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2. Lyn D. Weiss MD , Harry J. Lena burg MD, Jay M. Weiss MD. Physical Medicine and Rehabilitation Q&A Review. April 23, 2013.ISBN-13: 978-1620700006.Edition: 1.
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4. Karen Barr et al.Electro diagnosis of Lumbar Radiculopathy. *Physical Medicine and Rehabilitation Clinics of North America*; **24(1):** 79-91.
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Case Report

Indwelling Catheter Related Pressure Ulcer in Groin in a Tetraplegic Patient: A Case Report

Ngampa Sangme [1], *Th Khelendro Singh* [2], AS Mohes[3], L Nilachandra Singh [4], AK Joy Singh[5]

Abstract

Ulcer prevention and its management has been a challenge in the practice of rehabilitation medicine and more so, with the tetraplegic subjects. We herein report a case of a 42-year-old tetraplegic male, who presented with multiple pressure ulcers and atypical grade-II ulcer in the right groin due to mismanagement of indwelling urethral catheter. Groin is extremely an unusual site for ulcer and no similar case has been previously reported with an ulcer in the groin in a spinal cord injury (SCI) patients. This case highlights the importance of proper positioning of indwelling urethral catheter, its care, and prevention of medical devices related (iatrogenic) complications in patients undergoing treatment.

Key words : ***Ulcer groin tetraplegia urethral secretions urethral catheter SCI.***

Introduction:

In spinal cord injury(SCI) patients, pressure ulcer usually develops in the soft tissues overlying bony prominences, resulting in ischaemia, cell death, and tissue necrosis.[1] Ischial tuberosity, greater trochanters, sacrum and heel are common sites. In addition to these, pressure sores at unusual sites like nasal alae, malar eminences, cervical region and medial side of knee have also been described.[2] Two cases of pressure ulcers in the medial aspect of thigh as an unusual complication of indwelling urethral catheter in a SCI patient has been reported.[3] But ulcer in the groin due to misplacement of the indwelling catheter in a tetraplegic patient has not been reported as yet.

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Case Report:

A 45-year-old male with a history of spinal cord injury following road traffic accident 3 months ago, presented with the weakness of all the four limbs and multiple sores. He was earlier managed conservatively in other set up and was put on indwelling urethral catheter. After thorough clinical examination, he was diagnosed as traumatic tetraplegia, ASIA gr-A, with motor level of C7, sensory level of D4 bilaterally with gr-IV sacral ulcer, Gr-II bilateral trochanteric ulcers and gr-II right groin ulcer (Fig 1) with neurogenic bowel and bladder with anaemia. His investigation profile shows Hb 7g/dl, TLC-7500/cmm, ESR-105mm/1st hr, S total protein-5.2mg% with sterile urine culture and sensitivity after 24 hours of incubation. On further examination of the well circumscribed (12X12mm) right groin ulcer, it was found that the indwelling catheter was left strapped on to the anterior aspect of the right upper thigh (Fig-2). There was constant soiling of the area with the urethral secretion, well hidden underneath his lower garment which leads to the ulcer development at the right groin. He is being managed with whole blood transfusion, protein supplement, clean intermittent catheterisation and saline wound dressing.

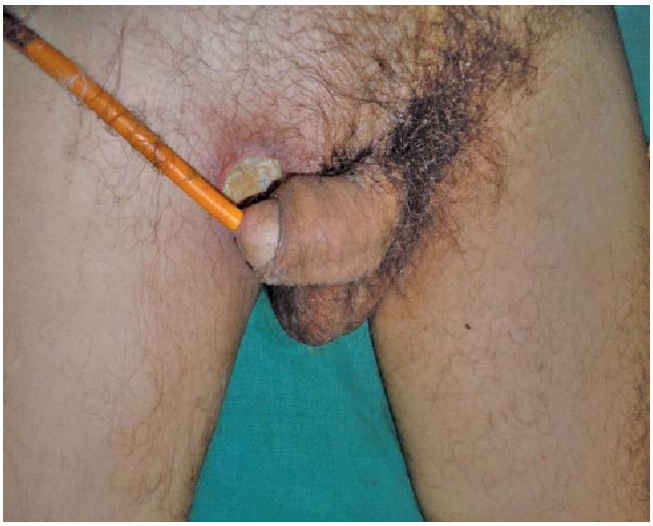

Fig 1- *Ulcer in the Groin*

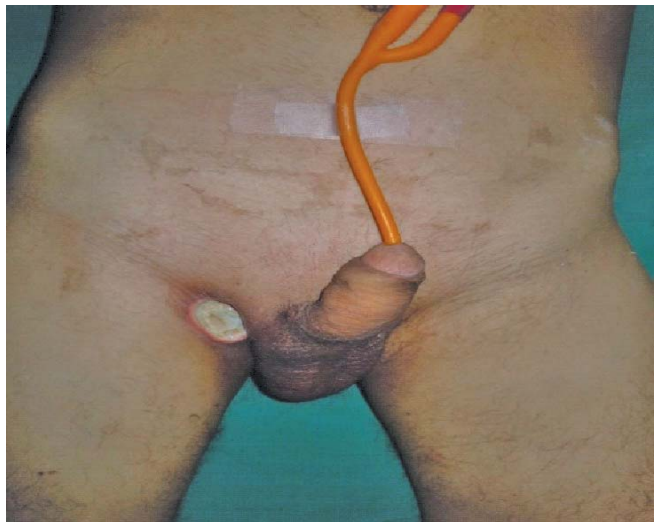

Fig 2- *Catheter Strapping in the Abdomen*

Discussion:

The problems associated with the inappropriate use of medical devices can be referred to as iatrogenesis and are applicable to any form of medical treatment that causes side-effects. Iatrogenesis has been shown to be a major recurring problem in medicine and of particular concern in the older and paralytic patient[4,5]. However, in many cases it is potentially preventable. The initial goal is to increase the level of awareness among the treating staffs and to emphasise caution with the use and placement of medical devices. Tubing (urinary catheter, oxygen, intravenous, feeding,) should be situated so as to be completely visible during each shift and not pass under the patient's body[6].

Urinary retention is a common problem during spinal shock and is often managed with continuous indwelling urethral catheter. However, these catheters result in several complications like urinary tract infection, chronic irritation resulting in urethral inflammation and stricture formation, urethral and penoscrotal fistula, urolithiasis, squamous metaplasia and rarely carcinoma of bladder[7]. The patient in this report was put on continuous indwelling catheter for urinary retention during the phase of spinal shock following SCI and thereafter. Improper positioning of the indwelling catheter for a prolonged period together with lack of sensation and neglected personal hygiene resulted in this ulcer in the groin. This complication could have been avoided by improving catheter care, proper positioning of the indwelling catheter and increase level of awareness among the treating staffs and caregivers alike.

Conclusion:

The primary aim of this report is to highlight an unusual and potentially preventable complication of indwelling urethral catheter in patients with SCI. An improperly positioned indwelling urethral catheter may result in ulcers from pressure or constant soiling over the thighs in patients with SCI. Absence of sensation, weakness of both the legs and lack of knowledge about indwelling catheter care contributed to this ulcer formation. Hence it is important to properly position the indwelling urethral catheters (vertical abdomen fixation, not pulling) in these patients.

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Case Report

Management of Over-Granulation in a Diabetic Foot Ulcer: A Clinical Experience

Krishnaprasad I N[1], Soumya V[2], Abdulgafoor S[3]

Abstract

Over-granulation or exuberant granulation tissue is a common problem encountered in the care of chronic wounds, especially that of diabetic foot ulcers. There are several potential options for the treatment of this challenging problem. Some have an immediate short term effect but may have a longer term unfavourable effect, for example, silver nitrate application and surgical excision, which may delay wound healing by reverting the wound back to the inflammatory phase of healing. Other products, such as foams and silver dressings may offer some effect in short term, but their long term effects are questionable. The more recent research supports Haelan cream and tape as an efficacious and cost effective treatment for over-granulation in a variety of wound types. The future of treating over-granulation may lie with surgical lasers, since lasers can not only remove over-granulation tissue but will also cauterise small blood vessels and are very selective, leaving healing cells alone while removing excess and unhealthy tissue.

Recently Drs Lain and Carrington have demonstrated the utility of imiquimod, an immune-modulator with anti-angiogenic properties, in the treatment exuberant granulation tissue, in a patient with long standing diabetic foot ulcer, resistant to other forms of therapy. We adapted a modified version of their protocol in the management of a similar patient in our hospital and achieved a good result in lesser time than the former.

Keywords: ***Over-granulation, diabetic foot ulcer, imiquimod.***

Introduction[1-3]

Granulation tissue is composed largely of newly growing capillaries. If granulation is present in the wound, it is an indication that the wound is healing, and a dense network of capillaries, large number of fibroblasts, macrophages and new formed collagen fibres will be present. However, sometimes the granulation will 'over grow' beyond the surface of the wound and this is called 'hyper-granulation' or 'over-granulation'. Over-granulation is defined as granulation tissue which is in excess of required amount needed to replace the tissue deficit. It often results in a raised mass above the wound. It may be a difficult condition to manage as the presence of such tissue will prevent or slow epithelial migration across the wound, and thus delay wound healing.

Over-granulation usually presents in wounds healing by secondary intention. It is clinically recognised by its friable red, often shiny and soft appearance that is above the level of the surrounding skin and can be healthy or unhealthy. Healthy over-granulation tissue presents as moist, pinky-red tissue that may bleed easily. Unhealthy over-granulation tissue presents as either a dark red or a pale bluish purple uneven mass rising above the level of the surrounding skin which also bleeds very easily. However, whether healthy or unhealthy, the wound generally will not heal because, epithelial tissue will find it difficult to migrate across the surface and contraction will be halted at the edge of the swelling. The healthy granulation tissue has the potential to reduce naturally and to eventually heal without intervention although this may take longer than if it is treated.

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Particular care should be taken in differential diagnosis, as a fungating malignant ulcer can mimic a hypertrophic granulation tissue.

Case Report:

A 55 years old female patient, diabetic, on insulin therapy for the past few years, presented with a non-healing ulcer over the past 6 months, over the inferolateral aspect of left heel (Fig 1).

On examination the ulcer was about 5×5 cms, with slightly indurated and unhealthy margins. The ulcer floor had a dusky red fungating mass filling almost the entire floor, slightly indurated, fragile and adherent to the ulcer base. The mass was not tender but has occasional foul smelling discharge and caused difficulty in donning a foot wear. Also it bled whenever the patient walked barefooted for a few distances. She had symmetric sensory peripheral neuropathy of both lower extremities. Peripheral pulsations were all normal in the lower extremities. Because of the bleeding mass and ulcer, the patient was physically, socially and psychologically incapacitated. She had undergone multiple therapies, including indigenous treatment, but none has given her a permanent cure. She was advised surgical removal of the excess granulation tissue by her diabetologist, but she was not willing for surgery. Then she was referred to our department for any non-surgical options in her management.

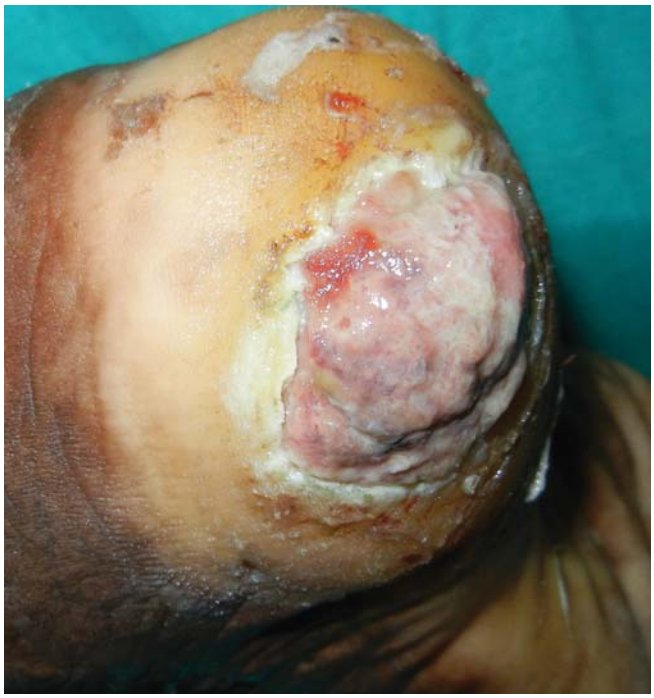

Fig 1- *Ulcer Pre treatment*

We did a thorough literature search for the possible management options and came across many different options, many of which she already had tried, and many which were not locally available. Among those methods, the utility of topical imiquimod, an immunomodulator with anti-angiogenic properties was demonstated by Lain and Carrington[4], in a patient with a diabetic foot ulcer with overgranulation. Their treatment protocol consisted of 4 days/week regimen of topical imiquimod at night, an enzymatic debriding agent for the remaining 3 days and morning application of mupirocin cream. They reported a good ulcer healing in 7 months time.

Imiquimod cream was locally available, since it is used by dermatologists in the management of perianal and genital warts, actinic keratosis, basal cell carcinoma, keloids etc. We discussed this treatment option with the patient and caregivers, with explanation of the benefits and possible side-effects and the need for a strict compliance to the regimen. We adopted a modified protocol since enzymatic debriding agents were not locally available. We used topical imiquimod 3 days per week and for the remaining 4 days, special moisture

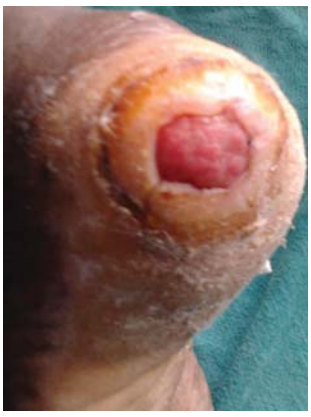

Fig 2- *6 Weeks Follow-up*

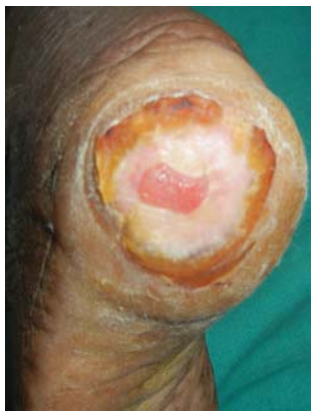

Fig 3- *12 Weeks Follow-up*

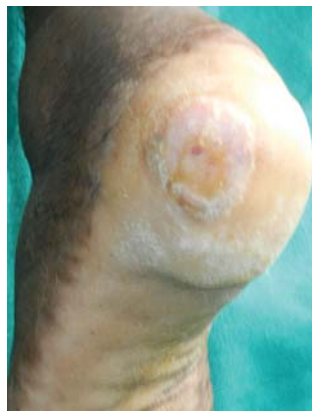

Fig 4- *18 Weeks Follow-up*

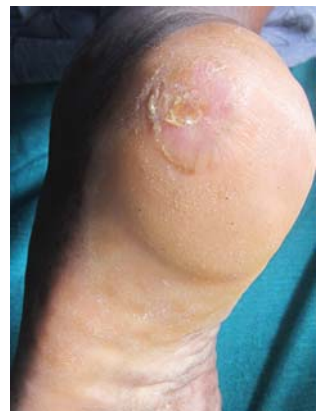

Fig 5- *24 Weeks Follow-up*

retaining dressings were given to promote autolytic debridement. Every morning a topical antiseptic preparation containing nano-crystalline silver was applied. Before starting treatment, malignancy and infection were ruled out by appropriate biopsy and culture methods. Correct application method was taught with special care to protect surrounding skin and the patient was asked to review every 6 weeks. We also emphasised the importance of proper foot care and diabetic control.

We reviewed the patient every 6 weeks (Figs 2-5) and the progress was assessed. The unhealthy edge of the ulcer was curetted at each visit to improve the chance of re-epithelisation. Blood sugar level was optimised and nutritional anaemia was corrected. There was a dramatic reduction in the size of hypertrophied granulation tissue over a period of 12 weeks, and by 18 weeks the epithelisation was almost complete covering the entire ulcer area.

The patient was extremely happy with the result and had very good functional improvement. She did not complain of any local or systemic adverse reaction during the therapy. She was given a proper foot wear and instructed a proper foot care plan.

Discussion:

There are many treatment options for over-granulation with limited research to support their use or to clearly suggest which is the most effective.

A "wait and see" approach was suggested by Dunford[3] but the last decade has seen some significant developments in this area of tissue viability and a more pro-active approach should be taken.

Inflammatory response may be related to infection and the use of an antibacterial dressing such as sliver, cadexomer iodine, honey, PHMB (polyhexamethylene biguanide) can assist with managing local colonisation and reduce the potential and also reduce the over-granulated tissue[5].

The earliest recommendation for treating over-granulation was foam. Harris and Rolstad[6] reported the findings of a prospective non-controlled correlation study with 10 patients and 12 wounds using a polyurethane foam dressing to reduce over-granulation tissue. The results demonstrated a reduction in granulation tissue. It was concluded that the pressure of the foam on the granulation tissue reduced the oedema and flattened the over-granulation tissue. Pressure from foam was then replaced by the suggestion of double application of hydrocolloid. Controversially an occlusive dressing is thought to be a possible cause of over-granulation but potentially the pressure of the double application may reduce the excess tissue.

Morison *et al*[7] noted that silver nitrate reduced fibroblast production. However, the use of silver nitrate directly reduces fibroblast proliferation and is therefore, not recommended for prolonged or excessive use[8] and should never be considered first-line therapy and should only ever be used with great care for the more stubborn area of granulation. This is particularly important as chemical burns have been reported and more likely to occur with longer application times. When it is necessary, a topical barrier preparation such as petroleum jelly or white soft paraffin should be applied to protect the normal skin surrounding the area of over-granulation[9].

Another highly successful method of treatment would be a short course of a topical steroid to suppress the inflammatory process[10,11] and tri-adcortyl was often the chosen steroid to be used in this case. However, it is no longer recommended for this purpose as it contains auromycin, an antibiotic, and it is indiscriminate use of such antibiotic therapy that may have initiated MRSA. Reducing the bacterial burden with auromycin may be one of the possible reasons for the success of tri-adcortyl in reducing over-granulation as reducing the bacteria load would remove the infection that stimulated the tissue to overgrow while the steroid reduces the inflammation that also stimulates overgrowth.

Lloyd-Jones[12] reported resolution of over-granulation tissue using a silver hydrofibre dressing, but this took some weeks to resolve which is much longer than other treatments.

Haelan tape[13] is a transparent, plastic surgical tape, impregnated with 4 mg/cm^2 fludroxycortide, which allows steady distribution of the steroid to the affected site. Fludroxycortide is a fluorinated, synthetic, moderately potent corticosteroid. As with other topical steroids, the therapeutic effect is primarily the result of its anti-inflammatory, antimitotic and antisynthetic activities.

Because granulation tissue is very delicate, it can sometimes be removed by wiping with a cotton swab. However, this should only be undertaken by an experienced person, as the wound could be traumatised

and healing could be further delayed. Surgical debridement is also an option, but should only be undertaken by an experienced surgeon.

Imiquimod, first approved by the Food and Drug Administration in 1997 for the treatment of external genital and perianal warts, has since been approved for treatment of actinic keratoses and has shown activity against basal cell and squamous cell cancers, melanoma, other verrucae, keloids, cutaneous T-cell lymphoma, morphea, and other viral infections[14,15]. As a synthetic ligand for toll-like receptor 7 at therapeutic doses, imiquimod stimulate immature, plasmacytoid dendritic cells, which secrete very large amounts of interferon. Interferon has numerous clinical effects including anti-proliferative, immunomodulatory, and anti-angiogenic effects[16,17]. Angiogenesis, whether in tumours or as part of wound healing, requires the correct cytokine milieu, including VEGF, MMP 9, bFGF, and TIMP1. Interferon achieves its anti-angiogenic effects by tilting the balance of cytokines to decrease those cytokines that favour angiogenesis, such as VEGF and MMP 9, and promote those that cause vessel involution, such as TIMP 1.

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Editorial

Global Brief on Hypertension: Silent Killer, Global Public Health Crisis

World Health Day was celebrated on 7 April to mark the anniversary of the foundation of WHO in 1948. Each year a theme is selected for World Health Day that highlights a priority area of public health concern in the world. The theme for 2013 is high blood pressure that describes why, in the early 21st century, hypertension is a global public health issue. This document describes how hypertension contributes to the burden of heart disease, stroke and kidney failure and premature death and disability. The document also explains how hypertension is both preventable and treatable and how governments, health workers, civil society, private health sector, families and individuals can join forces to reduce hypertension and its impact.

Many people do not know that they have high blood pressure because it does not always cause symptoms. As a result, it contributes to more than nine million deaths every year, including about half of all deaths due to heart disease and stroke. It is very easy to reduce the burden of high blood pressure by cutting down on salt; eating a balanced diet; avoiding harmful use of alcohol; doing regular physical activity and avoiding tobacco use. In Japan several community-based non-communicable disease programmes have contributed to a reduction in raised blood pressure and strokes.

Hypertension is estimated to affect more than one in three adults aged 25 and over (or about one billion people) worldwide. Africa sees the highest prevalence of hypertension (46 percent of adults aged 25 and over), while the Americas the lowest (35 percent).Owing to appropriate public policies and better access to health care, high-income countries have a lower prevalence of hypertension (35 percent) than low- and medium-income countries (40 percent).

In India documented prevalence of hypertension may be the tip of the iceberg. Lack of uniform healthcare delivery system, lack of availability and standardised practise of nationalized protocols, poor accessibility of modern health care system for a significant percentage of populations are the main culprits of the expected huge number of hidden hypertensive Indians. These tremendous hidden cases are indirectly influencing the prevalence of disability in our country.

According to this year WHO report, the prevention and control of hypertension requires the efforts from government policy makers, health workers, academic research community, civil society, private sector and families and individuals because all have a role to play. As a part of world health care delivery system let us join hands and share the ultimate goal of World Health Day 2013 to reduce coronary artery diseases and strokes. Specific objectives of our campaign to prevent disability will be:

- to raise awareness of the causes and consequences of high blood pressure;
- to provide information to general population on how to prevent high blood pressure and related complications;
- to encourage adults to check their blood pressure and to follow the advice of health-care professionals;
- to encourage all for healthy diet and regular exercise habit;
- to make blood pressure measurement affordable to all;
- to incite national and local authorities to create environments for healthy behaviours.

In the era of modern medicine of twenty-first centuries we, the physiatrist community of India, should take the call of WHO to resist this silent killer and to encounter the global public health crisis because the physiatrists are not only with the disabled and for the disabled persons but also for the community to prevent disability.

R. N. Haldar
Rajesh Pramanik

An Unusual Case of Chronic Lower Limb Pain in an 11-Year-Old Boy

Chandy B R[1], Tharion G[2]

Spinal neurenteric cysts are rare congenital abnormalities composed of heterotopic endodermal tissue. These cysts are considered to be a form of occult spinal dysraphism that result from inappropriate partitioning of the embryonic notochordal plate and presumptive endoderm during the third week of embryogenesis. These heterotopic epithelial remnants of gastro-intestinal and respiratory tissue lead to eventual formation of compressive cystic lesion of the spine[1]. The terminology of these cysts are synonymous with enterogenous cyst, split notochord syndrome, endodermal cyst, gastro-enterogenous cyst and teratoid cyst. They account for 0.7-1.3% of all spinal cord tumours[2]. Intradural/extramedullary compartments are the commonest location for the neurenteric cysts, approximately 90%, whereas the remaining 10% are found at an intradural/intramedullary or extradural location[3] (abdomen, mediastinum, pelvis, brain and rarely subcutaneously). Individuals with neurenteric cysts frequently present in the second or third decade of life with an approximate 2:1 male-to-female ratio[4,5]. In the paediatric population, 61.2% patients with these cysts are males with a mean age of 6.4 years at presentation[6]. In this report we are presenting an unusual case of chronic pain and lower limb posturing in a child diagnosed to have a spinal neurenteric cyst.

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Case Report:

11-year-old boy, a sixth standard student, was referred to the PMR outpatient's department for management of pain and abnormal posturing of the left lower limb. He was apparently well till eight months prior to presentation, when there was a history of trauma to the left foot while playing football in school. Other than mild pain in the foot, child was alright and was able to complete the game and walk back home. As the foot pain did not resolve in the following 3 weeks, he was taken to a local orthopaedic surgeon who diagnosed a metatarsal hairline fracture and conservatively managed this with a below knee plaster cast. This cast was removed after three weeks. However, the pain in the left foot worsened and gradually progressed to involve the entire left lower limb.

He complained of pain on touch but was able to walk with a mild limp for another 2 months from onset, when the severity of pain increased and ambulation became progressively difficult. By the fourth month from the onset of injury, the child stopped walking and found relief in the pain by keeping the left hip and knee in a flexed posture. There is no history of any cognitive decline, behavioural change, bowel-bladder symptoms, sensory or motor impairment elsewhere in the body, at the time. The hip-knee flexed posture was maintained at all times, even in sleep. Any attempt to correct the hip/knee resulted in severe pain. Child found it increasingly difficult to wear trousers as the touch of the cloth aggravated the pain.

He was taken to several hospitals and was evaluated for the painful condition. At most places, he was treated with analgesics. He was diagnosed as chronic regional pain syndrome type 1 at one hospital and was given an epidural block following which manual stretching of the left lower limb was done. The pain was better; however, it recurred a few days later, with the same intensity, as the effect of the block wore off. He was then brought to CMC, for further management.

On examination, the child was of a cheerful disposition, sitting comfortably with the hip at 90 degrees flexion, knee completely flexed and ankle in plantar flexion. Vital signs were within normal limits and other general and systemic examination were unremarkable. Power in the upper limbs and the right lower limb was grade 5 (MRC grading), and sensations were normal except on the left, below L1, he had allodynia and would not permit examination. On standing on the right lower limb, he was able to extend the hip from 90 degrees by 30 degrees and the knee from complete flexion, by 20 degrees. He was also able to minimally move the toes. Muscle wasting could not be commented upon. The tone was mildly increased in the right lower limb and deep tendon reflexes were within normal limits in the upper limbs but mildly exaggerated in the right lower limb.

Historically the child had good relationships with his parents, siblings, other family members and friends/ classmates. He is an above average student and there was no history suggestive of any difficulties in school. There was no suggestion of secondary gains from the situation. Other than the allodynia and left lower limb posturing, there were no other features suggestive of an ongoing illness.

The investigations done elsewhere consisted of magnetic resonance imaging of bilateral hip joints and x-ray of the left ankle and foot, which were all within normal limits. A bone scan showed a mild tracer uptake at the level of T6 but no significant disease process was reported.

As history was unremarkable for the cause of pain and the clinical signs were limited, the question of diagnosis and appropriate treatment were discussed with the parents. After having been to several hospitals and not having any relief in the child's symptoms, the parents were on the verge of giving up hope and returning home due to financial and time constraints. A probable need for intervention of child psychiatry unit was also discussed. It was decided to evaluate the condition with

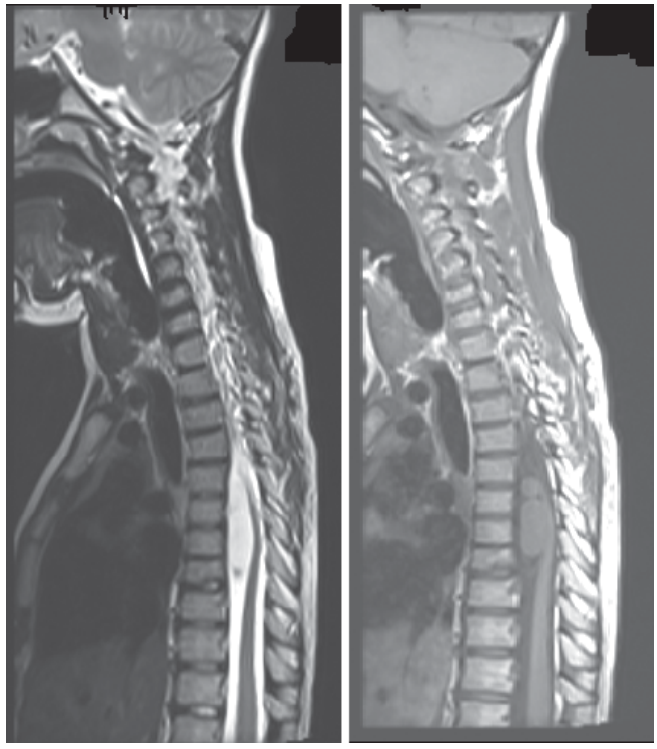

Fig 1- *MRI showing sagittal section of the cervico-dorsal spine with the Neurenteric cysts at T5-8 level, T1 (cysts are isointense) and T2 (cysts are hyperintense) weighted images*

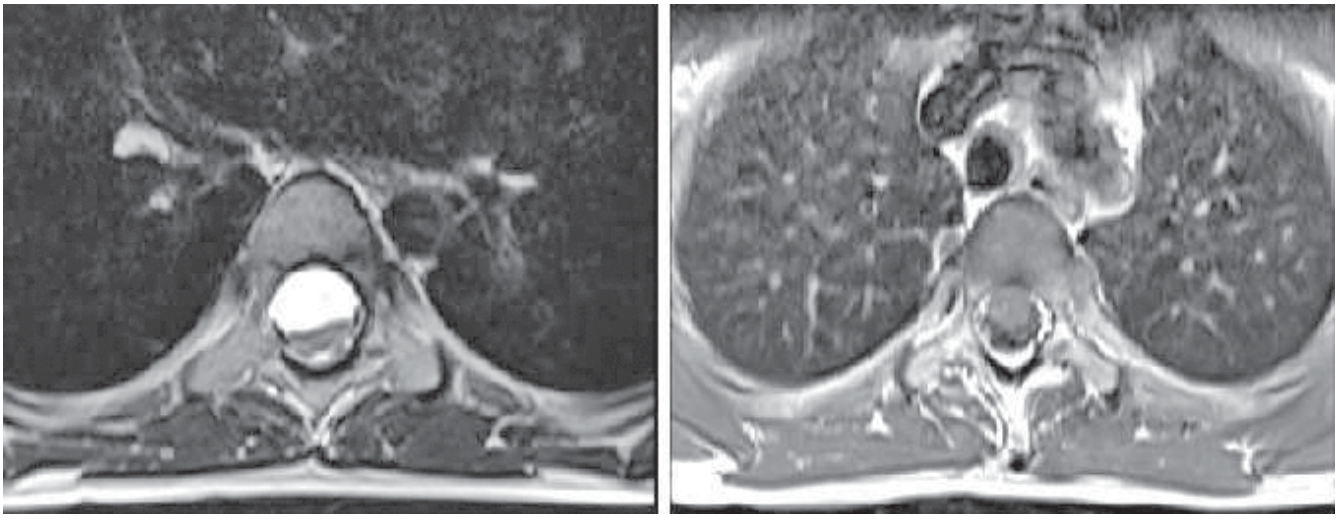

Fig 2- *MRI showing transverse section of the cervico-dorsal spine with the Neurenteric cysts at T5-8 level, T1 (cysts are isointense) and T2 (cysts are hyperintense) weighted images.*

an MRI of the spine and electrodiagnostic tests for the lower limbs to look for any spinal pathology causing these symptoms prior to referral to psychiatry.

Nerve conduction studies could not be done as the child did not permit the test to be done on the left lower limb. However, MRI of the spine revealed two well-defined intradural, extramedullary oval, cystic lesions with the anterior thecal sac, extending from lower T5 up to mid T8 vertebral body (Figs 1&2). The larger cyst measured 3×1.4cm and the smaller lesion measured 9×11mm superior to the lesion mentioned above. Both were isointense on T1 and hyperintense on T2 sequences with no enhancement or diffusion restriction. The lesions displaced the cord posteriorly causing severe thinning and straightening of the mid dorsal column. A thin septum of the cord was seen from T4 extending up to T8 level. The findings were suggestive of probable neurenteric cysts.

The child was referred to neurosurgery for surgical management of the cysts. A T5-8 laminoplasty and total excision of the cystic mass was done. Intra-operatively, the dura was found to be tense but the arachnoid was normal. The cord was displaced dorsally by the two ventrally located cysts which were intradural and extramedullary. The cysts were not found to be communicating with each other. They had thick white walls and contained white, mucoid fluid. While under anaesthesia, the left lower limb was manually stretched and a plaster cast (above knee) was applied. Post-operatively, allodynia in the left lower limb completely resolved, the mild tone and exaggerated reflexes also improved. The mild urinary hesitancy the child had developed prior to surgery also resolved postoperatively. Biopsy of the cystic mass was reported as type A neurenetric cyst.

Discussion:

In human embryogenesis, during the third week, the neurenteric canal unites the yolk sac and the amniotic cavity as it traverses the primitive notochordal plate. Persistence of the normally transient neurenteric canal prevents appropriate separation of endoderm and notochord. Manifestation of this anomalous union is seen as the congenital abnormalities of the spine defined by the presence of mucus-secreting epithelium reminiscent of the gastro-intestinal and respiratory tract.[1] The diagnosis is by classical histopathological description of the cyst on haematoxylin and eosin staining of the tissue which shows a collection of mucin producing simple columnar or cuboidal ciliated and non-ciliated goblet cells surrounding a central cystic cavity. Wilkins and Odom in 1976, classified these cysts into three types based on the histological features of cyst wall and its contents.[1] The walls of type A cysts mimic gastro-intestinal or respiratory epithelium with a basement membrane supporting single or pseudostratified cuboidal or columnar cells, which may be ciliated or non-ciliated. type B cysts include all the features of type A as well as additional tissue containing glandular organisation, usually producing mucin or serous fluid. Type C cysts are most complex, containing ependymal or glial tissue within the cyst[7]. As mentioned previously, the commonest age of presentation is the second or third decade, however, they can manifest soon after birth or during the neonatal period if they are associated with severe cardiopulmonary abnormalities[8]. In rare cases, they may remain latent until the seventh decade of life[3].

Adult patients with neurenteric cysts may present with focal pain at the level of the spinal pathology, radicular symptoms or fluctuating neurological signs. These symptoms are associated with lesions in the cervical and thoracic spine, whereas radicular symptoms are seen in persons with cysts in the cervical or lumbar spine.

The volumetric flux of the cyst associated with periodic leakage of fluid content secondary to osmotic and haemodynamic factors is responsible for the fluctuating nature of the symptoms[9]. The waxing and waning nature of the signs and symptoms associated with spinal cord compression secondary to the volumetric instability frequently leads to misdiagnosis of central nervous system demyelinating disorders[10] like multiple sclerosis. A variety of clinical manifestations have been seen in the paediatric population in addition to the common signs and symptoms. Case reports of children with presentations of aseptic meningitis, pyogenic meningitis, chronic pyrexia, incontinence and paraplegia , have been described[6,9,11,12].

Magnetic resonance imaging is the investigation of choice for the diagnosis of neurenteric cysts. The most common MRI findings associated with neurenteric cysts are non-contrast enhancing lesions that are isointense on T1-weighted sequences and hyperintense on T2 weighted images[13]. The incidence of neurenteric cysts along with osseous malformation warrants plain radiographs or CT imaging to fully delineate the pathologic spectrum of the process.

As in the reported case, surgical excision of the cystic mass is the first line of management for these cysts. Total excision of the mass is the ideal outcome given the

association between partial resection and cyst recurrence[13]. However, on occasion, vertebral anomalies or extensive adhesions to the neural anatomy makes complete resection hazardous and complicated[9]. Post-operative outcome of total resection is most often reported as curative of the sensory and motor deficits associated with the cysts. In literature, 11% patients have reported worsening of symptoms and 18% have had failure to regain pre-morbid neurological function[6]. Post-surgical recurrence have been reported in the range of 0%[14] and 37% with the later being reported in the longest follow-up at 30 years in eight patients[15].

Conclusion:

In literature, there are case reports for neurenteric cysts in children and adults. However, this particular case reported serves to illustrate the atypical presentation of the spinal lesion with allodynia with secondary posturing, in an otherwise healthy child with no previous history of any neurological disease. With paucity of neurological signs, a diagnosis of somatisation and psychological disorders are easy to make with the actual disease process being completely missed. Due to the wide range of signs and symptoms, this diagnosis, though rare, should be kept in mind in order to diagnose and promptly treat this lesion before permanent deficits occur.

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Original Article

Impact of Early Physiotherapy Intervention on Neuro-development in Preterm Low Birth Weight Infants during the First Six Months of Life

N. Meena[1], V. K. Mohandas Kurup[2], S. Ramesh[3], R. Sathyamoorthy[4]

Abstract

A prospective, controlled trial was conducted to assess the outcome of early physical therapy intervention on preterm low birth weight infants during the first six months of life. A cohort of 100 preterm low birth weight infants who got admitted in neonatal intensive care unit (NICU) and referral newborn (RNB) of Raja Muthiah Medical College and Hospital (RMMC & H) were included prospectively. Infants who received regular early physiotherapy intervention were assigned as interventional group (EI) and infants who were advised but did not turn up for early intervention as comparison group (NEI). The Amiel-Tison neurologic examination and Denver developmental screening test (DDST) were used and results were compared. Better performance of infants was found in EI group in neurologic and developmental domains. The data suggest significant benefit of the use of EI programme over NEI in the neuro-developmental outcome of preterm LBW infants at 6 months of corrected age.

Key words: *Preterm low birth weight infants, Early Intervention, Developmental outcome*

Introduction:

Improving perinatal and neonatal care has led to increased survival of infants who are at-risk for long-term disabilities[1,2]. Survivals of preterm LBW infants have resulted in an increased incidence of physical and mental disabilities[3]. Preterm birth and medical complications due to LBW infants may impact later development such as neuromotor delays, intellectual and behavioural problems[4-6]. Early detection of infants at high-risk is of paramount importance to assess their developmental status and for planning intervention to avoid secondary problems[7,8].

Early intervention (EI) consists of providing continuous multidisciplinary services to infants from birth throughout the first year of life.It means interventional therapy specified for babies at-risk for developmental delay and periodic developmental assessment of motor, cognitive function, language/adaptive functioning[9]. EI promotes child health, minimise developmental delays, cures existing disabilities, prevents functional deterioration, and promotes parent-child interaction[9].

The goal of this study is to measure the effects of EI programme in a group of high-risk preterm LBW infants. The hypothesis is that high-risk infants under EI perform better than a group of high-risk infants without EI. DDST comprising gross motor, fine motor, personal social and language domains were used prospectively to evaluate the effects of EI on their neurodevelopment during follow-up in the first six months of life.

Materials and Methods:

Subjects – Preterm LBWnewborns in NICU and RNB of our hospital over a period of two years were recruited for the study. Inclusion criteria–infants with gestational

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age between 28 and 36weeks[10]; inadequate weight for gestational age[11]; singleton delivery. Exclusion criteria- Maternal history of high blood pressure; diabetes or any chronic maternal disease during pregnancy; congenital infections; congenital malformations.

Infants who received regular early physiotherapy intervention were assigned as interventional group (EI) and infants who were advised but did not turn up for early intervention as comparison group (NEI). Sixty infants constituted the EI group (31male and 29 female) and forty infants (21males and 19 females) comprised the NEI group.

Early intervention – EI was initiated for high risk infants right from the neonatal period after the babies became stable. Early intervention applied remarkably to preterm low birth weight infants, in order to arouse their actions and feelings, ultimately giving them a normal experience of development through interaction with the mother and environment[9]. The individually adjusted programme was described to the parents (especially to the mother), who were trained and received written programmes elaborated for their infants. These programmes contain intensive schedules to develop elementary sensorimotor patterns[12,13], individualized care plans centred on the infant behavioural organisation, mother-child interaction, and extending to vision, hearing, feeding, and vocalisation. Stimulation was given for at least one hour a day, according to the infant feeding and sleep-time schedules. Infants were reviewed every month. It was emphasised that, aside from the training programmes, the infant requires the affection and care of the family members.

Neurologic Examination – The Amiel-Tison[14] test was performed by a pediatric therapist, with the infant undressed and awake but quiet. Hypertonia or hypotonia were looked for by measuring the adductor angle, popliteal angle, ankle dorsiflexion, and scarf sign. Any asymmetries between the extremities were recorded.

Denver Developmental Screening Test (DDST) – The Denver Developmental Screening Test is a simple, clinically useful tool for early detection of infants with developmental delay[15]. The test comprised four domains: gross motor, fine motor/adaptive, language and personal social. The level of achievement was scored as advanced, ok/pass, caution and fail depending on the age line[16]. The assessment was done according to the corrected age, often calculated prior to developmental assessment for a more accurate comparison of the developmental status[4].

Data Analyses – In order to examine the effectiveness of early interventional therapy, it is proposed to apply the Chi-square test of independence to examine whether the level of achievement depends up on the early interventional therapy.Also to compare the effectiveness of the therapy over the level of achievement in the EI group and NEI, the "Z" test for the equality of proportions is applied[17].

Results:

The age of each infant in both groups was corrected for comparison, and the last examination for the objectives of this study was performed at 6 months of corrected age. No differences in age, socioeconomic features, and examination results were observed at the first examination. Significant differences between groups were observed with better outcome in EI than NEI group after 6 months.

Neurologic examination – In the initial assessment, infants of 86% were suspected of neurologic abnormalities, while 14% exhibited a normal result. Six months later at the second examination, in NEI infants12.5% present a normal result, while 87.5% had suspicion of neurologic abnormalities. In EI group, almost all infants had a near normal result at sixth month. Significant differences between groups were observed with better performance in EI than NEI group.

DDST – With a view to examine the impact of the EI therapy for improving the level of achievement in gross motor, fine motor/adaptive, personal social and language domains of preterm LBW infants, the Chi-square test of independence is carried out. The results obtained are given in **Table 1**. The null hypothesis to be tested is H0: The level of achievement in all domains is independent of the EI and NEI preterm LBW infants.

From the results obtained the following conclusions could be drawn :

The chi-square statistic value for the gross motor domain data is =18.37 with a corresponding p=0.004. Since 'p' value is <0.05, the Chi-square statistic is significant and hence the null hypothesis is rejected. It implies that the level of achievement in gross motor domain is influenced by early interventional therapy. In the case of fine motor, personal social and language domains also the Chi-

Table 1: *Level of Achievement in all Domains in Early Interventional (EI) and Non-Interventional (NEI) infants*

Domains	Interventional (EI) / Non-interventional (NEI)	Level of achievement (%)			
		Advanced	Ok	Caution	Fail
Gross motor	EI NEI	33.3 12.5	35 15	23.3 37.5	8.4 35
Fine motor	EI NEI	25 15	41.7 10	20 37.5	13.3 37.5
Personal social	EI NEI	18.3 12.5	41.7 10	28.3 25	11.7 52.5
Language	EI NEI	16.7 12.5	45 10	23.3 27.5	15 50

square value is significant, and the level of achievement in these domains is also influenced by the early interventional therapy. Therefore the interventional therapy is useful in getting higher level of achievement.

It is further proposed to examine whether there is any significant difference between the proportions of preterm LBW infants with regard to each level of achievement in all domains, the 'Z'test for the equality of proportions is used. The null hypothesis to be tested is theproportion with the level of achievement in all domains differs significantly between the EI and NEI. So the null hypothesis is given as H0:P1=P2, where P1 and P2 refer to the population proportionsof the two groups. **Table 2** gives the 'Z' statistic values with their level of significance as well as the proportion of two groups of infants achieving the desired level of improvement in all four domains.

From the Table 2, following conclusions can be drawn.

There is a significant difference in the proportion of infants achieving advanced,ok and fail level of achievement in gross motor domain. But there is no significant difference in the proportion of caution level of achievement.

The % or proportion of babies with advanced level of achievement is higher in the EI group when compared to the same for the NEI group. Therefore the interventional strategy contributes to the level of achievement in gross motor domain. In the case of fine motor, personal social and language domains the difference is not significant between the proportion of the two groups with the advanced level of achievement.

So having advanced level of achievement is found to be a difficult task for even the EI group with regard to fine motor, personal social and language domains.

Discussion:

We studied the effects of intensive EI in selected sample of high risk infants from birth to 6 months of age. We found differences in neurologic and developmental outcome between EI and NEI infants, with a better performance in EI infants. The study suggests a positive effect of EI on neurodevelopment.

"Early" can be understood in several ways, for example: 1) early after birth; 2) early in the first year of life; and 3) early after onset of the condition. Each intervention type is associated with advantages and disadvantages. Very early treatment is intervention provided for infants who are at risk for neuromotor disorders, and treated as soon as possible to minimise future handicaps[18]. The early intervention institute at Utah University reviewed 316 articles suggested that EI has immediate positive effect[19]. CDC model of 'early stimulation therapy' was effective.The beneficial effect also persisted at 2 years, without any additional interventions. A reduction of 40% in poor performance could be achieved by EI in LBW babies in Trivandrum[20].

There are various longitudinal studies related to the developmental outcome of infants born prematurely[21-23]. EI showed greater developmental progress in acquisition of skills,cognition, intellectual, social functioning and increased weight gain[24-28]. Many recommend the study of specific developmental training techniques to find positive effects of EI on neuro-development of infants during their first year of life[29,30]. Thus, we employed these techniques to study the effects of EI in the neurodevelopment of preterm LBW infants followed during their first six months of life.

EI have been carried out in the NICU, after hospital discharge, or during the first semester of life[31-33]. But

Table 2: *'Z' statistic Values with Their Level of Significance as well as The Proportion of Two Groups of Infants Achieving the Desired Level of Improvement in All Four Domains*

Domains	Interventional (EI) n=60	Non-Interventional(NEI) n =40	z	P1	P2
Gross motor					
Advanced	20	5	2.32*	0.33	0.125
O k	21	6	2.25*	0.35	0.15
Caution	14	15	1.64	0.23	0.38
Fail	5	14	3.41*	0.08	0.35
Fine motor					
Advanced	15	6	1.20	0.25	0.15
O k	25	4	3.41*	0.08	0.35
Caution	12	15	1.97*	0.2	0.37
Fail	8	15	2.85*	0.13	0.37
Personal social					
Advanced	11	5	0.74	0.18	0.125
O k	25	4	3.4*	0.08	0.35
Caution	17	10	0.33	0.28	0.25
Fail	7	21	4.46*	0.116	0.52
Language					
Advanced	10	5	0.56	0.166	0.125
O k	27	4	3.72*	0.45	0.1
Caution	14	11	0.51	0.23	0.27
Fail	9	20	3.77*	0.15	0.5

*Significant

in our study we began EI during newborn period itself before hospital discharge. Various studies[34,35] suggested that children who were born prematurely are discharged from NICU were still at risk for future developmental disabilities, this necessitates systematic monitoring, follow-up, and early intervention services. In our study, we initiated early intervention right from the neonatal period itself and continued during the first 6 months of life by reviewing infants every month in EI group. NEI group was also advised to take EI for their infants.

In our study in the initial assessment of neurological examination, infants of 86%were suspected of neurologic abnormalities, while 14% exhibited a normal result. Six months later at the second examination, in NEI infants12.5% present a normal result, while 87.5% had suspicion of neurologic abnormalities. In EI group, almost all infants had a near normal result at sixth month. So significant differences between groups were observed with better performance in EI than NEI group

A difference in developmental items was observed when comparing infants under EI group with those of NEI group. The level of achievement in gross motor, fine motor, personal social and language domains of preterm LBW infants is influenced by the early interventional therapy in EI group. It is therefore suggested that the use of early interventional therapy will help in the process of achieving higher level of achievement in different domains of preterm LBW infants.

In our study, EI therapy helps in the process of achieving higher level of achievement in gross motor domain, similar studies [36-38] is in agreement with our result.

The difference between the proportions of preterm LBW infants with regard to each level of achievement in all domains was examined. In the gross motor domain there is a difference in infants achieving advanced, ok and delay level of achievement. But there is no significant difference in caution level of achievement.

The advanced level of achievement is higher in gross motor domain of EI group when compared to the same for the NEI group. Therefore the interventional strategy contributes to the level of achievement in gross motor domain.

In the case of fine motor domain the difference is not significant between the two groups with the advanced level of achievement. A similar conclusion was drawn in the case of personal social and language domains. So having advanced level of achievement is found to be a difficult task for even the EI group with regard to fine motor, personal social and language domains .

We conclude the infants under the caution group both in EI and NEI groups do not show a significant improvement in all the domains except in fine motor.

Our data attributed to the most intensive EI programme. Moreover; the training facilitated the mother-infant relationship. It was emphasised that, aside from the training programmes, the infant requires the affection and care of the family members.

Although our follow-up time was short, our results hold the promise of good outcome in the neurodevelopment of high-risk infants. In **summary,** comparison between the EI and NEI premature LBW infants, the early interventional therapy helps in the process of achieving higher level of functions in different domains.

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Medical Philately

This is an image of a semi-postal stamp depicting a victim of poliomyelitis printed by photogravure.

This was issued by Argentina on April 14, 1956 to benefit the fight against this disabling disease

The Popeye Sign

Mansoor S N[1], Rathore F A[2]

A 67 years old previously healthy gentleman presented with two months history of pain and weakness left shoulder and arm. There was no history of trauma. His dominant hand was right. He gave history of lifting a heavy bag of wheat one month back when he felt a sudden "pop" and excruciating pain in his left upper anterior arm near the shoulder. He developed bruising in the area and restriction and pain in shoulder and arm movements. He consulted local GPs for the pain and it responded well to NSAIDs and household remedy of hot fomentation. He also noticed a small lump in the arm region that could be reduced manually but he ignored that (Fig 1). On examination there was mild restriction of range of motion of left shoulder both actively and passively. There was a visible lump in left forearm that was firm and non-tender and became prominent on resisted flexion of arm that could be manually reduced (Fig 2). There was mild weakness of left biceps brachii (MRC Grade 4). There was no signs of impingement. Rest of the musculoskeletal examination and neurological examination was unremarkable. A diagnosis of ruptured long head of biceps brachii along with early adhessive capsulitis was made and was confirmed on musculoskeletal ultrasonography (USG).MRI of rotator cuff was not ordered as there was no signs of impingement or associated injury. Patient was advised surgical repair but he declined as he was satisfied with the functional upper limb. He was advised analgesics for pain and home based exercise plan. He was lost to follow up.

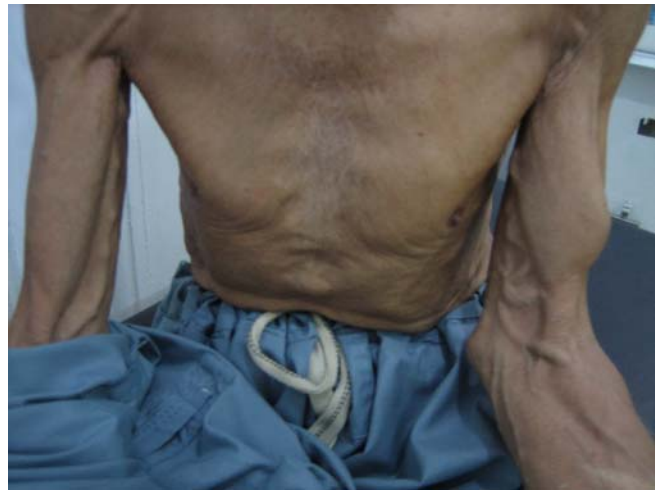

Fig 1- *Left Arm with a Prominent Bulge*

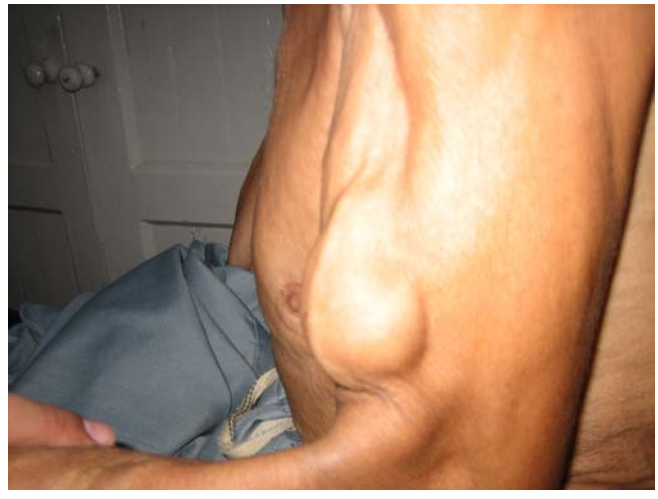

Fig 2- *The Biceps Muscle Balled up*

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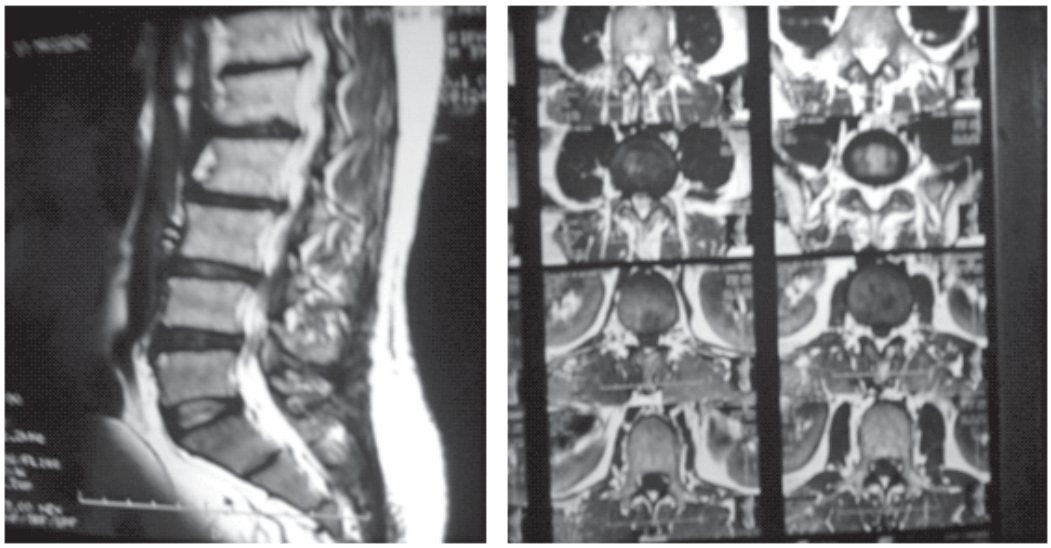
PG Forum

REHAB CHALLENGES

39 year male patient presentedin PMR OPD with severe low back pain (VAS score 8 out of 10) with both lower limb radiation. After conservative therapy with lumbosacral orthoses, standardized exercise schedule,analgesics, muscle relaxant, pregabilin etc. pain score was not improved significantly. On clinical examination there are right L3 and L5 sensory radiculopathy and left sided L5 and S1 sensory changes without any motor deficit. MRI picture of his lumbosacral spine clearly showedmultiple levels PIVD like disc bulge in L4/5 and L5/S1 and disc desiccations in L2/3.



MRI of lumbosacral spine

The patient is unable to do his ADL for last few weeks. Please opine regarding specific interventional pain management approach.

PG Forum

REHAB QUIZ

1. Myokymia can be identified by EMG when one observes
A) Single action potential fasciculation
B) High frequency synchronous discharge
C) Repetitive (group discharge) fasciculation
D) All of the above

2. Evidence of denervation in the rhomboid muscle indicates the lesion is in
A) Proximal to the trunk of the brachial plexus
B) In the upper trunk of the brachial plexus
C) In the middle cord of the brachial plexus
D) In the supra-scapular nerve

3. Inability to differentiate between different weights is called
A) Atopognosis
B) Baragnosis
C) Autotopagnosia
D) Anosognosia

4. Arteriography and other blood flow studies aid in determining the level of amputation by all except
A) By assessing the amount of remaining blood flow
B) By measuring arterial filling time
C) By revealing collaterals
D) By assessing degree of Ischemia

5. Suction sockets can be best used by
A) Geriatric amputees
B) Young traumatic amputees
C) Any age amputated for diabetic gangrene
D) Patients with previous bypass surgery with new amputee

6. Myotonic dystrophy is characterised by all of the following except
A) Testicular atrophy
B) Posterior lenticular opacities
C) Endocrine dysfunction
D) Joint contracture

7. H reflex involves conduction as follows
A) Antidromic motor and orthodromic sensory
B) Orthodromic motor and antidromicsensory
C) Orthodromic motor and orthodromic sensory
D) Antidromic afferent and efferent fibres

8. A C6 quardriplegic can be expected to be able to
A) Ambulate with crutches and braces
B) Push up while sitting in wheelchair
C) Pick up a heavy object without a splint
D) Dress independantly

9. An energy expenditure of 8.5 cal/min is used standard in
A) Exercise electrocardiogram
B) In single master two steps
C) Maximal performance testing
D) Treadmill test

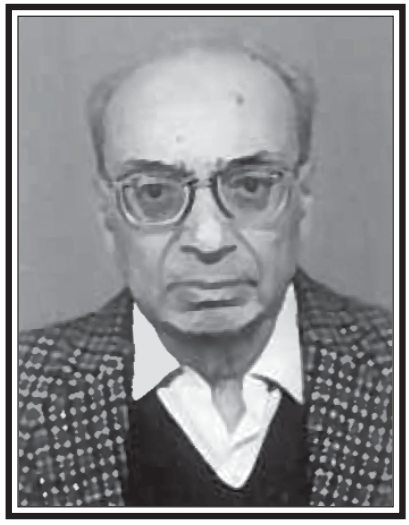
10. In patellar tendon bearing (PTB) socket the patient's stump is held in
A) extension
B) 15 degree flexion
C) 30 degree flexion
D) 45 degree flexion

ANSWERS

September 2012 issue:

1-B; **2**-D; **3**-B; **4**-C; **5**-B; **6**-D; **7**-D; **8**-C; **9**-A; **10**-B

Obituary



Dr. Sanat Kumar Sarkar the teacher of the teachers passed away for his heavenly abode on 25th March 2013. He was born on 7th March 1926. He completed his M.B.B.S course from the prestigious Calcutta Medical College, Kolkata in 1949. He also acquired DTM&DPH in 1953-55.

He was the pioneer person to open a department of Physical Medicine, first ever of its kind in B.C.Roy Polio Clinic & Hospital for crippled children in the year 1954. In 1956 he proceeded for England and acquired D.PHYS.Med (Eng) in 1958. He came back to Calcutta and in 1959 started School of Physical Medicine (SPM) at SSKM hospital Kolkata under active influence of Dr. B. C. Roy, the then chief minister of West Bengal & builder of modern West Bengal. He worked there up to 1976 and then transferred to NRS Medical College & Hospital till his superannuation in 1984 as a head of the department.

He started diploma course in physiotherapy (DPT) in 1963 at SPM. His dream of opening MD course in PMR was finally materialised in 1979 as a pioneer course in India. He had his maximum involvement in MD (PMR) course as a teacher and course guide. He had been the vice president of Asia Pacific league of Physical Medicine and Rehabilitation in 1974 and was an executive committee member of International Rehabilitation Medicine Association. He had his contribution to medical hydrology in the text book, edited by Sideney Licht and the various other works.

His demise is an unrepairable loss to the PMR community. We will be deprived of his wisdom and fatherly presence. A big umbrella has been removed from the head of physiatrists of this world.

We pay our sincere condolence to the bereaved family for their immense loss. We pray to almighty for his soul to rest in peace.

Review Article

Rehabilitation Medicine Implications of Stem Cell Therapy in Spinal Cord Injury–A Review

Sumalatha K B[1], Gita Handa[2], U Singh[3]

Abstract

The life expectancy in spinal cord injury has increased but no cure has been found yet. Stem cell therapy in the spinal cord injury stands high hopes of neural repair and regeneration and getting back to normal life. But for its fruitful result it is essential to know the pathophysiology of the spinal cord injury and also the treatment should be appropriately timed according to the stages of injury. Regular follow-up of these patients is very important as stem cell therapy alone without appropriate rehabilitation may not only result in failure of therapy but also patients may end up in complications such as UTI, bed sores etc. Role of rehab in spinal cord injury with respect to physiological and task oriented neuroplasticity has shown benefits in animal studies. Rehabilitation programme integrated with the stem cell therapy may help to improve the functional outcome.

Key words: ***Spinal cord injury, stem cell therapy, rehabilitation.***

Introduction:

The incidence as well as prevalence of spinal cord injury has remained same with the increase in their life expectancy[1]. Spinal cord injury (SCI) results in loss or damage of the nervous tissue with loss of motor and sensory function below the level of injury and consequently loss of bowel and bladder sensation and control. This makes the affected dependant on others, with many of them going into depression and loss of employment, adding on to the burden. At present, there is no treatment that can repair the lost or damaged nervous tissue to restore normal life of the sufferer.

Stem cell therapy is one of the new modalities which once being the talk of the hour, is considered a glamorous technique of treatment. Treatment with stem cells may help in spinal cord repair or replacement and thus lays a potential scope for stem cell research in spinal cord injury. Stem cell by definition is a cell that is capable of both self renewal and differentiation. There are different varieties of stem cells which have been evaluated in animal models and humans. Stem cell therapy combined with rehabilitation in SCI patient may show better results than single therapy alone. To understand rehabilitation implications of stem cell therapy better, we need to first analyse the pathophysiology of spinal cord injury related basic sciences research and the relevant guiding principles for rehabilitation of persons with SCI who have received or are likely to receive stem cell therapy.

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Pathophysiology of Spinal Cord Injury:

After primary insult (physical injury) to spinal cord, secondary changes (the subsequent chain of events)[2] occur to curtail the primary injury but paradoxically causes damage at the cellular level. The secondary phase of injury includes inflammation, ischaemia, disruption of ion channels, axonal demyelination, massive cell death, oxidative damage, excitotoxicity, glial scarring (astrogliosis), secondary necrosis and/or apoptosis; which altogether can damage the remyelinating cells of spinal cord i.e. oligodendrocytes and other cells (Fig 1). This makes us understand that we need to use multiple

techniques to tackle this altogether and the necessity to treat at the right time. Time sequence of SCI is divided into three stages: acute (primary injury occurring seconds to minutes after SCI), subacute (secondary changes occurring minutes to weeks after SCI), and chronic stage. The treatment should confirm according to these stages. In the acute and subacute stages, the intention of treatment is neuroprotection (to prevent secondary changes) whereas in the chronic stage; it is neural repair and restoration[3]. Spinal cord has also been shown, in basic research on animal models, to have spontaneous neuroplasticity after injury which may occur at the level, caudal and rostral to the level of injury and in supraspinal pathways along with cortical reorganisation. This occurs in the form of axonal sprouting and cellular proliferation. This neuroplasticity may aid in spontaneous recovery seen in a few of the injured.

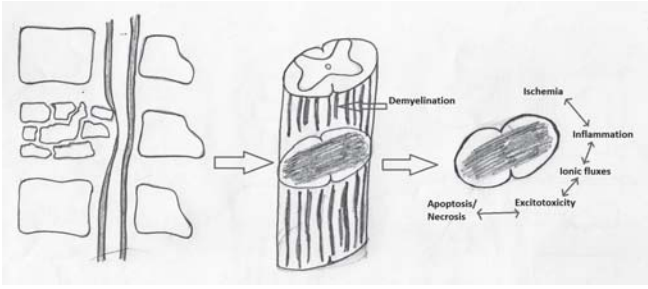

Fig 1- *Pathophysiology of Spinal Cord Injury*

Stem cell–Past, Present and Future:

Stem cells can be allogenic or autologous. Various sources of stem cells include embryonic stem cells[4], neural stem cells from adult brain[5], mesenchymal stem cells (MSCs) from bone marrow[6] and other organs (foetal blood, adipose tissue, umbilical cord)[7] and non-stem cells like olfactory ensheathing cells[8] and Schwann cells[9]. With so many varieties of stem cell available and further being developed, the hope and expectations from the research are high but there are only a handful of clinical trials few of which are listed in Clinical Trials hosted by the National Institute of Health[10].

The stem cell therapy can be compared with Gartner's Hype Cycle (Fig 2) theory that every new technology experiences a period of continuous hype growth, followed immediately by a strong downward trend in the expectation and viability of that particular technology sector. Finally, there is a gradual increase towards the productivity[11]. Stem cell therapy was much hyped few decades back and there came a plateau phase and a phase when the adverse effects came into picture (cancerous growth/ no improvement with stem cells). Again a prolific approach is being considered now with combined therapies linked to functional outcomes, which shows some positive results and is likely to get better in the near future. No research technique can accomplish success without proving its odds out.

Fig 2- *Gartner's Hype Cycle*

Combination therapies are being tried for edging in the various stages of the injury and to enhance the growth or inhibit the apoptotic factors by adding some yet undefined factors along with stem cells like the use of growth factors, axonal guiding, overcoming inhibition, stimulating remyelination, multi cell transplant (Schwann, OEG, Stem cell implants). Regeneration, remyelination and restoration of spinal cord function are taken care of by different methods using combination therapies and thus seem more likely to be successful. The pros and cons of the stem cell types have been described elsewhere[12]. But what we also need to pay attention to is when exactly the stem cells can be implanted in a patient of spinal cord injury.

Timing and Site of Stem Cell Transplantation:

Optimal timing would mean better stem cell survival and thus better clinical outcome. Neural stem cells (NSC) transplantation rostral to the site of injury at the subacute stage showed less macrophage infiltration at 4 weeks post operation suggesting better engrafted NSC survival and host behavioural response[13]. Optimal time for NSC transplantation would result in its high survival ratio and efficient differentiation[14]. Okano *et al*[15] also suggested that optimal time for NSC transplantation should be 7-14 days post injury, as acute inflammatory stage lasts for 1 week and glial scar formation would occur by 3 weeks post injury. Optimal timing would also mean better clinical neurological recovery and to support this; Mac

Donald *et al*[16] found that there was partial recovery in coordination of hind limbs and in weight bearing when NSC transplantation was done on 9th post op day. Although clinically it is seen that the recovery and regeneration process that occurs naturally also is responsible for the considerable functional improvement and it is difficult to isolate the two in case of early approach. The studies done on chronic SCI patients highlights the challenges in the stem cell therapy outcomes.

Rehabilitation Implications with Stem Cell Therapy: Learning from Research in Basic Science:

Apart from the spontaneous neuroplasticity occurring in CNS after SCI, task oriented training or physical exercise has been studied to cause various changes in CNS which may help in spinal reorganisation. It (1) increases neurotrophic factors and their receptors in spinal cord[17,18], (2) increases dentate gyrus (neuronal cells) in adult rats and cortical reorganization[19], (3) causes reorganisation of locomotor networks along the spinal cord generating new patterns of muscle activity[20], (4) stimulates serotonergic fibre growth[21], (5) increases ependymal cell (endogenous stem cells) proliferation[22]. Spinal cord is not just a bundle of tracts but has dynamic neuroplasticity which helps in regaining function. Human locomotion is controlled by mainly supraspinal pathways, which differ from rats/cats and so motor neuron pools below the lesion may be unable to generate activities to support body weight and propel the limb forwards. This suggests that humans develop new compensatory strategies to replace lost function. This was proved by recording neuroplastic redistribution of activity across most of the rostro-caudal extent of spinal cord generating new patterns of muscle activity, which seem to be motor equivalent of normal people in the treadmill trained SCI. Body weight support used in these was 75% of body weight. Though it was done on only 11 patients, they noted change in ASIA score in incomplete paraplegia (ASIA C to D) but not in complete paraplegia (ASIA A). Neuroplastic redistribution of activity was recorded in all these. Further, adult neural stem cells have been isolated from subventricular zone and ependymal cells from around cord central canal which in vivo develop to glial scar tissue after a SCI but in vitro these can be processed to develop to neural progenitors. Ependymal cells found around the central canal of adult spinal cord are endogenous stem cells and these have been shown to proliferate with physical exercise (treadmill training) in a study by Foret *et al*[22]. 5HT descending fibres have been shown to disappear 1 month post-transection below the level of lesion. 5HT has been proposed to originate from autonomic regions of brainstem raphe, with only 2-10% intrinsic to spinal cord. Thus identification of 5 HT fibres rostral to the lesion may indicate regeneration though it's not proven till.

Task oriented training produces improved function which is lost in subsequent change in the training[23]. One study[24] show the motor response to the rate of application of sensory input to the human spinal cord during stepping using body weight supported treadmill and proposed that human spinal cord can interpret complex step-related, velocity-dependent afferent information to contribute to the neural control of stepping, thus supporting the task oriented training theory.

Carvalho *et al*[25] in their trial on the combination of bone marrow stem cell therapy (CD45(+)/CD34(-)) and exercise in functional outcome after SCI found that the combination therapy resulted in significant functional improvement in acute SCI than with single or no therapy. Ying *et al*[26] did MSCs transplantation combined with electroacupuncture (EA) treatment and found that this could promote axonal regeneration and partial locomotor functional recovery in the transected spinal cord in rats and indicate a promising avenue of treatment of SCI. Bone marrow mesenchymal stem cells electro-acupuncture downregulate the inhibitor molecules and promote the axonal regeneration in the transected spinal cord of rats[27]. This was also supported by another study by Z Yiu *et al*[28] who also proposed from their study that combined strategy could promote a better structural and functional recovery of injured spinal cord, as electro-acupuncture may activate the process of cell metabolism, and initiate synthesis and secretion of endogenous neurotrophic factors in the ambient tissues at the lesion site of spinal cord.

OEG tranplantation improves hindlimb stepping in paraplegic rats and task specific training enhances the effect[29]. Exercise increases neurotrophic factors and their receptors in spinal cord. The neurotrophic factors like BDNF which are also secreted by the stem cells like OEG has been shown to facilitate intrinsic spinal cord reorganisation; thus exercise and stem cells may have synergistic effects. For example, in a study by Kubasak *et al*[29]; OEG tranplantation improved hindlimb stepping in paraplegic rats and task specific training enhanced

Table 1: *Integrative Approach in Spinal Cord Injury. MSC- Mesenchymal Stem Cells*

Study	Intervention	Result
Foret A et al	Treadmill training (physical exercise)	Endogenous stem cell proliferation --à can promote regeneration
Janell A et al (Task oriented training)	Body weight supported treadmill training	Motor response to the sensory stimuli increases in spinal cord
Carvalho et al	Bone marrow stem cell and exercise	Significant functional improvement
Yin et al	MSC implantation and electroacupuncture application	Axonal regeneration and partial locomotor recovery
Z Yiu et al	Stem cell and electroacupuncture	Significant functional improvement
Kubasak et al	OEG transplantation and step training	Improves hindlimb stepping
Yoshihara H et al	Passive motorized cycling and stromal cell transplants	No recovery in incomplete contusive injury
Harvey P J et al	Electrical stimulation with peripheral nerve grafts	No rubrospinal tract regeneration
De Leon RD et al	Robotic assisted locomotor training on treadmill and quipazine (5 HT agonist)	No locomotor recovery

the effect. Repair strategies must be coupled with rehabilitation therapies that drive activity dependent plasticity for walking, reaching and grasping, bowel and bladder control, prevention of pain and dysautonomia[30]. CNS responds negatively to the suboptimal rehab strategy and training in one behaviour can negate the consequences on other behaviours[31,32]. Few of combination therapies have shown no positive results[33-35]. Exercise, being a broad term, raises query as to what type of exercise helps in recovey. Lynskey *et al*[36] reviewed role of passive exercise, active exercise and neuroprosthesis in promoting plasticity and recovery. Because of loss of modulation by supraspinal fibres after SCI, spinal circuitry depends on peripheral input as stimulation, which may be the cause of spasticity[37,38]. Passive exercise through joint movements activates H reflex via group 1a afferents and with repetition of movements conditions the spinal cord to normal motor neuron electrophysiology[39] and help reduce spasticity and also influence dendritic morphology[40]. Active exercise in incomplete SCI (ex- partial weight supported treadmill training) has been found to cause task specific changes[41,42] apart from causing task oriented changes. It decreases inhibitory molecules[43] and enhances neurotrophic factor (BDNF) expression[44], causes cortical motor reorganisation, collectively enhancing recovery. It increases corticospinal drive to the muscles of lower limb[45,46]. Neuroprosthesis is another type of modality being tried in SCI. It uses electrical stimulation to activate neural structures. The types of neuroprosthesis include functional electrical stimulation (FES- stimulates the peroneal nerves to elicit a flexion withdrawal reflex and thereby cause limb movement), Functional neuromuscular stimulation (FNS- stimulates multiple leg muscles at their motor points in an appropriate sequence to produce coordinated functional movements, such as grasping, standing, or rhythmic leg movement) and epidural spinal cord stimulation (ESCS- stimulates the dorsal aspect of the spinal cord at a particular spinal level using implanted electrodes). The mechanism by which it helps in recovery is not known exactly but it may cause plastic changes at cellular and neural circuitry level. It also enhances BDNF factor and its receptor expression, promoting axonal regeneration[47-49].

Stem Cell Therapy in Other Aspects of SCI:

Few patients of SCI, who have accepted their condition but are held back because of complications, may want improvement in these aspects only. Stem cells can be tried to improve at least some aspects if not completely restore the condition back. Gonzalez Sarasua *et al*[50] did a preliminary study on the use of bone marrow mononuclear cells (BM-MNCs) to treat pressure ulcers in terms of clinical outcome, procedure safety, and treatment time. Their data indicate that cell therapy using autologous BM-MNCs could be an option to treat type IV pressure ulcers in patients with SCI, avoiding major surgical intervention, which also decreased the duration

of hospital admission and wound care time. Stem cell therapy has also been tried in neuropathic pain associated with SCI and found to have effective results. Three cycles of allogenic MSC treated CD 34 cells given over 14 months to a subject of incomplete SCI showed significant reduction in neuropathic pain and also resumption of motor and sexual activities[51]. But in a study, early exercise in spinal cord injured rats induced allodynia through TrkB signalling[52]. In another open labelled case control study taking 64 patients of SCI treated with monthly MSCs for 6 months; more than half of the patients developed neuropathic pain[53]. So, it can act as double edged sword; one should be cautious while treating a patient and also while choosing an appropriate patient.

Long Term Results with Stem Cell Therapy:

Park *et al*[54] in their human clinical study on long term effects of SCI therapy using mesenchymal stem cells concluded that 3 of 10 patients showed improvement in motor power of upper extremities and in activities of ADL along with significant MRI and electrophysiological changes on long term follow-up.

Present Status Regarding Stem Cell Research and its Rehab Implications:

The stem cell clinical trials done until now are mainly on rats and only a few on humans. The sample size in each is small. Mode of injury incurred on the rats are through weights or balloon dilatation, that are not similar to forces involved in human SCI which also includes rotational and shearing component; chances of incomplete injury are high in rats which may naturally recover over a period of time. Safety standards have to be maintained in the labs while preparing the stem cells before putting humans under trial. Dobkin *et al*[55] concluded from their observational study on cellular transplants in SCI done in China; that perioperative morbidity and lack of functional benefit were identified as the most serious clinical shortcomings and the procedures observed did not attempt to meet international standards for either a safety or efficacy trial. Kwon *et al*[56] also suggested for more preclinical trials before translation into humans. They did a comparison of opinion between researchers and spinal cord-- injured individuals on the preclinical evaluation of novel therapies for SCI. They found that SCI individuals had high expectations in the level of pre-clinical evidence required before proceeding with the clinical trials and their expectations should be kept in mind before doing the clinical trials.

Tator[57] in his review article on trials in human SCI states that stem cells have unproven effectiveness and proven effective are methyl-prednisolone (controversial) and gravity assisted ambulation training, thus emphasising the rehab component.

There have been few studies quoting time taken for recovery after treatment with stem cells and poststem cell therapy management. There has been no study regarding the number of sittings with the exact duration of gap between each sitting required for the stem cell treatment. And also how the rehabilitation programme be structured to these patients. The complacence on part of physicians administering the stem cell therapy could be counterproductive as waiting for recovery may in fact hinder the rehab protocol and worsen the functional outcome or may even cause complications like pressure ulcers, UTI etc. Adding to it is the fact that patients who have received the stem cell therapy are reluctant participants in rehabilitation and are too hopeful even if some sensory improvement is seen and often become too resentful if there is no benefit from the procedure. It is observed that they often think that cell transplant therapy is the quick-fix to their all problems related to SCI. We have to put a lid on expectation from stem cell therapy alone and encourage the patients to continue with the rehab prescript. Patients often incur huge debts and have sold everything in hope of walking back normally after the procedure and eventually do not get rehabilitation done and further deteriorate. Media hype fuels the expectations and gives rise to increased vulnerability of patients to fall for non-standardised cell therapies.

It is therefore imperative that rehab should be continued even after stem cell treatment and it should be a part of the clinical trials and these clinical trials should be aimed related to functional goals, so that functional outcome may be better related to the stem cell therapy. More clinical trials should be done focusing on integrative approach of stem cell with rehabilitation to clear the concepts and help the individual. People should not fall victim for these stem cell trials without proper structured rehab facility; since these can not only worsen there condition but can also lead to financial loss with waste of time which may add on to their frustration and depression. Since most of the clinical trials on stem cell therapy in SCI are still in initial phases, it would be more

beneficial if we club these trials along with structured rehab programmes for a better clinical outcome.

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Abbreviations:

SCI – Spinal cord injury

MSC – Mesenchymal stem cells

ASIA – American Spinal Injury Association

BDNF – Brain derived neurotrophic factor

UTI – Urinary tract infection

BM MNCs - Bone marrow mononuclear cells

OEG – Olfactory ensheathing glia

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Case Report

Whistling-face Syndrome – A Case Report

Sahoo P K[1], Sahoo J[2], Das S P[3], Mohanty R N[4]

Abstract

The craniocarpotarsal, or "whistling face" syndrome was first described by Freeman and Sheldon in 1938. It's an extremely rare condition, comes under one type of distal arthrogryposis category. Prominent deformities include deformity of hand and foot with typical whistling face. Early diagnosis of the condition aware the clinician about resistance to different therapeutic manoeuvres and management is planned accordingly.

Key words: Arthrogryposis, Freeman–Sheldon syndrome, craniocarpotarsal dystrophy.

Introduction:

Whistling-face syndrome (WFS), is characterised by craniocarpotarsal dystrophy. It was originally described by Freeman and Sheldon in 1938[1], also called as Freeman–Sheldon syndrome. It is a rare form of multiple congenital contracture (MCC) syndromes (arthrogryposes multiplex congenita) and is the most severe form of distal arthrogryposis (DA)[1,2].

As per presentation of the condition, different terminologies assigned for the condition are distal arthrogryposis type 2A (DA2A), craniocarpotarsal dysplasia (or dystrophy), craniocarpotarsal syndrome, Windmill-Vane-Hand syndrome.

Distal arthrogryposis was identified as a separate genetic disorder in 1982[3]. Characteristically distal part of the limbs i.e. hands and feet are involved. Sometimes proximal affection like congenital knee flexion contracture and hip dysplasia are seen. There are three forms of DA; DA1, DA2A, DA2B. DA1 is the least severe; DA2B is more severe with additional features that respond less favourably to therapy. DA2A (WFS) is the most severe of the three, with more abnormalities and greater resistance to therapy[2].

The diagnostic criteria for DA2A or WFS includes two or more features of DA: microstomia, whistling-face, nasolabial creases, and 'H-shaped' chin dimple[1] (Fig 1). The condition is also described as a type of congenital myopathy[4].

Besides the craniofacial manifestations patients generally seeks for deformities of hands and feet. Common hand deformities are clenched hand or thumb in palm deformity and foot present with resistant club foot deformity. Virtually all individuals with DA are born with their hands clenched tightly in a fist due to the abnormal muscle physiology[4]. The deformities are very much resistant to therapeutic stretching and serial corrective plaster cast. Difficulty in endotracheal intubation and predisposition to malignant hyperthermia and frequent respiratory tract infection in these cases also increase anaesthetic risk for surgery. Unfortunately, many surgical procedures have suboptimal outcomes, secondary to the myopathy of the syndrome.

Case Report:

A 6 years boy admitted to Department of Physical Medicine and Rehabilitation for difficulty in walking and difficulty in holding objects because of deformity of hand and foot from birth. None of his family member

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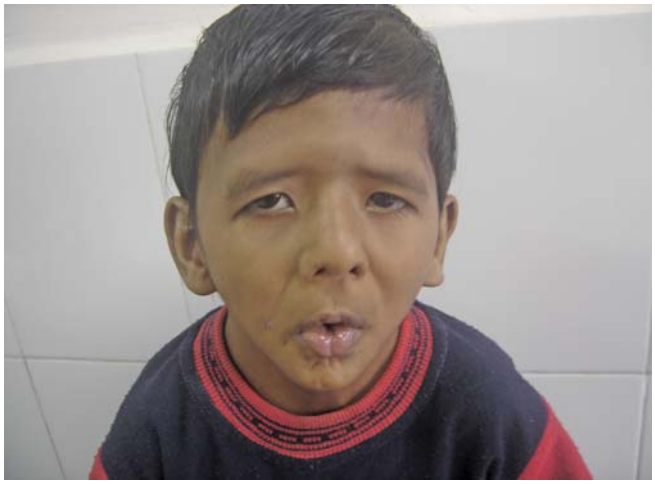

Fig 1- *Whistling-face Syndrome with H-shape Chin Dimple*

had any form of congenital limb anomalies. There was no pre or perinatal bad history. There was no known history of maternal exposure to drug or radiation. The mother and child were immunised properly as per WHO guidelines.

The child was thin built, short stature, small orifice of mouth (microstomia), nasolabial creases, prominent supraorbital ridges, typical chin dimple and whistling-face (Fig 2). Speech was not cleared. Both the hands

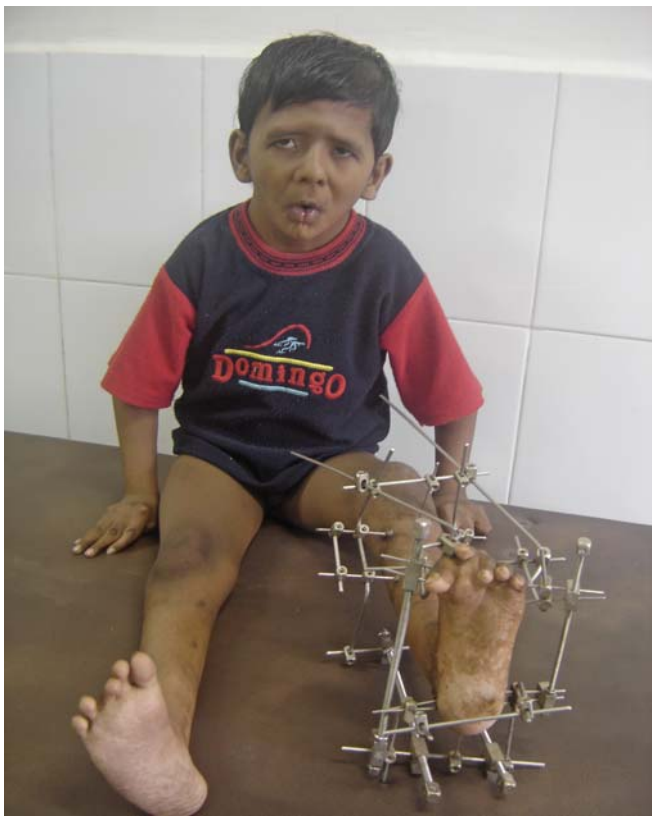

Fig 2- *The Same Child with Hand Deformity*

presented with similar deformity with thumb adductrd and flexed over palm and other fingers overlapped over thumb like a clenched fist. There was no voluntary opening of fingers. Both the feet were operated for club foot deformity 2 years back and recurrence of deformity on both the sides. Deformity on left side was much rigid (Fig 3). Abduction of on left side was limited. Both the lower limbs were cylindrical shaped with less subcutaneous fat as seen in arthrogryposis. The child was dependent for most of his ADL.

All the blood parameters were within normal limit. X-ray of skull and spine did not show any specific abnormality. Left side dysplasia of hip was marked in x-ray of pelvis. After anaesthetic clearance the child had undergone surgery for correction of his rigid left club foot deformity by universal mini external stabilisation system (UMEX) (Fig 4). Hand deformities were tried to manage conservatively by stretching and adaptive devices.

Discussion:

WFS is an uncommon congenital anomaly mostly found in journals of genetic studies. There is paucity of clinical literature on WFS.

So far 65 patients have been reported in the literature, with no sex or ethnic preference notable[2,4].

WFS is caused by genetic changes. Krakowiak *et al*.[5,6] mapped the DA multiplex congenita (DA2B; MIM #601680) gene, a syndrome very similar in phenotypic expression to classic WFS, to 11p1 5.5-pter. Other mutations have been found as well[7,8].

Toydemir *et al*[9] showed that mutations in embryonic myosin heavy chain 3. In 1996, more strict criteria for the diagnosis of WFS were drawn up, assigning the syndrome as DA type 2A[2].

Due to the abnormal musclephysiology in WFS, therapeutic measures may have unfavourable outcomes[4], deformities recurred very often even after adequate correction[10]. Patients and their parents must receive psychotherapy, which should include marriage counselling[11]. Chronic psychological problems, including depression secondary to chronic illness of unfavourable outcomes, can be very successfully addressed with early interventions[12]. The child should have pre-emptive and ongoing mixed cognitive therapy-psychodynamic psychotherapy for patients with WFS and cognitive-behavioural therapy (CBT), if begun after onset of obvious pathology.

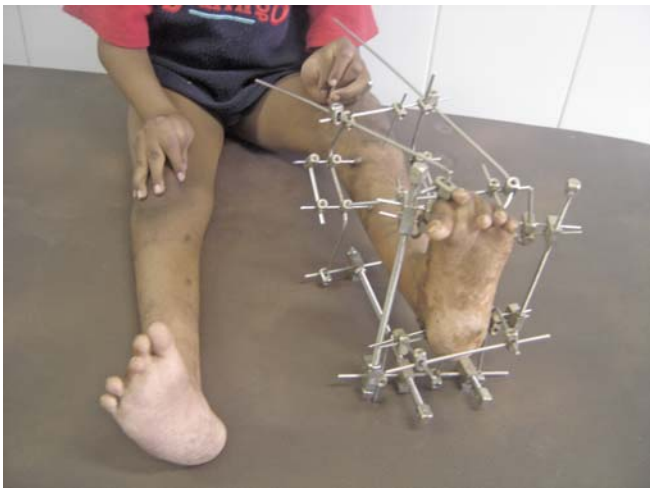

Fig 3- *Deformed Left Foot*

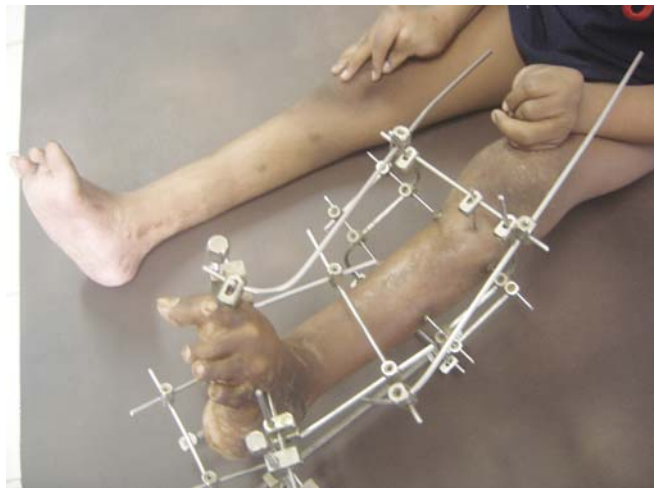

Fig 4- *Corrected Left Limb*

A family with 7 persons affected with WFS in 3 successive generations has been described by Wettstein and Buchinger[13]. Six affected persons are female; the only male carrier died in early infancy because of the severity of symptoms.

All efforts to be made to make the child ambulatory by correcting the foot deformities.

There are little data on prognosis. However respiratory complications are very common even death from pneumonia, empyema have been reported[14,15].

Conclusion:

WFS is an uncommon congenital anomaly.Awareness of such a resistant syndrome is useful in clinical practice of a physiatrist. Since prominent manifestations being the deformity of hands and feet, making the child dependent on ADL, early setting of rehabilitation goal is essential. The objectives of management would be directed towards ambulation of the child and improvement of hand activities. Early intervention gives better result with special emphasis on chest therapy. Psychotherapy for patient and parent is an integral part of rehabilitation.

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