ray Shows HO of Middle one third of both thighs

Chart 1: ESR

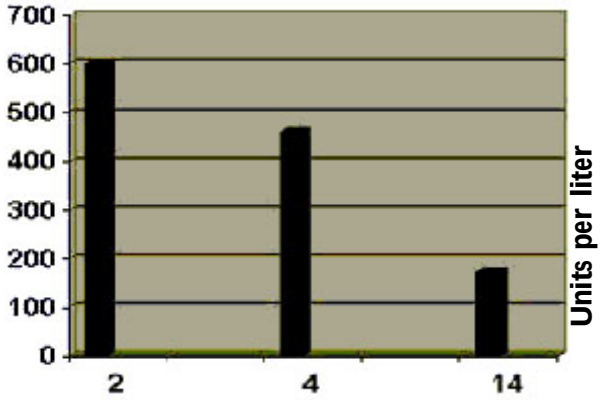

Chart 2: Alkaline phasphatase

Fig.3 Marked retution of thigh Swelling and full flexion of both knee 14 months after follow-up

Fig. 4 X-ray Shows Significant maturation of HO and osteoporosis of both femur 14 months

phosphatase 171U/L after 14 months (chart 2). Thigh swelling decreased significantly and range of motion at both knees completely recovered. X-ray revealed significant maturation of HO at middle third of both thigh and osteoporosis of femur after 14 month (fig3 and 4).

Discussion

HO is a potential sequaele of spinal and head injury. The exact triggering mechanism for the formation of HO is unknown, but local, systemic neural, and humoral causes have been suggested. There is either a migration of distant mesenchymal cells to the area involved, with subsequent transformation of these cells into osteoblasts, or a transformation of the local mesenchymal cells directly into osteoblasts[2]. Neurogenic heterotopic ossification is seen after any neurologic insult, notably after spinal cord injury (SPI), traumatic head injury and rarely following stroke and non traumatic spinal cord injury (NTSCI). In a prospective study conducted at National Institute of Mental Health and Neuro Sciences (NIMHANS) showed seven (6.04%) among the 114 subjects with NTSCI had HO[3].

The clinical, radiological and bone scan features of HO are characteristic. Clinically pain is the most common symptom followed by decreased range of motion, localized soft tissue swelling, joint erythema and warmth, joint effusion, increasing spasticity, and low grade fever [4, 5]. Our patient had severe restriction of the ROM of knee joints and swelling. Absence of pain could be due to severe cognitive impairment. Earliest detection of HO is by three-phase bone scan but plain. Plain X-ray films are helpful in assessing the extent and shape of HO (Fig2 and 4). Spontaneous regression of HO is rare. It can cause mechanical obstruction to the joint or form bony bridges across the affected joint, resulting in ankylosis.

Gentle passive ROM at joints without stretching is cornerstone for prevention and treatment of HO, once it has begun. This may maintain functional ROM of the joints even in the presence of HO and during the maturation of HO maturation [6]. Efficacy of diphosphonates, non steroidal anti-inflammatory medication (NSAIDs) [7], radiotherapy and surgery is

debatable. Diphosphonates appear to be effective at inhibiting neurogenic HO in SCI and TBI patients and recurrence after resection of HO[8]. NSAIDs have not been shown to be effective in HO but seem to be effective in inhibiting recurrence in patients treated with surgical resection [9]. Prophylactic local radiotherapy has been used after hip surgery to prevent HO formation [10]. But it is not been tried in NHO. Surgical excision of HO is done on matured bone only when there is a loss of joint function or when other complications of the HO necessitate it.

In our patient we excluded possibility of myosities ossificans which usually follows following trauma and massage, muscle trauma by clinical examination and Rhabdomynolysis by urine examination for hematuria. Our patient had HO confined to both thighs with sparing of traditional sites viz. hip, knee and elbow. we excluded possibility of myosities ossificans which usually follows following trauma and massage, muscle trauma by clinical examination and rhabdomyolysis by urine examination for hematuria. Severe head injury, major surgery, prolonged vegetative state, hypertonia and systemic infections, which are the known risk factors during acute phase of TBI could have triggered HO in this patient. However, contribution of occult direct trauma to thighs at the time of head injury can not be excluded even though child was not having external evidence of abrasion, swelling or fracture. Timely and proper intervention facilitated recovery of range of motion of joints at knee.

Conclusion

Heterotopic ossification can rarely develop away from the joints in patients with TBI. Presence of multiple risk factors in severe TBI can predispose to HO. Awareness about this complication is essential for early diagnosis and management.

References

1. Garland DE. A clinical perspective on common forms of acquired heterotopic ossification. Clin Orthop.1991 Feb;263:13-29.
2. Buring K. on the origin of cells in heterotopic bone formation. Clin Orthop.1975 Jul-Aug;(110):293-301.
3. Taly AB, Nair KP, Kumar MV, Jayakumar PN, Vasudev MK, Ravishanker D, Kalaivani PL, Padankatty BS, MuraltT. Heterotopic ossification in non-traumatic myelopathies. Spinal cord. 1999 Jan;37:47-9.
4. Baron,M, stern,J, Lander P. Heterotopic ossification heralded by a knee effusion. J.Rheumatol. 1983 dec;10:961-4.
5. Buschbacher RM, Coplin B, Buschbacher LP, McKinley WO, Benign knee joint effusions in spinal cord injured and other paralysed patients: four case studies. Am J. Phy med. Rehabil. 1991Dec;70:309-12.
6. Stover SL Hataway CJ, Zieger HE. Heterotopic Ossification in spinal cord-injury patients. Arch.Phys.Med.Rehabil. 1975 May;56:199-204.
7. Ritter MA. Indomethacin: an adjunct to surgical excision of immature heterotopic bone formation in patient with severe head injury. A case report, Orthopedics. 1987 Oct;10:1379-81.
8. Garland DE, Blum CE, Water RL. Periarticular heterotopic ossification in head injured adults: Incidence and location. J.Bone Joint Surg. 1980 Oct;62:1143-6.
9. Mital MA, Garber JE, Stinson JT. Ectopic bone formation in children and adolescents with head injuries: its management. J. Pediatr.Orthop.1987 Jan-Feb;7:83-90.
10. Ayers DC, Evarts CM, Parkinson JR. The prevention of heterotopic ossification in high risk patients by low radiation after total hip arthoplasty. J. Bone Jt. Surg. 1986 Dec;68:1423-30.

IJPMR 15, April 2004; 38-44

Prevalence of Medical Complications vis-à-vis Psycho-social Complications in Spinal Cord Injury Patients

Dr. Sindhu Vijayakumar, MBBS, MD (PMR), Senior Resident
Dr. U Singh, MBBS, DPMR, DNB (PMR), Professor and Head
Department of Physical Medicine and Rehabilitation,
AIIMS, New Delhi 110029

Abstract

Rehabilitation Management of spinal cord injury (SCI) patients is often hindered by the presence of many medical complications. There also various psycho-socio-vocational complications which go unnoticed. These may vary in different setups.

Twenty consecutive SCI patients were examined in this cross sectional study for the presence of complications. Psychological distress was the highest prevalent complication with 7 patients having suicidal ideas, followed by neurogenic bladder dysfunction, spasticity, pain and pressure ulcer in that order. Symptomatic urinary tract infection (UTI) was present in only two patients. Though there was fair functional independence and adequate family support, only 9 were productively employed at time of study. Only two persons had satisfactory sexual relationship. Most of the patients were reluctant to discuss psychological and sexual issues.

There is a need for more stress in psychological problems faced by patients with SCI. Studies with larger patient population is warranted in the light of decreasing incidence of preventable complications like UTI and pressure ulcers.

Introduction

Management of spinal cord injury (SCI) has come a long way from "ailment not to be treated" of Edwin Smith Papyrus to present day interdisciplinary approach, considering spinal cord injury medicine as a subspecialty of Physical Medicine and Rehabilitation (PM & R).

SCI management comprises of acute phase management, rehabilitation and management of secondary complications, which may have to be carried out for life-time of such patients.

Patients with SCI frequently encounter various medical complications, which are common reasons for hospital admissions and thus receive prompt medical attention. There are other associated problems of psychological, social or vocational nature, which often go unrecognized. These issues usually are considered shameful to express and hardly receives medical attention. These complications, medical or psychosocial affect quality of life (QOL) adversely than the extent of SCI[1,2].

Prevalence of secondary complications vary according to methodologies of data collection, socio-political, economic and sanitary levels of country of residence and environmental aspects.[3] Thus study of prevalence is important.

Objectives

To assess the prevalence of medical complications as well as psychosocial complications in spinal cord injury patients in a tertiary level Indian set up.

Address for Correspondence: Dr Sindhu V, Department of PMR, AIIMS, New Delhi 110029.

Methodology

Twenty (20) consecutive SCI patients (both inpatient and outpatient) were examined after consent.

Study Design: Cross-sectional study.

No. of cases: **20**

Method of data collection: History, clinical examination and relevant investigation.

Inclusion Criteria

- Chronic SCI patients (more than 6 months duration)
- Age above 15 years
- Both sex
- No associated headinjury
- Willing to take part in study

Exclusion Criteria

- Acute SCI
- Less than 15 years age
- Malignancy as cause of SCI
- Cognitive impairment
- Pre-existing psychiatric illness

Results

Out of twenty, 14 patients were male and 6 female. The age distribution was 15 to 58 years with a mean of 32.7 years, a relatively younger population. The duration of SCI varied from 6 months to 14 years. There were 16 paraplegics and 4 tetraplegics in the study.

Trauma was the commonest cause of SCI (12). Only one tetraplegic was completely dependent in activities of daily living (ADL). Ten patients had modified ADL dependence and 9 did not

Table 1. Patient characteristics

Variables		Number Of patients
Sex	Male	14
	Female	6
Cause of SCI	Trauma	12
	TB Spine	1
	TB myelitis	1
	Compressive myelopathy	5
	Non compressive myelopathy	1
Spinal cord levels	Cervical	4
	Thoracic	11
	Lumbar	5
ASIA Impairment Scale	A	6
	B	5
	C	2
	D	7
	E	0
FIM Score	No helper	9
	Modified dependence	10
	Complete dependence	1

need any helper (Table 1).

Medical complications

Medical complications present in these patients at the time of study in order of prevalence were:

1. Neurogenic bladder and bowel dysfunction. Present in 14 (70%) patients with highest prevalence. Six (30%) patients were managing bladder problems by doing clean self intermittent catheterization (CSIC). Vesico-ureteric reflux (VUR) with hydronephrosis was present in 2 (10%) cases.
2. Spasticity

   Spasticity was the second common complication, present in 12 (60%) patients. The grades on modified Ashworth scale (MAS) were as follows:

   - Grade 1 - 5 cases
   - Grade 1+ - 1
   - Grade 2 - 4
   - Grade 3 - 2
   - Grade 4 - 0

   Troublesome spasms were present in one patient. Two patients had Baclofen pump (Fig. 1) inserted for spasticity management and one of them had pump related complication of non-healing abdominal pouch wound and oedema.
3. Pain – Total of 9 (45%) patients experienced pain of different nature. The pain was of musculo-skeletal origin in 5 (25%), referred pain in 3 (15%) and central cord pain in 1 (5%) patient respectively. The patient with central cord pain had syringomyelia.
4. Pressure ulcer – Five (25%) patients had

Table 2. Prevalence of complications

Complication	Number of patients	Percentage
Psychological distress	16	80%
Neurogenic bladder dysfunction	14	70%
Hydronephrosis	2	10%
Spasticity	12	60%
Baclofen pump	2	10%
Pain	9	45%
Pressure ulcer	5	25%
Limb deformities	5	25%
Heterotopic ossification	4	20%
Urinary tract infection	2	10%
Vesical calculus	1	5%
Autonomic dysreflexia	2	10%
Lower limb oedema	2	10%
Thoracolumbar kyphosis	2	10%
Syringomyelia	1	5%
Anaemia	1	5%
Suicidal ideas	7	35%
Unemployed	11	55%

Figure 1. IVP film showing baclofen pump

pressure ulcers grade 1 in 1, grade in 3 and grade 4 in 1 (Fig. 2).

Figure 2. Pressure ulcer (grade 3)

5. Limb deformities – Out of 5 (25%) patients who had limb deformities, 3 had flexion deformities of hip joint, 2 had both hip and hence flexion deformities and one patient had equines deformities of both ankle joints (Fig. 3).

Figure 3. Hip and knee flexion deformities

6. Heterotopic Ossification (HO) – HO around hip joint was present in 4 (20%) of these patients (fig. 4). One patient had around unilateral knee joint as well. One patient had right sided hip dislocation due to this (Fig. 5).
7. Urinary tract infection (UTI) –

Figure 4. Hetrotopic Ossification

Figure 5 HO with hip dislocation

symptomatic UTI was present only in two (10%) patients at time of study. One patient had vesical calculus (Fig. 6).

Figure 6 Vesical calculus

8. Autonomic dysreflexia – Two high level paraplegia patients had autonomic

Figure 7. Syringomyelia

dysreflexia. Triggering factor was UTI in one and menstrual cycle in the other.

9. Oedema – Two (10%) had postural oedema of both lower limbs.
10. Spinal deformity – Thoracolumbar kyphosis was present in 2 (10%) patients.
11. Syringomyelia – One patient with quadriplegia had severe dysaesthesia and the reason was found to be syringomyelia (Fig. 7) on magnetic resonance imaging (MRI).
12. Others – One patient had anaemia. One male paraplegic had osteoporosis with healed fractures of femur and clavicle. Personal hygiene was very poor in two patients.

None of the 20 cases studied had any evidence of deep vein thrombosis (DVT) or respiratory complications.

Sexual complications

Of the 20 persons studied, 11 (55%) were married and only two had satisfactory sexual relationship according to them. Other patients had limited intimacy with spouse and did not attempt sexual intercourse due to illness. Excepting three, all were reluctant on sexual issues. Two persons separated trone spouses prior to SCI did not express any desire for recession or remarriage.

Possibility of any form of sexual abuse was difficult to assess due to reluctance, especially in outpatients. However, 5 female patients were asked, 2 denied abuse and 3 preferred not to discuss.

Psycho-social complications

Psychological status was assessed using general health questionnaire (GHQ), which is a 12 item scale, each item scored from 0 to 3. Score more than 15 indicated evidence of psychological distress and more than 20 indicated presence of severe problems and psychological distress. Fifty five percent (11) of patients had score > 20.

Suicide

Suicidal ideas were present in 7 (35%) patients. Two had attempted suicide in the past few weeks. One of these two was an inpatient and received psychiatric intervention and help. The other outpatient was forth coming with information and expressed the need for help.

Others indicated suicidal ideas only on questioning and never received any help. None admitted to any form of substance abuse.

Vocation

Fifteen (75%) persons were employed prior to SCI only 9 (45%) were productively employed at time of study. Only two were doing full time job. The reason for unemployment was ill health in only two patients. Four had lack of motivation and 5 did not find any suitable work.

Social Intervention and Recreational Activities

Seven (35%) persons maintained a balance of social contacts and 13 (65%) had restricted social life.

Television viewing was the recreational activity reported by majority. Six persons did not indulge in any recreational activity.

Architectural Barriers

This problem was irrelevant for half of the study population and seven had minor problems but were able to manage without assistance in the household. Only 3 persons had major problems at home.

Family Support

Eleven (55%) patients reported adequate physical and mental support from family members. Three persons experienced strain in family relationships due to disability. Other 6 needed minor adjustments in relationships.

Discussion

Urinary tract infection (UTI) is reported to be the highest prevalent medical complication after SCI[3,4]. In the present study, symptomatic UTI was 7th in prevalence. This may be due to (1) rigorous bladder management programme, (2) small study population or (3) immediate medical attention and treatment. Our findings become significant in the light of observations made by Whiteneck et al[5] and Ditunno and Formal[6]. White neck et al reported that the number of renal deaths is decreasing over time. Ditunno and Formal observed that UTI is the most frequent complication in 2nd year after injury and is the 5th frequent complication 3rd or more years later, where pressure sore is the most frequent. This also could explain our finding where the duration after SCI varied greatly.

Some authors opined that pressure ulcers were the most frequent complications in SCI patients, followed by autonomic hyperreflexia and respiratory problems[5,7,8]. We found that pressure ulcer was fourth in prevalence and autonomic hyperreflexia was still lower in prevalence. These findings suggest that there is a decline in the prevalence of preventable complications.

Neurogenic bladder dysfunction, spasticity and pain in that order were the highest prevalent medical complications in our study. This is important as prevalence rates vary from country to country and hospital to hospital.

A total of 16 patients (80%) had evidence of psychological distress and 11 had severe problems in this study, despite fair amount of independence in ADL and adequate family support. This view is supported by Gerhart et al who stated that perceived stress in long-term SCI is not closely related to severity of disability or physical dependence[9].

Two subjects had attempted suicide. This needs to be taken care of as there is evidence of higher suicide rate in SCI population over general population[10,11]. Hartkopp et al also suggested that the total suicide rate in marginally disabled is twice as high as in complete tetraplegics. We support the view of Scivoletto et al that provision of psychological services in rehabilitation centres is justified and should be provided even after discharge[12].

Forty five percent of patients were productively employed in the study. Hall et al reported that approximately 1/3rd of patients in their study had at least a college degree and only 1/4th were employed[13]. Krause et al suggested that whereas 58.6% of patients were gainfully employed at the time of injury, only 27% were working at follow up[14].

Conclusions

Psychological distress revealed by GHQ had maximum prevalence in the study population (16/20). The highest prevalent medical complication was neurogenic bladder dysfunction (14/20). All cases with medical complications received treatment but only two with psychological distress sought treatment.

Though majority of persons with SCI had fair functional independence levels and adequate family support, few were satisfactorily employed. Majority hesitate to discuss sexual problems. The picture might change with frequent reinforcement. Recreational activities took learnt priority in daily life of these patients with most of them confined to bed for major part of day.

References

1. Westgren N, Levi R. Quality of life and traumatic spinal cord injury. Arch Phys Med Rehabil 1998; 79: 1433-1439.
2. Vogel LC, Klaas SJ, Lubicky JP, Anderson CJ. Long-term outcomes and life satisfaction of adults who had

paediatric spinal cord injuries. Arch Phys Med Rehabil 1998; 79: 1496-1503.

3. Noreau L, Proulx P, Gagnon L, Drolet M, Laramee MT. Secondary impairments after spinal cord injury: a population-based study. Am J Phys Med Rehabil 2000; 79: 526-535.
4. Barrett Sugarman. Medical complications of spinal cord injury. Quart J Med, Jan 1985; 213 (NS 54): 3-18.
5. Whiteneck GG, Charlifue SW, Frankel HL, Fraser MH, Gardner BP, Gerhart KA, Krishnan KR, Menter RR, Nuseibeh I, Short DJ, Silver JR. Mortality, morbidity and psychosocial outcomes of persons spinal cord injured more than 20 years ago. Paraplegia 1992; 30: 617-630.
6. Ditunno JF, Formal CS. Chronic spinal cord injury (current concepts). N Engl J Med Feb 1994; 330(8): 550-556.
7. McKinley WO, Jackson AB, Cardenas DD, DeVivo MJ. Long-term medical complications after traumatic spinal cord injury: a regional model systems analysis. Arch Phys Med Rehabil 1999; 80: 1402-1410.
8. Chen D, Apple DF Jr., Hudson LM, Bode RK. Medical complications during acute rehabilitation following spinal cord injury-current experience of the model systems. Arch Phys Med Rehabil 1999; 80: 1397-1401.
9. Gerhart KA, Weitzenkamp DA, Kennedy P, Glass CA, Charlifue SW. Correlates of stress in long-term spinal cord injury. Spinal cord 1999; 37: 183-190.
10. Harris EC, Barraclough BM, Grundy DJ, Bamford ES, Inskip HM. Attempted suicide and completed suicide in traumatic spinal cord injury. Case Reports. Spinal Cord. 1996; 34: 752-753.
11. Hartkopp A, Bronnum-Hansen H, Seidenschnur AM, Biering-Sorensen F. Suicide in a spinal cord injured population: its relation to functional status. Arch Phys Med Rehabil 1998; 79: 1356-1361.
12. Scivoletto G, Petrelli A, Lucente LD, Castellano V. Psychological investigation of spinal cord injury patients. Spinal cord 1997; 35: 516-520.
13. Hall KM, Knudsen ST, Wright J, Charlifue SW, Graves DE, Werner P. Follow-up study of individuals with high tetraplegia (C_1-C_4) 14 to 24 years post injury. Arch Phys Med Rehabil 1999; 80: 1507-1513.

Krause JS, Kewman D, DeVivo MJ, Maynard F, Coker J, Roach MJ, Ducharme S. Employment after spinal cord injury: an analysis of cases from the model spinal cord injury systems. Arch Phys Med Rehabil 1999; 80: 1492-1500.

IJPMR 15, April 2004; 45-47

Chronic Planter Ulcer: A new technique of Management

Dr Ashesh Ray Chaudhury, MBBS, MD, DNB (PMR), Medical Officer.
Department of Physical Medicine and Rehabilitation.
G B P Hospital, Agartala,Tripura(West).
Dr Samir Das, MBBS, Medical Officer, PHC, Tripura(North)

Abstract

Chronic planter ulcer is found in sensory deficient feet as in diabetes, leprosy etc. The treatment principle involves dressing and avoiding pressure on the ulcerated site called "off loading". Off loading is traditionally being done by either with the crutches or with complete plaster casing of the foot. In advanced techniques bioengineered tissue and growth factors are used for enhancing healing. But these are expensive and not available here in India. In the present technique plaster casing with a window and walking iron for weight bearing is applied to the patient with chronic plantar ulcer. Dressing can be accomplished through the window and patient can be ambulatory with the walking iron. This simple technique helps in early mobilization and prevents secondary complications such as foul smelling discharge, decalcification of bone, and other complications.

Key Words : planter ulcer, debridement, dressing, PTB plaster, walking iron

Introduction

Chronic planter ulcer is also known as trophic ulcer[1]. It is usually seen in sensory deficient foot. Diabetes and leprosy along with other neuropathic conditions give rise to chronic planter ulcer. Management of planter ulcer gives rise to twofold problems; first, to help healing of the ulcer avoidance of weight bearing is required on the affected foot, which demands discontinuation of ambulation, and also ambulation is to be allowed to keep complications of immobilization to minimum. In case of chronic nonhealing ulcer of the foot, decalcification and stiffness of the joints are already present and treatment strategy should rather not enhance it rather than reversing it . The new management method under discussion had been tried to overcome the shortcomings of the management techniques commonly practiced.

Address for Correspondence: Dr Ashesh Ray Chaudhury, Department of Physical Medicine and Rehabilitation. G B P Hospital,Agartala,Tripura(West).Email:asheshrc@hotmail.com Phone/Fax: +91-381-2358078 Phone:+91-381-401234

Management principles for chronic planter ulcer are

a. To promote tissue repair with debridement
b. To remove or reduce mechanical pressure on the ulcer or off-loading
c. To use specific antibiotics when required
d. To apply dressing

Removal of mechanical pressure on the ulcer or the off loading is usually done by

1. Avoidance of weight bearing on the affected foot by crutch walking and at the same time to continue with the dressing.
2. Below knee plaster casing with or without walking heel.

The technique practiced in G B Hospital, Agartala:

Seven cases having chronic planter ulcer were treated in last one year in a new technique. In

six cases ulcers were due to leprosy and in one due to diabetic neuropathy. .

Cases: Total No. of cases :

7(seven) with 6 males and 1 female.

Causes of ulcer - Leprotic neuropathy 6 cases
Diabetic neuropathy 1 case

Site of ulcer - At the ball of toes: 4 Nos.
At the heel: 3 Nos.

Duration of ulcer -Average 1 year, minimum 3 months, maximum 2 years.

All the ulcers were in gr II A, gr II B and gr III as per modified Wagner classification of diabetic foot infection. In this technique walking iron is used along with plaster cast.

Walking- iron. -is a simple device with two metallic vertical bars and one sole to bear weight, being made with rubber. This is fitted to the affected limb incorporating with the plaster of paris(POP) cast.

The Procedure followed is given below:

Fig. 1 PTB Plaster with Walking Iron

1. In all the cases thorough debridement was done surgically
2. Off loading was done by-

i) Applying patellar tendon bearing (PTB) cast incorporating walking-iron with vertical bars within the plaster

ii) A window was left open over the ulcer area. Patients were advised to do daily dressing with boiled cooled water mixed with Povidon Iodine.

iii) By this time patients were ambulatory with 1" shoe raise of other lower limb, with walking stick.

Out come – On an average ulcers healed by two weeks time

Follow-up — After the healing is achieved one more week is allowed for the scar to consolidate. Next the shoe modification is done to distribute the weight born on the affected foot evenly all over the available weight bearing surface and not to allow any concentration of pressure on a limited area which is being a very important point to prevent pressure sore.

Discussion

Ulceration is initiated with a minor trauma or using a ill-fitting shoe, in a foot affected with neuropathy or peripheral vascular disease. To avoid unperceived trauma in advanced neuropathy the load on the ulcerated area is to be removed and the area is protected. Infection is a secondary phenomenon which enhances the process of ulceration and tissue loss.There are different debridement techniques which are followed in different centers almost uniformly as

1. Surgical or sharp
2. Mechanical – by

a) wet to dry dressing change

b) wet to wet dressing change

c) pulsed –lavage hydrotherapy using high pressure water jet on the wound

3. Enzymatic [2]

In the new technique described here debridement is done as usual but off loading is achieved with the walking iron attached to a PTB plaster where weight is born by it from upper tibia bypassing foot and lower tibia. These patients usually have limited mobility of tarsal and metatarsal joints which contributes to enhancement of the ulceration[3]. Walking with walking-iron helps to avoid foot joint movement required in normal gait.

Infection can be controlled well with daily dressing through a window in the plaster cast. This also helps to avoid the foul smell invariably produced in closed walking plaster which is now used as a method for offloading. There are some modern materials used for promoting healing early. These are

1. Bioengineered tissue; i.e. an artificial skin made from fibroblasts cultured from new born's foreskin and woven on a poligalactic acid mesh. [4,5]
2. Growth factors; these are proteins secreted by a variety of cell types during the different phases of wound healing. e.g. basic fibroblast growth factor[6], epidermal growth factor[7] or platelet derived growth factor (PDGF)[8]. Becaplermin is the first recombinant prescription formulation available containing PDGF.

The newer materials mentioned above are costly and not easily available in our country. This new technique offers the clear advantages over others because the healing time in this technique was very short, foul smell did not develop within the plaster as a window was kept open for regular dressing and aeration, this method did not involve high cost and all the materials involved were locally available.

Conclusion

In Indian context while newer techniques developed in advanced countries have little practical meaning because these are costly and not easily available. The traditional techniques have got limitation in the form of –

1. Restriction of mobility
2. Foul smell of closed plaster

2. Long period of ulcer healing.

It can be concluded that ulcer healing is early with this technique, no foul smell is produced in the plaster, the technique does not involve high cost and required materials are easily available. The only disadvantage with this technique is that making of the PTB socket requires some skill, which can be developed through little training.

References

1. Mann Charles V, Russel R.C.G. Baily and Love's Short Practice of Surgery. 21st Ed. E.L.B.S. London 1991:151
2. Millington J. Thomas. Medical Director. St John's Pleasant Valley Hospital Wound Treatment and Hyperbaric Medical center. Camarillo, CA. Taking Diabetic foot ulcer into the New Millennium. www.mmhc.com/hhcc/arti/HHCC9903/Millington hhcc.html/
3. Bouton Andrew J M. The Diabetic Foot Surgery International 1996; 7: 37-39.
4. Paquette D, Badiavas, Evangelos V, Paquette, Dana, Carson, Polly. Human chronic wounds treated with bioengineered skin: histologic evidence of host-graft interactions. J Am Acad Dermatol 2002 Apr;46(4):524-30.
5. Strait, M, Braathen, L R. Apligraf—a living human skin equivalent for the treatment of chronic wounds. Int J Artif Organs 2000 Dec;23(12):831-3.
6. Fu XB, Guo ZR, Sheng ZY. Effects of basic fibroblast growth factor on the healing of cutaneous chronic wounds. Zhongguo Xiu Fu Chong Jian Wai Ke Za Zhi 1999 Sep; 13(5): 270-2.
7. Zhu JX, Zhang YM. Application of recombinant human epidermal growth factor on chronic ulcer wound. Zhongguo Xiu Fu Chong Jian Wai Ke Za Zhi 2002 Jan; 16(1): 42-3.
8. Tarroni G, Tessarin C, De Silvestro L, Casol D, Giozzet M, Caloprisco G, De Paoli Vitali E. Local therapy with platelet-derived growth factors for chronic diabetic ulcers in haemodialysis patients. G Ital Nefrol 2002 Nov-Dec;19(6):630-3.

IJPMR 15, April 2004; 48-51

Hypokalemic Thyrotoxic Periodic Paralysis in Female - A Report of 2 Cases with Review

Dr. L. Nilachandra, Registrar (PMR)
Dr. AK. Joy Singh, Assistant Professor (PMR)
Dr. Brogen Akoijam, Assistant professor (Community Medicine)
Dr. N.B. Singh, Director, RIMS
Regional Institute of Medical Sciences, Imphal 795004, Manipur

Abstract

Hypokalemic thyrotoxic periodic paralysis (HTPP) is a rare disorder, which is common among male Asian descents though hyperthyroidism is commoner among females. Clinical manifestations are same as that of familial hypokalemic periodic paralysis except for the presence of hyperthyroidism, which may be overlooked. Reports on HTPP occurring in females are scarce. We investigated all 12 cases with recurrent attacks of nocturnal hypokalemic periodic paralysis without a family history for possible HTPP since June 1998. We are reporting two cases of HTPP in female from this North-Eastern state of the country with Mongoloid features because of its rarity and to highlight the importance of testing thyroid function in such cases.

Key Words : Hypokalemic thyrotoxic periodic paralysis (HTPP), Hyperthyroidism

Introduction

Periodic paralysis is a relatively rare hereditary muscle disorder. Until recently, existence of thyrotoxic periodic paralysis was not thought of in this state of Manipur where the people have a mongoloid/an oriental background. When there is no familial involvement and when there are episodes of periodic paralysis during prophylaxis with acetazolamide among the indigenous population with negative family history suffering from hypokalemic periodic paralysis, we started studying thyroid function in these patients since June 1998. So far we have tested thyroid function in all 12 patients diagnosed and treated as cases of hypokalemic periodic paralysis in the Department of Physical Medicine and Rehabilitation, Regional Institute of Medical Sciences, Imphal. We were surprised when we found very low thyroid stimulating hormone level in 2 female patients during their acute attacks. They are reported here because of its rarity and occurrence in females. We have not come across many reports of thyrotoxic periodic paralysis occurring in females.

Address for correspondence: Dr. L. Nilachandra Singh Department of Physical Medicine and Rehabilitation Regional Institute of Medical Sciences, Imphal-795004

Case no. 1

In June 1998, a 38 years old female patient was referred to the Department of Physical Medicine and Rehabilitation for physiotherapy. She complained of sudden weakness of all four limbs associated with difficulty in respiration. She had 5 similar attacks within the previous 2 years. There was no familial history of similar attack. She was treated earlier with intravenous drips and potassium supplements.

On examination, she was afebrile, pulse rate was 84/min and blood pressure was 118/80 mm of Hg. Her higher mental functions and cranial nerves were intact. Limbs were

hypotonic with muscles power less than 2/5 in both upper and lower limbs. Reflexes could not be elicited and planter was nonresponsive. Sensory was intact. Fundus was normal.

Routine haemogram, urine analysis, blood sugar, blood urea, serum creatinine, creatine phosphokinase (CPK), serum Na+, etc. were within normal limits. Serum K+ was 2.9 mEq/l. Thyroid function test showed very low TSH level (0.1mU/ml). E.M.G. showed total electrical silence. Compound Motor unit Action Potential (CMAP) was not recorded on motor nerve stimulation. Hypokalemia was corrected within 48 hours of onset of paralysis with potassium supplementation and she showed dramatic improvement in muscle power and deep tendon reflexes. She was again independent in all activities of daily living within 4 days of onset. Antithyroid drug was started from the 5th day and it took around 3 months to become euthyroid. She remained asymptomatic till date on antithyroid drug.

Case no. 2

A 40 years old female of hypokalemic periodic paralysis was referred to the Department of Physical Medicine and Rehabilitation for EMG and NCV studies in October 1999. She noticed weakness of all four limbs when she wakes up in the early morning. She complained of similar episodes on three occasions within the last 2 years, which were treated successfully with potassium supplementation. There was no history suggestive of a familial involvement or attacks precipitated by exhaustion or food.

On examination, her higher mental functions and cranial nerves were intact. Limbs were hypotonic with muscles power less than 2/5 in proximal groups of muscles and hyporeflexic without planter response. Sensations were intact. She was afebrile with a pulse rate of 90/min and blood pressure of 110/80 mm of Hg.

Complete haemogram, routine urine analysis, blood sugar, urea, serum creatinine, creatinine phosphokinase (CPK), Na+ were within normal limits. However, serum K+ level was low (2.8 mEq/L). EMG showed CMAP of very low amplitudes with normal nerve conduction velocities. Thyroid function test showed serum T3 (200g/dl), T4 (20g/dl) and a remarkably low level of TSH (0.1u/ml). A final diagnosis of thyrotoxicosis hypokalemic periodic paralysis was made. She was treated with a combination of oral and intravenous potassium supplementation and she became asymptomatic within 36 hours of the initiation of treatment. Antithyroid drug was started on the 7th day of the episode and is being continued. She remained asymptomatic since then.

Discussion

Thyrotoxicosis periodic paralysis is a thyroid related neuromuscular disorder that, in a global perspective, only affects a small percentage of patients with thyrotoxicosis of any etiology[1,2]. HTPP manifests as recurrent episodes of hypokalemia and muscle weakness lasting from hours to days (may last upto a week). It is a rare disorder affecting primarily men of Asian descent. It is also reported to be common among young Latin Americans[3]. Upto 10% of thyrotoxic patients may have this condition. The thyrotoxicosis may be overlooked for many months. Occasionally, the only indication of the thyrotoxicosis is a depressed level of thyroid stimulating hormone[4]. Males are 6-20 times more commonly affected than females despite a higher incidence of thyrotoxicosis in females. It may be because of decreased penetrance in women. Some women have only infrequent attacks. In some studies, upto 13% of Asian thyrotoxic men have had periodic paralysis[5], which may be an autosomal dominant trait in Asians [5]. Certain HLA antigen including A2,

Bw22, Aw19, and DRW8 have been also incriminated[6].

Dietrich reported a young Native American female with HTPP. Thyrotoxic periodic paralysis is an under diagnosed but probably a frequent complication of hyperthyroidism in Caucasians. Early recognition of the conditions is essential to investigate and treat the underlying thyroid dysfunction whose symptoms are usually mild. The episodes of periodic paralysis lasting about 1-96 hours resolve with the correction of the hypothyroidism [7]. The paralysis is mainly confined to proximal limb and trunk muscles and usually spares oropharynx and diaphragm[8.] The clinical presentation, in majority of cases, is similar to familial periodic paralysis; however, the therapies proven to be effective differ in the two syndromes[9]. Periodic paralysis, without familial background, manifests only in the thyrotoxic patients [10]. It is a self-limiting disorder provided the underlying hypothyroidism is treated. Hypokalemia, hypophosphatemia, and mild hypomagnesemia are characteristic features of thyrotoxic periodic paralysis (TPP). Hypokalemia occurred in 100% and hypophosphatemia in 80% of the episodes[11]. Gonzalez-Trevino O reported a case of normokalemic periodic paralysis in a Mexican man with thyrotoxicosis[12].

The pathogenesis of TPP is uncertain, but there is evidence of a decreased activity of the calcium pump[3]. It has been suggested that the membrane Na+-K+ pump is involved in the pathogenesis of this complication. However, other reports emphasize the role of Na+-K+ pump independent K+ influx, which would be specific for TPP [12]. Acetazolamide is not helpful in preventing the attacks. Acute attacks respond to potassium administration.

The incidence was 8.6% among male and 0.4% among female thyrotoxic patients according to a survey performed in the three major thyroid clinics in Japan in 1957. The incidence of paralysis in 1991 was 4.3% among male and 0.04% among female thyrotoxic patients, indicating more than a 40% decrease in incidence. The possible cause of the decrease is related to the changes in food consumption habit; less carbohydrate and more protein were taken in 1991 than in 1957[13].

Rone[11] reported occurrence of euthyroid thyrotoxicosis periodic paralysis. Risk factors for TPP include the postprandial state after carbohydrate- rich meals and post exertional state. At least 2-week “window of vulnerability” for TPP appears to exist after initiation of antithyroid therapy.

The diagnosis of periodic paralysis can be aided by demonstrating a decrease in compound motor unit action potential (CMAP) amplitude after several minutes of exercise which improved dramatically after treatment, when a euthyroid state is achieved. Therefore, the exercise test is a useful electrophysiological means of monitoring the neuro-muscular status of patients with thyrotoxicosis periodic paralysis prior to and after treatment of the thyrotoxicosis[15].

References

1. Magsino Ch Jr, Ryan AJ Jr. Thyrotoxic periodic paralysis. South Med J 2000 Oct;93(10):996-1003.
2. Papadopoulos KI, Diep T, Cleland B, Lunn NW. Thyrotoxic periodic paralysis: Report of three cases and review of literature. J Intern Med 1997 June;241(6):521-24.
3. Robert H Brown, Jr, Jerry R Mendell. Muscular dystrophies and other muscular diseases. In: Harrison’s Principles of Internal Medicine. Eugene Braunwald, Anthony S Fauci, Dennis L Kasper, Stephen L Hanser, Dan L Longo, J Larry

Jameson. 15th edn. Vol2. New york. Mc Graw-Hill. 2529-2540.

4. Satoyoshi EK, Murakami K, Kowa H, Kinoshita M, Nishiyama Y. Periodic paralysis in hyperthyroidism. Neurology 1963;13:746
5. Kufs WM, Mcbilles, Jurney T, Familial thyrotoxic periodic paralysis. West J Med 1989;150:461
6. Tamai H, Tanaka K, Komaki G, Matshubayash S, Hirota Y, Mori K et al. HLA and thyrotoxic periodic paralysis in Japanese patients. J Clin Endocrinol Metab 1987;64:1085
7. Reisin RC, Martinez O, Moran M, Rovira M, Roccatagliata G, Pardal A, de la Balze AE. Thyrotoxic periodic paralysis in Caucasians. Report of 8 cases. Neurologia 2000 Jun-Jul;15(6):222-225.
8. Engel AG. Neuromuscular dysfunction in Graves disease. Mayo Clin Proc 1972;47:919
9. Milite CP, Golob DS. Thyrotoxic Hypokalemic periodic paralysis; case report and review of the literature. Conn Med 2000 Apr; 64(4):195-197.
10. Kodall VR, Jeffcote B, Clague RB. Thyrotoxic periodic paralysis: a case report and review of literature. J Emerg Med 1999 Jan-Feb;17(1):43-45.
11. Manoukian MA, Foote JA, Carpo LM. Clinical and metabolic features of thyrotoxic periodic paralysis in 24 episodes. Arch Intern Med 1999 Mar 22;159(6):601-606.
12. Marier S, Raccah D, Disdier P, Molle L, Harie Jr, Vialettes B, Weiller Pj. Thyrotoxic periodic paralysis- discussion of role of Na+-K+ ATPase apropos of a case. Rev Med Intern 1995;16(3):209-211.
13. Schizume K, Shishiba Y, Kuma K, Noguchi S, Tajiri J, Ito K, Noh JY. Endocrinol Jpn 1992 Jun;39(3):315-318.
14. Rone JK, Brietzke Sa. Euthyroid thyrotoxic periodic paralysis. Mil Med 1991 Aug;156(8):434-436.
15. Jackson CE, Barohn RJ. Improvement of exercise test after therapy in thyrotoxic periodic paralysis. Muscle Nerve 1992 Oct;16(10):1132-1133.

IJPMR 15, April 2004; 52-54

Swelling of the Thigh and Adductor Muscle Rupture - A Case Report

Dr Poonnoose PM, MS (Ortho), DNB (PMR), Lecturer
Dr Suranjan Bhattcharji, MS (Ortho), MS (Ortho), DNB (PMR), Professor
Dr Shyamkumar, NK, DNB (Radiology), Lecturer
Dr Raji Thomas, DNB (PMR), Lecturer
Dr George Tharion, DNB (PMR), Professor
Dr Venugopal K, DNB (PMR) Lecturer
Department of PMR, CMC Hospital, Vellore, Tamil Nadu

Abstract

Swelling around the thigh is a common clinical finding in the paralysed patient, heterotrophic ossification and deep vein thrombosis being the usual etiological factors. This case report illustrates another unusual cause – an adductor muscle rupture – a complication which occurred due to overenthusiastic stretching of the spastic adductor muscles.

Key Words : 1. adductor 2. rupture 3. paralysis

Introduction

Unilateral swelling of a paralysed limb is commonly associated with deep vein thrombosis, or heterotrophic ossification. We report a paralysed patient who presented with an acute swelling of the thigh, due to an unusual aetiological factor – an adductor muscle rupture.

Case Report

A twenty six-year-old man was admitted to our unit, a year after a road traffic accident, in which he sustained a head injury. A CT scan of his brain showed evidence of diffuse brain damage. He was unable to move all four limbs, had significant spasticity, and multiple joint contractures. He had sustained a fracture of the right femur and tibia, which were nailed at the referring hospital. He had a tracheostomy tube and was being fed through a naso-gastric tube at the time of admission. His bladder was drained with an indwelling catheter. His perineal hygiene was poor due to severe adductor muscle spasm. The range of movement in the right hip was restricted, possibly due to inadequate mobilisation of the hip following the fracture. A diagnosis of traumatic brain injury sequelae with total body involvement was made. To reduce the spasticity, and aid in perineal hygiene, he was started on Tab Tizanidine, and subsequently, phenol blocks were given to the Obturator nerves. This was supplemented by prolonged stretching of the adductor muscles, both by the therapist, and the patient's relatives.

A month after admission and twenty-five days after the Obturator nerve block, the patient was noticed to have a swelling of the right thigh. The thigh was reportedly normal earlier in the day and the swelling had developed suddenly. On examination, there was only minimal distal oedema. There was mild induration of the medial thigh, but no obvious mass was palpable. There was no abnormal mobility of the femur, and the range of movement in the hip was not altered. Clinical examination of the abdomen

Address for Correspondence : Dr Poonnoose PM, Lecturer, PMR department, Christian Medical College & Hospital, Vellore, India, 632004 Telephone: + 416-2222102) (Fax No.: + 416-2232054)

was also normal. A Doppler examination of the pelvic and lower limb vessels was negative for deep vein thrombosis, and the X-ray and Ultrasonography of the hips did not show any evidence of any Heterotrophic Ossification around the hip, nor any fracture. As there was a swelling and induration in the medial aspect of the thigh (Fig 1), an adductor muscle rupture was suspected. A CT scan of the thigh confirmed our clinical suspicion (Fig 2). The scan showed marked swelling of the adductor muscles, with evidence of a probable bleed into the muscle bulk, as seen on the scan. On discussing the findings with the father, he admitted that he had been vigorously stretching the adductors a few hours before the swelling was noticed. The swelling settled in a few days time, with anti-inflammatory drugs.

Fig.1 Swelling of the thigh

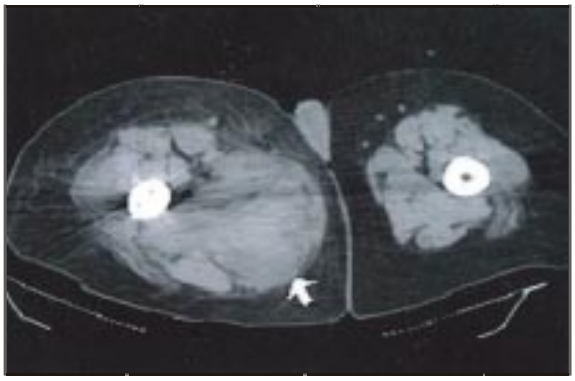

Fig.2 CT Scan of the thigh

Discussion

Unilateral swelling of the lower limb in any bedridden patient with neurological deficits, is most commonly associated with deep vein thrombosis (DVT), or heterotrophic ossification (HO). DVT is usually detected in the second to fifth week post injury, and a second peak around the twelfth week has also been described among paraplegics[1]. There is an increase in the girth of the calf muscle, and the thigh (in case of a femoral DVT), with distal pitting oedema. There is an increased firmness of the calf on palpation. The usual signs of pain on squeezing the calf (Homan's sign), or on dorsiflexion of the ankle, do not cause pain in a paralysed individual, and this subjective 'firmness' of the muscle compartment is one of the signs to be looked for in a suspected DVT . In HO, there may be swelling of the thigh, associated with distal oedema, but the firmness of the calf is usually absent. There may be induration/ firmness around the hip joint, with restriction of the range of movement. A Doppler scan is usually taken to detect DVT, and an X-ray or ultrasonography of the hip is used to detect HO. Ultrasonography picks up the HO earlier than routine X-rays do. If there is no other obvious cause like trauma, or abscess, one should consider an adductor rupture – especially if associated with induration and swelling in the medial aspect of the thigh, and minimal pedal oedema. The muscle is seen to be bunched/ swollen in the medial aspect of the thigh (Fig 1). This could be confirmed with ultrasonography, or with a CT scan. The traumatic rupture could subsequently lead onto heterotrophic ossification in the medial compartment of the thigh, and this could cause restriction of movement in the spastic hip.

Previous case reports of adductor muscle rupture have been in sports injuries. The muscle has been reported to rupture either proximally or distally[2,3,4]. This case highlights one of the

potential complications associated with unsupervised, excessive stretching of the spastic adductor muscle – a common problem in the paralysed patient. Care should be taken to prevent such problems.

References

1. Thumbikat P et al. A comparison of heparin/ Warfarin and enoxaparin thromboprophylaxis in spinal cord injury: the Sheffield experience. Spinal Cord 2002; 40 (8): 416-20
2. Sangwan SS, Aditya A, Siwach PC. Isolated traumatic rupture of the adductor longus muscle. Indian J Med Sci 1994; 48 (8):186-7
3. Ippolito E, Postachinni F. Rupture and disinsertion of the proximal attachment of the adductor longus tendon. Case report with histochemical and ultrastructural study. Ital J Orthop Traumatol 1981; 7(1): 79-85
4. Symeonide PP. Isolated traumatic rupture of the adductor longus muscle of the thigh. Clin Orth 1972; 88: 64-66

Aetiology and clinical profile of osteomalacia in adolescent girls in northern India

by Dr. J. Rajeswari, Dr. K. Balasubramanian, Dr. V. Bhaita, Dr. V.P. Sharma, Dr. A.K. Agarwal

Published in National Medical Journal of India , Vol - 16, No-3, 2003

Abstract

Background. The adolescent age group is particularly prone to nutritional rickets/osteomalacia due to an increased demand for nutrients, especially calcium and vitamin D. Osteomalacia presents with non-specific signs and symptoms because of which diagnosis may be delayed. Vitamin D deficiency is unexpected in India which is a tropical country with abundant sunshine.

Methods. We prospectively studied the clinical presentation, aetiology and social factors contributing to adolescent rickets/osteomalacia in our region.

Results. We saw 21 symptomatic adolescents with osteomalacia during the study period (November 2000-July 2002). All were girls. Only I practised purda and 4 belonged to a low socioeconomic class. The mean (SD) duration of illness before correct diagnosis was 2.8 (2.1) years. Bone pains and muscular weakness were universally present. Non-specific complaints (especially limb pains being mistaken for joint involvement) led to a delay in diagnosis with consequent morbidity. All but 10 patient had low serum 25-hydroxyvitamin D levels (<10ng/ml), with the mean (SD) being 4.9 (2.7) ng/ml. Their mean dietary calcium intake was low [265 (199) mg/day, range 40-810 mg/day]. Restricted outdoor activities (n=19) and the traditional dress code (n=21 were contributory factors, as they led to poor exposure to sunshine.

Conclusion. Nutritional osteomalacia among adolescents is a poorly recognized entity. Even in non-purda practising communities in the tropics, poor exposure to sunshine due to social factors, compounded by low dietary calcium intake, can lead to osteomalacia in adolescents.

Nati Med J India 2003; 16:139-42

Go to the next Abstract

Varying Role of Vitamin D Deficiency in the Etiology of Rickets in Young Children vs. Adolescents in Northern India

by Dr. K.Balasubramanian, [a] Dr. J. Rajeswari, [a] Dr. Gulab, [b] Dr. Y.C.Govil, [b] Dr. A.K. Agarwal, Dr. A. Kumar, [b] and Dr.V. Bhatia [a]

[a] Department of Endocrinology,
Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow, India
[b] Department of Pediatrics and [c] Rehabilitation and Artificial Limb Center,
King George's Medical College, Lucknow, India

Published in Journal of Tropical Pediatrics, 2003, Vol 49, No. 4, 201 - 206

Summary

The relative importance of calcium vs. vitamin D deficiency in the etiology of nutritional rickets in the tropics may be different in children compared with adolescents. We studied calcium intake, sun exposure, serum alkaline phosphatase, and 25 hydroxy vitamin D in 24 children and 16 adolescents with rickets/osteomalacia. The values were compared with those obtained in control subjects (34 children and 19 adolescents). We found that young children with rickets had lower calcium intake compared with controls (285 ± 113 vs. 404 ± 149 mg/day, $p < 0.01$), but similar sun exposure (55 ± 28 vs. 56 ± 23 min-m^2/day) and 25 hydroxyvitamin D (49 ± 38 vs. 61 ± 36 nmol/I), in contrast to one of 16 adolescents. Adolescent patients had low calcium intake vs. controls (305 ± 196 vs. 762 ± 183 mg, $p < 0.001$), and lower sunshine exposure (16 ± 15 vs. 27 ± 17 min-m^2/day, $p< 0.01$) and serum 25 hydroxyvitamin D (12.6 ± 7.1 vs. 46 ± 45.4 mol/I, $p< 0.001$. The odds ratio for developing rickets with a daily calcium intake below 300 mg was 4.8 (95 per cent CI, 1.9 - 12.4, $p = 0.001$). Subjects with rickets were randomized to receive 1 g calcium daily, with or without vitamin D. Children showed complete healing in 3 months, whether they received calcium alone or with vitamin D. Adolescents showed no response to calcium alone, but had complete healing with calcium and vitamin D In 3-9 months (mean 5.3 months). Thus deficient calcium intake is universal among children and adolescents with rickets/osteomalacia. Inadequate sun exposure and vitamin D deficiency are important in the etiology of adolescent osteomalacia.

Indian Journal of Physical Medicine and Rehabilitation

April 2003 & 2004; Volumes 14 & 15

This multi-disciplinary professional journal is devoted to the needs of the service providers, professionals, applied researchers and educators.

Frequency: Yearly.

Note: 1. Sole responsibility of the published material rests with the IAPMR. However, the views expressed in the articles are those of the authors and IAPMR need not subscribe to them in whole or in part.

2. The journal is circulated free to IAPMR life members.

3. Kindly intimate the change of address to the editor.