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An interesting case presenting with bilateral ankle joint swelling

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A 34-year-old female presented in a Physiatrist's clinic with low back pain for one month and left knee pain and swelling around ankle joints for one week without any previous similar episodes. There was H/O mild non-productive cough with effort intolerance and H/O early morning stiffness for about ½ to 1 hour. There was no family history of active arthritis. On examination she was normotensive with body wt.of 61.5 kg without any significantly palpable lymphadenopathy anywhere. Ankle joints were swollen, mild to moderately tender (Figs 1 to 2). Patellofemoral movement and knee ROM were normal with mild tenderness over medial joint line of left knee. There was no neurodeficit in either lower limb including normal straight leg raising test. Sacro-iliac joint stress test and schobers' test were normal. Auscultation of lungs revealed discrete crepitation without any abnormal breath sounds.

Fig. 1

Fig. 2

Investigation reports: Hb% 10.2, TLC-6000,N 68 L28 M01 E03. ESR 45. Pl. glucose (F) 92 mg%, uric acid 4.0 mg%, TSH 3.93 µIU/ml (0.25-5.0), Free T4 12.48 pmol/L (9-20), CRP 21.7mg/L (up to 5), RF 8.7 IU/ ml (up to 20). Sputum for AFB on consecutive 3 days were negative X-ray chest : Bilateral hilar prominence.

Fig. 3

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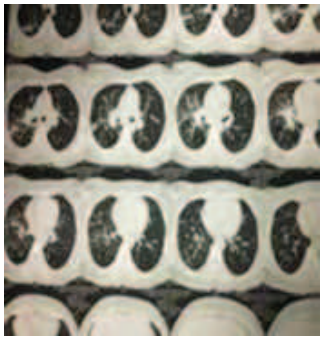

Fig. 4

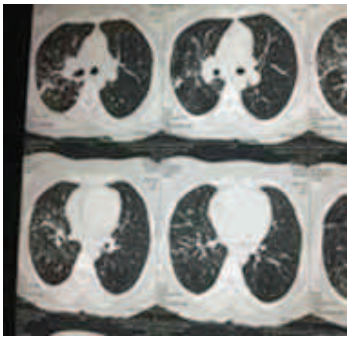

Fig. 5

Fig. 6

Mantoux test was advised which was negative.Serum ACE report was not available till that time.

Hence to get more information CT scan of thorax was done (Figs 4-6).

Then a transbronchial lung biopsy was planned which could not be done due to continuous cough. Patient tolerated a fibreoptic bronchoscopy and BAL fluid report showed cell count 120x 1000000/L (Ref. range 3-59 x1000000/L), lymphocyte 50%, polymorph 10%. Alveolar macrophage 40%, RBC- moderate number. No AFB or fungal element was seen in the fluid. Gram-stain and culture were also negative for bacterial infection. Transbronchial needle aspiration was performed and histopathology ruled out any malignant or epitheloid cell.

Patient revisited the clinic with worsening of swelling and pain around ankles. interestingly erythema nodosum-like lesions were noted over dorsum of (R) hand, in front of (L) ankle, behind (R) heel (Figs 7&8).

Considering persistent cough, joint pain, bilateral hilar prominence in chest x-ray, alveolar opacity in right lung and hilar and mediastinal lymphadenopathy in CT scan, lymphocytosis in BAL fluid, negative Mantoux test and erythema nodosum in a young female patient figured out the diagnoses of sarcoidosis, and patient was put on prednisolone 30 mg daily for 1 month followed by gradually tapering over time to 10 mg daily. Patient was improved and all the symptoms subsided after the treatment.

Fig. 7

Fig. 8

Original Paper

Assessment of the role of sulfasalazine in alteration of biological markers, sacro-iliac joint pathology and bath index of ankylosing spondylitis

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Abstract

To assess the role of sulfasalazine in alteration of biological markers, sacro-iliac joint pathology and BATH index of ankylosing spondylitis.

From February 2008 to July 2009.

Prospective randomised open level controlled trial.

Group 1- 16 patients received indomethacin and exercise.

Group 2- 16 patients received sulfasalazine in addition to above. Department of Physical Medicine & Rehabilitation, Institute of Post Graduate Medical Education &Research, Kolkata. ESR, CRP, Sacro-iliac test, radiological grading of SI joint, BATH index.

Data analysed by McNemar's chi-square test and Fisher's exact test showed no improvement in sacro-iliac test, SI joint involvement and CRP. But ESR was diminished significantly in group 2 according to Mann- Whitney test. Interestingly BASDAI and BASFI score was not improved according toWilcoxon's matched pairs signed rank test. Sulfasalazine is being used as disease modifiers in AS patient for long time. But this study showed that only ESR not CRP was improved with sulfasalzine. Interestingly sacro-iliac joint pathology, BATH indexes for disease activity and function (BASDI & BASFI) were not improved significantly with sulfasalzine. Sulfasalazine is effective to reduce ESR not CRP in patient with ankylosing spondylitis. It is not helpful to improve BATH index of disease activity and function.

key words **: Ankylosing spondylitis, sulfasalazine, CRP, ESR, BATH index.**

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Ankylosing spondylitis is an inflammatory disorder of unknown cause that primarily affects the axial skeleton; peripheral joints and extra-articular structures may also be involved. The disease usually occurs in the second or third decade with male preponderance. However, its prevalence in the young working group of people with the considerable contribution to socio-economic condition of country is one of important reasons of studying the disease.

It is well known that spinal and hip ankylosis often makes the patient completely disabled. This disability renders a threat to the economic condition of not only the patient and his or her family but also to the society in general[1,2]. The only hope to prevent this situation is early diagnosis, management and rehabilitation. The rational for the use of sulfasalazine in AS is the common

association between inflammatory bowel disease and spondylo-arthropathies, as well as the description of inflammatory lesion in the ileum of spondylo-arthropathy patient[3].

Sulfasalazine (dose 2-3 g/day) has been used in AS since 1984. A meta-analysis showed sulfasalazine to be superior to placebo for three clinical variables (duration of morning stiffness, severity of morning stiffness, severity of pain) and one laboratory parameter (IgG level)[4].

Since that publication however the new evidence for the effectiveness of this drug for AS is less convincing, at least for patients with axial involvement only. Sulfasalazine proved to be more effective than placebo in spondylo-arthropathy patient (including AS)[5]. Sulfasalazine is effective in reducing synovitis in peripheral arthritis but had no result in axial involvement[6].

Material and Methods

The present study was conducted in the Department of Physical Medicine and Rehabilitation IPGME & R, Kolkata during the period from February 2008 to July 2009. The patient with Ankylosing spondylitis (fulfilling modified New York criteria 1984) attended PMR OPD, IPGMER and SSKM Hospital was included in this study with following exclusion criteria:

(1) Complication of AS like aortic incompetence, cardiac conduction defect, neurological involvement, renal amyloidosis

(2) Chronic hepatic disease and chronic renal disease

(3) Hypersensitivity to sulfasalazine.

Informed consent was obtained from all individuals and the study was carried out in accordance with the Institutional Human Clearance Committee. After randomised selection into two groups a detailed history was taken and clinical examination was done. The relevant clinical findings and history were recorded in the proforma. Routine blood examination like Hb %, TC, DC, ESR, CRP, and HLA B27 as well as radiological examination of SI joint, spine, peripheral joints were done. Disease activity and functional capacity were assessed by BATH index like BADAI, BASFI.

The management of patients was based on a regular approach to exercise, NSAIDs when necessary along with motivating the patients for active physical therapy and educating about the disease. Patients were encouraged to maintain a good posture, to avoid harmful activities and injuries. Indomethacin 75 mg sustained release capsule once daily was prescribed for all the patients as per individual‘s need along with antacids. Sulfasalazine was used in a 500 mg twice daily for 2 weeks followed by 1 g twice daily for next five and half months to group B patients. After initial visit all the patients were followed up at monthly interval and detail follow up results were recorded at 6 months.

Results

At the end of the study period a thorough statistical analysis by different tests like Fisher’s exact test, Mann-Whitney U test, Wilcoxon’s matched pairs signed rank test, McNemar’s chi - square test were done. Fifty per cent of the patient of this study were in there third decade with male preponderance (male: female = 7: 1). During this one and half years study the youngest and the oldest patients were aged 18 and 53 years respectively; 43.75% of patients were in middle income (Rs 3000-6000 / month) group. Labour (31.25%) was the predominant group followed by service holder (18.75%), student (25%), businessman (12.5%), household (12.5%). In this present study 93.75% of the patients had insidious onset with predominant (87.50%) axial skeletal involvement. ESR, determined in first visit were up to 30 in 18.75%, between 31-60 in 43.75 %, more than 60 in 37.50% of cases; 62.5% of cases were CRP positive and 68.75% patients were with grade 2 radiological sacro-ilitis. Sacro-iliac test was positive in 78.12% of study group.

Comparative analysis of numerical variables between groups 1 and 2 by Mann-Whitney U test, it is noted that in visit 2, improvement of ESR in group 2 has become statistically significant (p value 0.022) indicating the positive effect of sulfasalazine. Comparative analysis of categorical variables between group 1&2 Fisher’s exact test failed to show any improvement of CRP in either group (p value 0.273 in group1 and 0.724 in group 2). No change in sacro-iliitis grading noticed in either group (p value 0 .336 in group1 and 0.131 in group 2). Peripheral joint involvement has come down to 4 from 9 in group

1 while in group 2 it has come down to 2 from 7 without any statistical significance (McNemar's chi-square test p value 0.063 in both the groups). Comparative analysis of different parameters including chest expansion and BATH index showed that only ESR was improved in group 2 (Table 1).

Comparative analysis different variables from visit 1 (v1) to visit 2 (v2) in group 1 and group 2 by McNemar's Chi - square test failed to show any improvement of sacro-iliac stress test due to sulfasalazine. Similarly no statistically significant improvement was noted in radiological grading of sacro-illitis (p value 0.500 in group1 and 1.000 in group 2).

Improvement of CRP was much better in group 2 than group 1 but this improvement was not statistically significant (p value 1.000 in group1 and 0.063 in group 2) (Table 2).

Discussion

Three patients were dropped out from this study comprising 32 patients conducted over 18 months. Age of onset was most commonly in the 15-24 years with male preponderance (male to female ratio was 7:1)[7]. 10% develop symptoms before puberty.[8, 9]. In this study 87.5 % (n=28) patient's site of disease onset was in the axial skeleton and 24 of them presented with low back pain without radiation as the initial symptom. According to

Table 1 — *Comparison of numerical variables between Group 1 and 2 – Mann-Whitney U test*

Variable	Rank sum group 1	Rank sum group 2	U	Z	P value
Age	289.5	238.5	102.5	.961	.336
Chest v1	298.5	229.5	93.5	1.3	.1935
Chest v2	305.5	222.5	86.5	1.564	.1177
ESR V1	260.0	268.0	124.0	-0.150	0.880
ESR V2	324.5	203.5	67.5	2.28	0.0225
BASMI V1	289.5	238.5	102.5	0.96	0.336
BASMI V2	286.0	242.0	106.0	.829	0.407
BASFI V1	272.5	255.5	119.5	0.32	0.748
BASFI V2	257.5	270.5	121.5	-0.244	0.806
BASDAI V1	304.5	223.5	87.5	1.526	0.126
BASDAI V2	281.0	215.0	95.0	0.988	0.323

Comparisons of numerical variables between group 1&2 by Mann-Whitney U Test

Under this heading it is noted that in visit 2, p value in respect to ESR has become statistically significant ,the value being 0.022.So it indicates that sulfasalazine has added advantage in reducing ESR though none of the other parameters has shown statistically significant change

Table 2 — *Distribution of Cases according to CRP Positivity*

	Visit 1			Visit 2		
Group	Negative	Positive	Total	Negative	Positive	Total
Group 1	8	8	16	7	9	16
Group 2	4	12	16	9	7	16
	12	20	32	16	16	32

Fisher's exact test 2 tailed p value 0.273 Fisher's exact test 2 tailed p value 0.724

Above table shows that in group 1, 8 patients were CRP positive in first visit that became 9 in second visit whereas in group 2 of the 12 positive patients 7 remained positive in second visit

several evidences 15% of patient's first symptom is in one or more peripheral joint.[9] In this study 12.5% patients came with peripheral joint arthritis as the presenting symptom.

In this study the patients on sulfasalazine had shown clinical and functional improvement though all of them may not be statistically significant. On first visit 14 had ESR in the range of 31-60 mm, 12 had ESR more than 60 mm.On follow up it is being seen that there is statistically improvement in this parameter especially in the patients getting sulfasalazine. Comparison of value of ESR between group 1 and 2 by Mann-Whitney U test shows significant improvement (p value of 0.022). Change in value from visit 1 to visit 2 in group 2 receiving sulfasalazine by Wilcoxon's matched pairs signed rank test shows significant p value of .033. It is clearly seen that sulfasalazine has significant role in reduction of ESR. There are studies including one by Kirwan in 1993 and another by Clegg, *et al* in 1996[10] showing reduction of ESR with sulfasalazine in ankylosing spondylitis patients. CRP was positive in 20 patients that came down to 16 on follow up but the improvement pattern of CRP is not statistically significant.

Sacro-iliac test positivity came down to 15 from 25 patients. So there is improvement in this parameter but is not statistically significant. One interesting finding here is that, there is clinical improvement in the form of sacro-iliac stress test but it is not being supported radio logically.

According to various studies sulfasalazine is effective in reducing synovitis in peripheral arthritis of AS patients but had no result on axial involvement.[11] In our study also 5 patients out of 7 in group 2 on sulfasalazine improved without any statistical significance. Although BATH functional index (BASFI) was improved without any statistical significance, disease activity of BATH index (BASDAI) was unchanged.

Conclusion

Although sulfasalazine is well known to control disease activity, this study showed that it is only good to improve ESR not CRP. Interestingly it is not altering sacroiliac joint involvement as evidenced by no statistical improvement in sacro-iliac test and radiological grading of sacro-illitis. Widely accepted BATH index of disease activity (BASDI) and functional capacity (BASFI) were also not improved by sulfasalazine.[12,13]

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BOOK REVIEW / INFORMATION

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Original Paper

Management of clubfoot by Ponseti technique — our experience

Ningthoujam Jungindro Singh, Sanjay Keshkar**, Pampa De***, Ratnesh Kumar*****

Abstract

We report our experience of using the Ponseti method for the treatment of congenital idiopathic clubfoot. From August 2007 to July 2010 we treated 107 feet in 79 patients by this method with the mean follow-up time of 15 months (6 to 24). The standard protocol described by Ponseti was used except that, when necessary, percutaneous tenotomy of tendo-achillis were performed under general anaesthesia in the operation theatre and change of plaster fortnightly. The Pirani score was used for assessment. The objectives of the study were to access the results in terms of the number of casts applied, the need for tenotomy of tendo achillis and recurrence of the deformity. Tenotomy was required in 87 of the 107 feet. Ten feet failed to respond to the initial treatment regimen and required extensive soft-tissue release. Of the 97 feet which responded to initial casting, 35 (32.71%) had a recurrence, 19 of which were successfully treated by repeat casting and/or tenotomy and casting. The remaining 16 required extensive soft-tissue release and external fixator application. Poor compliance with the foot-abduction orthoses (Denis Browne splint) was thought to be the main cause of failure in these patients.

key words **: Clubfoot, Ponseti technique, pirani scoring, percutaneous tenotomy.**

Congenital idiopathic clubfoot is a common but complex deformity of foot in an otherwise normal child consisting of four components: cavus, forefoot adductus, heel varus and equinus[1-3]. Some authors include atrophy of calf muscle with decrease in foot size and tibial length as associated components[4]. Various degrees of medial tibial tortion may be associated with clubfoot[5] but one must remind that normally, children have approximately 5° of internal tibial tortion at birth, which progresses to 10-15° in the adult[6]. The goal of treatment is to reduce or eliminate the four deformities and the patient have a functional, pain-free, plantigrade foot, with good mobility and without calluses, and does not need to wear modified shoes[1-3,5].

The estimated birth prevalence is 1 per 1000 live birth with male to female ratio of 3:1 and 40% bilateral cases[7]. The causes of congenital idiopathic clubfoot is unknown. Various theories have been proposed including muscular, viral, genetic, anatomical, environmental factors and the effect of the position *in utero*[8]. It is still a debate whether pathology at the talus or soft tissues along the posteromedial aspect is the causative factor. One study shows that the earliest changes occurs at the cells and collagen fibres of the medial ankle ligaments[9] and another study shows that the muscle imbalance around the ankle

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Account of contributions

Dr Ningthoujam Jungindro Singh, the main author of this article took keen interest during the whole process of the study. The study was conducted during his tenure of DNB training at the National Institute for the Orthopaedically Handicapped, Kolkata. He was one of the interobserver of the study. The manuscript is solely written by him.

Dr Sanjay Keshkar, initiated the idea of the study. He gave the theoretical and practical knowledge of the study. He was also one of the interobserver and also done proof readings of the manuscript.

Dr Pampa De, was also involved in the study as an interobserver. She took part in the study while she was working as Junior Resident at NIOH, Kolkata.

Dr Ratnesh Kumar, as the head of the institute always motivated the study works and gave valuable advice during the study especially in orthotic designing and fitment. He also did proof reading of the manuscript.

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as the aetiological factor of the idiopathic club foot[4]. Chromosomal deletion [on chromosome 2 (2q31-33) (related to the CASP10 gene)] has been found associated with clubfoot in one of the study[10].

Assessments of the severity of the deformity include imaging like radiograph, ultrasound, and MRI. The latter two used to visualise the non-ossified parts of the skeleton. Radiographs of the infant foot are difficult to interpret and hence, clinical examination remains the optimum means of assessment (Ponseti and Smoley system, Harrold and Walker system, Catterall system and Diméglio *et al*)[11]. Pirani and Diméglio scoring systems are commonly used classification systems for clinical practice with both systems having very good interobserver reliability and reproducibility[8,12]. Podograms may also be taken for documentation[13].

It has become a general rule to start treatment as soon as possible after birth with the initial treatment being non-surgical[1,5]. Many methods have been described in the literature (Kite technique, Ponseti method, French method, Ponseti modification etc.)[5-8,14-16] which are mostly serial manipulation and casting. Ponseti method has become famous after the author reported successful correction in 85% - 90% cases without need for posteromedial release. The correction achieved has been reported as being long lasting with some patients followed up to their fourth or fifth decade.[1,17]

Material and Methods

In our study we have included 107 idiopathic club feet, 79 patients (28 bilateral), 56 males and 23 females of 15 days to 1 year age group using Ponseti method of management. The study was conducted from August 2007 to July 2010 with maximum follow-up of two years. Secondary causes of talipes equinovarus and clubfoot associated with other deformities were excluded from this study. The patient and examination data were recorded in a 'Clubfoot Proforma'. This database included a detailed birth history and family history. Examination findings included side involved, grading of severity using Pirani score, other skeletal examination and the neuromuscular assessment.

Comment: Inclusion criteria needs to be more specified. Upper age limit of inclusion is preferably 9 months; though 1 year also can be accepted.

The results were evaluated for correction of deformity, the number of casts required, the need for tenotomy of tendo-achillis, relapse of the deformity and surgery required. We use the protocol as described by Dr. Ignacio Vives Ponseti[5] with little modification that instead of the weekly change of plaster we did fortnightly and tenotomy of tendo-achillis [Fig.1], when required, was done under general anaesthesia in Operation Theatre under proper aseptic and antiseptic precaution which Ponseti does under local anaesthesia. Tenotomy was indicated when hindfoot score >1 and midfoot score <1in Pirani scoring. After the last cast, the feet were kept with the foot abduction orthosis (Denis Browne splint). The orthosis consists of an open toe high-top straight last leather shoes attached to a bar with adjustable plastic screw [Fig.2]. The parents were advised to let the child use the orthosis for full time basis (23 hrs a day) for three months and thereafter at night time up to 3-4 years. The orthosis was kept at 70° external rotation on both sides for bilateral cases or 30-40° of external rotation on the normal side in unilateral cases. The verbal report given by the parents at follow-up was used to assess the compliance of the use of the splint. Follow–ups were done every 3 - weekly after the splint is given for the first 2 months and every 12-16 weeks thereafter. The result was designated as good (<0.5), fair (0.5-2) and poor (>2) using Pirani scoring system.

Results

The mean age of the patients was 12 weeks (3 to 48). Of the 79 study populations *(patients)* 51(64.56%) presented within 3 months of birth, 17(21.52%) between 3 and 6 months and 11 (13.92%) between 6 months and one year of age. Eight patients (10.13%) had already received 2-3 manipulations and plastering at some other centre. At the commencement, the severity of the case was assessed with Pirani scoring system and found the mean score of 5 (*rang*e- 4 to 6). The mean cast applied was 7 (*range* - 5 to 9). *Ten* failed (9.34%) to respond to casting (rigid cases) even up to 5 casts and were treated

by posteromedial soft tissue release (PMSTR). *Eighty-seven* feet (81.31%) underwent percutaneous tenotomy of tendo-achillis under general anaesthesia.

Of the 107 feet 97 (90.65%) responded to initial casting. The average time taken from the first cast to the full correction was 14 weeks (*range* - 10 to 18). After the successful treatment recurrence of the deformity occurred in 35 feet (32.71%) of which 11 feet were treated with replastering alone [mean plaster applied was 3 *(range* - 2 to 4)]. *Eight* of the recurrent feet were treated with tenotomy and replastering and 10 with PMSTR. *Six* feet were treated with universal mini external fixator (UMEX) system application.

**Most of the parents/guardians complained of difficult in maintaining the protocol of using the foot abduction orthosis. Other problems commonly faced were breakage of the plaster cast and slippage of the cast more in the first 2-3 plastering. Complications like pressure sore over the talar head occurred in 4 feet and skin erosion occurred in 5 feet. The most commonly occurred complication was mild swelling of the feet.*

Fig 1 — Percutaneous Tenotomy

Discussion

Ponseti technique of serial manipulation and casting is being employed vastly in many of the CTEV treating

Fig 2 — Foot Abduction Orthosis (D-B Splint, 70° abduction on Right Side and 40° on Left Side)

centres. Many authors have published their experiences. Ponseti and Smoley[21] reported that by this method of manipulation surgery was avoided in 89% of cases. In Ponseti method of management[5,20] the first element of correction is the cavus deformity by positioning the forefoot in proper alignment with the hindfoot. Cavus, which is due to the pronation of the forefoot in relation to the hindfoot requires only elevating the first ray of the forefoot to achieve a normal longitudinal arch of the foot. The forefoot is supinated not too high or too flat so that the plantar surface of the foot reveals a normal appearing arch. For subsequent correction of adductus and varus, alignment of the forefoot with the hindfoot is necessary to give an effective abduction movement of the foot. Using the stabilised talar head as fulcrum the foot is abducted. Pronation or eversion of the foot and external rotation of the foot to correct adduction while calcaneus remains in varus are to be avoided. Evertion of the calcaneus to correct heel varus (Kite's error) is not possible unless the calcaneus is abducted (i.e., laterally rotated) under the talus. Kite[14] explained in his method of correction to abduct the forefoot against pressure at the calcaneocuboid joint which Ponseti described as Kite's error. It blocked the correction of hindfoot varus and internal rotation.

In our study we could avoid extensive open surgery in 81 feet (75.70%) which is slightly less than that of Ponseti and smoley [21] (89%), Changulani M *et al*[1] (81%) or Agrawal *et al*[7] (96.7%). The main factor of low satisfactory result/recurrence was the noncompliance of use of the foot abduction orthosis, same as with many other studies.[1,3,7,8,15,21] Dobbs *et al*[2] in their study predicted that the most strongly associated variable with an increase risk of recurrence is noncompliance of the orthosis followed by educational level of the parents.

We assess the result of satisfaction using Pirani scoring system and regarded satisfactory with the score (good + fair). Pirani scoring system[8,18,19] is based on six clinical signs of contracture. Each is scored according to the following: 0, no abnormality; 0.5, moderate abnormality; 1, severe abnormality. The six signs are separated into three related to the hindfoot (severity of the posterior crease, emptiness of the heel and rigidity of the equinus), and three related to the mid foot (curvature of the lateral border of the foot, severity of the medial crease and position of the lateral part of the head of the talus). Thus hindfoot score ranged between 0 and 3, mid foot score between 0 and 3 making a total score between 0 and 6.

Percutaneous tenotomy was performed in 87 feet (81.31%) and was not associated with any complication. However, Changulani *et al*[1] reported one case of neurovascular damage and Dobbs *et al*[3] while performing tenotomy in 200 clubfeet produce serious bleeding in 4 patients either due to injury to the peroneal artery or lesser saphenous vein. Complications like pressure sore, skin erosion and mild swelling occurred during plastering. One limitation of this study was the non-availability of any objective tool to measure the compliance. Verbal reports were used, which might have been overreported or underreported. *Small number of patients and short follow-up of two years may also limit to generalise the study result.*

To conclude Ponseti technique of gentle manipulation and groin to toe plaster cast along with percutaneous tendo-achilles tenotomy is an effective treatment for congenital idiopathic clubfoot and reduces the need for extensive corrective surgery. Compliance to the use of the brace is the major factor to prevent recurrence. A long-term follow-up will decide the result to equate as par Ponseti's result.

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Editorial

Wish you a hearty thanks and gratitude from the new Editorial Board.

As you know that the June 2011 issue of Indian Journal of Physical Medicine & Rehabilitation marks the change of guard as I took over the baton of Editor of this prestigious journal from my predecessor on April 2011. Henceforth the journal will be published quarterly (March, June, September and December). I am aware of the tremendous responsibility and expectation built up by the good work of my predecessors for the last twenty one years.

Only collectively we can keep up the quality of this journal and improve progressively by conducting more research and submitting more original articles. Most important is to ensure that published articles will be of the highest standard and can attract wide citations. The contributions to this journal have started increasing which itself is a positive sign. I am looking forward for the day when the Editorial Board shall be flooded with original quality articles and our job will be difficult to select the best one from them for the IJPMR. The Editorial Board will encourage relevant articles, including original articles, reviews, interesting case reports, of course ultimately quality not quantity matters. Our Journal will eventually turn adult and will take place in the world of Physiatry.

The journal contains original papers, review articles and case reports as regular features and besides this Medical Philately and Pictorial CME have been introduced. As we know that Post Graduate students are the asset of any academic associations, steps have been taken to enrich their knowledge by introducing PG Forums. We are sure that Book Review, Recent articles, Rehab Quiz and Rehab Challenges will become popular. Editorial Board expects constructive feedback from the readers for further development in the near future.

This newly formed Editorial Board is a blend of experience and young energetic members and we are hopeful that in a short time we can enrich the journal with newer sections.

Editorial Board requests the readers to write Letters to the Editor for ‘Correspondence section’ and answer the Rehab Quiz and Rehab Challenge. Name of those giving correct answers will be published in the subsequent issues. I request you to kindly send Pictorial CME and Medical Philately for the journal also.This is your journal where you are the readers, critics, advisors and contributors. The Editorial Board is the custodian of your asset.

As a Physiatrist we believe in ‘Add life to years, not years to life’ and as human being we also believe in the saying ‘A man is known by his work, not by his age’.

Prof. R. N. Haldar

Case Report

Inflammatory multifocal encephalopolyradiculopathy : a case report

N Romi Singh, Syrpailang Kharlukhi**, Kunjabasi Wangjam****

We report a case of inflammatory disorder involving brain, cranial nerve and peipheral nerves following an attack of postviral meningo-encephalitis. Few cases has been reported involving inflammatory disorders affecting extensive nervous system sites like brain, cranial nerves, spinal cord and peripheral nerves and such presentation is usually associated with features indicative of malignancy or granulamatous lesions[1-3]. Here, we report a case of quadriplegia following an attack of viral meningo-enchephalitis with mixed presentation of spastic upper motor neuron lesion (affecting the brain and cranial nerve) and lower motor neuron lesions involving the peripheral nerves on the extremities.

Case report

A 11-year-old boy presented to us on July 2010 with complaints of weakness all four limbs following an attack of fever and loss of consciousness of one week duration, a month ago. He was treated as a case of meningo-encephalitis in Paediatric ward and discharged after 3 weeks. On examination, higher mental function (HMF) was affected (irritable, orientation to time, place and person affected, follows verbal command coma scale: M3E3V2). Speech aphasia (motor), Cranial nerves: Occulomotor nerve affected on left side. Motor system: Tone decreased on upper limb and left lower limb; DTR ++ on right biceps, triceps, supinator, knee and ankle, reduced on left knee, biceps, triceps, supinator, but not illicitable on left ankle. Plantar reflex: flexor on right and non-responsive on left side with no ankle clonus. Sensory system appears intact (though difficult to test in view of aphasia and HMF status). Spasticity modified Ashworth scale grade I to II present on right upper and lower limbs.

Bladder voluntary voiding with incontinence at times. He was managed with the provisional diagnosis of postmeningo-encephalitis sequelae (quadriparesis) with exercises to maintain range of motion of the upper and lower limbs, stretching exercises, regular change of posture to avoid pressure sore over and above to improve nutritional status.

He was readmitted in January 2011 for further evaluation, upright standing and gait training. Muscle wasting on left calf and thigh was present. Muscle tone on right lower limb was increased while on left lower limb hypotonia was observed. Muscle power on right upper limb and lower limb was 4/5 except for Knee extensor 3/5; that of left upper limb was 4/5 while that of left lower limb was 2/5 .Muscle stretch reflex ++ on right upper and lower limb; (-) on left ankle. Right plantar reflex is Babinski positive while left showed Babinski negative. There was also associated ill sustained clonus on right ankle. Spasticity of grade II in hip adductor, hamstring and gastrosoleus on right side. Thomas test positive at 30° on right side. Right hip abduction range was 40/60° (when hip and knee are kept in flexed position) but hip abduction range was 30/40° when measured with hip and knee extension compared with left side. Hip external rotation was full and internal rotation 30/45°

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compared with left side. There was pelvic obliquity on physical examination with no limb length discrepancy. On radiological examination of pelvis (anteroposterior view), there was 33.3% migration index on right hip as compared to 17% on the left hip joint suggesting Ist degree of hip subluxation on right side[4]. Electrophysiological studies (6 months after attack) showed features of peripheral neuropathy changes on both upper and lower limbs peripheral nerves with more affection on left lower limb i.e lateral popliteal and posterior tibial nerves. In view of bizzaire neuological presentation, a search for viral antibodies for cytomegalovirus, human immunodeficiency virus, Ebstien –Barr virus were made with all serological reports showed negative. We put the patient on KAFO with ischial socket extension to compensate weak hip extensor on left side for upright standing and gait training inside parellel bar. Adductor tenotomy (bilateral), Soutter Yount's release, fractional lengthening of hamstring and posterior tibial neurectomy on right side were performed to manage spasticity and grade I hip subluxation on right side. The patient was ambulatory with left Knee Ankle Foot orthosis (KAFO) at present.

Discussion

Sandroni *et al*[1] reported a case of subacute paraparesis, diplopia and perioral paresthesia after an attack of viral illness with probable diagnosis of acute inflammatory demyelinating polyradiculopathy. The patient rapidly progressed to paraplegia with T10 sensory loss with asymmetric upper extrimity weakness along with facial weakness, bilateral deafness and visual impairement. Extensive diagnostic tests revealed no evidence of infective, neoplastic or paraneoplastic causes with special emphasis for vasculitis, paraneoplastic diseases, cytomegalovirus, human immunodeficiency virus, Ebstein-Barr virus, immunoglobin M, West Nile virus and other viral diseases. All viral serologies were negative. Electromyography and conduction studies showed absent or delayed F-waves with increase blink reflex R1 latency suggesting a polyradiculopathy. Cerebrospinal fluid examination showed mild elevation of protien but no pleocytosis. MRI showed marked enhancement of cauda equina, thoracolumbar nerve roots, multiple cranial nerves and leptomeninges. She was managed with intravenous immunoglobulin and high dose intravenous corticosteroid therapy and showed improvement of craniobulbar symptoms by 4 months and remarkable recovery of neurological deficits occurred. After one year her symptoms were localised to left foot weakness and paresthesia, mild difficulty in emptying bladder and minor visual symptoms.

The present case also presented with quadriplegia and coma following a febrile viral illness. He was managed as postencephalitis sequelae with weakness of all four limbs with involvement of superior rectus palsy (ptosis) on left side. On follow up, the upper motor spasticity was observed on right lower limb with spasticity on hip adductor, hamstring and gastrosoleus with ileo-psoas spasticity and lower motor weakness on left lower limb with quadiceps power grade 2/5. Hip subluxation was confirmed on right side on radiological examination following work up for pelvic obliquity with migration index on right hip 33%. Soft tisuue surgery as mentioned above along with tibial neurectomy was performed and patient is ambulatory with left KAFO to support lower motor weakness of quadriceps.

Several studies confirmed that the incidence of hip displacement in children with cerebral palsy is approximately 33% and is directly related to gross motor function classification system (GMFCS), but not related to the type of movement disorder.[5,6] Scrutton *et al*[7] also confirmed the high incidence of hip displacement in children with cerebral palsy. The authors have emphasised the need for regular clinical and radiological hip surveillance. Hip surgery in patients with cerebral palsy has been simply classified as preventative, reconstructive or salvage[8]. Preventative surgery refers to procedures pertaining to adductor releases which are designed to prevent progressive hip displacement in children who show early signs of hip displacement on hip radiographs. When preventative surgery fails or children present with very displaced or dislocated hips, reconstructive surgery may be employed. Turker *et al*[9] also reported adductor tenotomy to be effective in management of hip subluxation in spastic cerebral palsy in long term follow up.

Early intervention can be effective in management of hip dislocation and clinically, hip at risk for progressive subluxation are hips with flexion contracture of more than 20 degrees and abduction less than 30 degrees[10]. The three parameters considered for adductor tenotomy

for management of hip subluxation are: i) hip flexion contracture more than 20 degrees[10], ii) hip abduction range less than 30 degrees[10] and iii) (radiologically) hip migration index more than 25 degrees[4]. The above three parameters are for typical spastic cerebral palsy children. The present case reported herein is not a typical spastic cerebral palsy (as the timing for insult to brain occurred at the age of 10 years, but presented with an already subluxed hip on the right side due to adductor spasticity). Moreover, flexion deformity of hip on right side was 30 degrees (more than 20 degrees) and hip migration index on right side was 33% (more than 25 %) , which are significantly higher than the cut off values mentioned above. Due importance was given to these two factors while considering for abductor tenotomy on right side while accepting the fact that hip abduction range was more than 30 degrees on right side (i.e. 40 degrees).

Hence, the adductor tenotomy on right side was performed to prevent further progression of the already subluxed right hip. And, we are following up the case for any improvement or deterioration of the hip migration. In regards to the left adductor tenotomy, it was performed to release the adductor tightness / contracture secondary to positioning and lack of exercise compliance.

The present case with spastic subluxation of the right hip was propmtly managed with adductor tenotomy and is being followed up.

Conclusion

The evolution of extensive neurological involvement indicated a fulminant process affecting brain, cranial nerves and peripheral nerves, which was unlikely of an acute inflammatory demyelinating polyradiculopathy. The presentation of upper motor neuron and lower motor neuron features cannot be explained by single granulomatous or malignant process which are also most unlikely in regards to the age of the patient as in this case. The case has been highlighted in view of the extensive neurological affection of both upper and lower motor neuron paralysis including the cranial nerve affection. And also to highlight the importance of hip surveillance and timely management of hip at risk in spastic children.

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Original Paper

Minimally invasive technique for tendo-achillis lengthening (Dr Kothari's modification of White's technique)

Shashank Yashwant Kothari, Ajay Gupta***

Abstract

White's technique is an established procedure for the lengthening of tendo-achillis in cerebral palsy and polio patients, as described in White's technique. We are presenting a series of 20 cases in whom we used two small incisions only at the proximal and disital ends of tendo-achillis. The procedure becomes minimally invasive with the total skin incision extending for only two inches, minimising skin complications. All cases reported with a very good healing within 15 days and the lengthening achieved was as desired. There were no complications of wound healing.

key words **: Tendo-achillis lengthening, spastic diplegia, cerebral palsy surgery, White's technique.**

Tendo-achillis (TA) is a strong plantar flexor of the foot, therefore important for walking and running purposes. Correction of equinus contracture by tendo-achillis lengthening is essential for the proper biomechanics of the entire lower limb, both in standing and walking. Various techniques are available for TA lengthening. Z-plasty may be done in sagittal plane or coronal plane according to biomechanical or functional needs. In White's technique the tendon slides on itself and gets adjusted according to the level of spasticity.

We modified the procedure by giving two smaller incisions so as to minimise skin complications.

The objective of our study is to analyse the modification in White's technique with two small incisions (Dr Kothari's modification).

The study was carried out in Department of Rehabilitation, Safdarjang Hospital and Vardhaman Mahavir Medical College, New Delhi. This is a retrospective study of twenty cases of TA lengthening done with the Kothari's modification of White's technique with a follow-up of 6 months. Of these twenty cases, 17 were cerebral palsy with spastic diplegia and 3 were infantile hemilpegia.

In Kothari's modification of White's technique, two small posteromedial longitudinal skin incisions are given approximately 2.5 cm each at insertion and at musculotendinous junction of the triceps surae. Distally, 2/3rds of the tendon is divided anteriorly and medial 2/3rds of the tendon is divided proximally. The foot is dorsiflexed forcibly when it snaps and correction is achieved as the tendon slides on itself. Incision is closed in layers. Below knee plaster of Paris cast is applied with foot in neutral position. Removal of sutures and AFO measurement is done after 14 days and POP cast is

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Account of contributions

The first Author is a qualified orthopaedic surgeon and a rehabilitation expert and was the chief surgeon for this series.

The Second Author is a qualified rehabilitation surgeon who was first assistant in the surgical procedure and was responsible for the follow up rehabilitation programme. He has also prepared the final manuscript for publication.

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reapplied for 4 weeks. AFO is fitted after 6 weeks of plaster cast immobilisation.

Two incisions are given for approaching tendo-achillis proximally and distally (Fig 1) .

The results were very encouraging in our series with good healing in all patients. No infection occurred in any of the 20 patients. Pain scoring during first 24 hours of surgery was 2.5/10 (as per numeric pain rating scale). There was minimal requirement of postoperative analgesics.

White's technique[1] is used for correction of TA contracture based on the observation that TA tendon rotates 900 on its long axis and an intracrural sliding can be achieved with appropriate fractional cuts. Graham *et al*[2] showed the efficacy of this procedure in long term follow-up. Khare *et al*[3] were following a similar procedure but they did not follow the principle of intracrural rotation of the tendon fibres and were using sutures to fix the lengthening contrary to our procedure in which we allow the spastic muscle to adjust the length as explained later. Cheng and So[4] have tried to establish a procedure for percutaneous lengthening but that is a blind procedure and there is no control on the tenotomy.

The TA lengthening in White's technique is done using a single incision from the level of insertion to the level of musculotendinous junction. Two-incision modifications help preserve a strip of skin in between the two incisions helping preserve skin circulation. Procedure is cosmetically better with early postoperative recovery. The spastic muscle adjusts the sliding after recovery from anaesthesia.

We will also like to recommend this technique for polio patients as the desired results can be achieved by two small incisions with caution that forcible sliding should not lead to overcorrection.

We already appreciate the importance of Tendoachillis lengthening procedure in spastic cerebral palsy. We highlight the benefits of using the White's techinique and modified the same with our minimally invasive approach which has shown excellent results.

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Original Paper

Psychological comorbidity of chronic low back pain

Dilip Kr Khatua, Sayanti Ghosh**, Dipta Kanti Mukhopadhyay***, Nivedita Goswami****, Partha Pratim Pan*****, Asim Kumar Palit*******

Abstract

Chronic low back pain (CLBP) is a common complaint among patients attending Physical Medicine Department. Psychological factors like depression, anxiety and somatisation were found to be associated with CLBP.

One hundred patients with CLBP and their age, sex and economic condition matched controls were screened with a validated Bengali version of GHQ-28. Study subjects with GHQ score four or more were evaluated for psychiatric disorder with standardised diagnostic interview.

Among 100 cases, 99% scored four or more in GHQ-28 and 91% had some form of psychiatric disorders. Corresponding figures among controls were 35% and 22% respectively. Prevalence of psychiatric disorders was more among females both among cases and controls. Depression, somatisation disorder and generalised anxiety disorder were more prevalent among CLBP patients.

key words **: Chronic low back pain (clbp), general health questionnaire (GHQ) score, psychiatric disorders.**

Chronic low back pain (CLBP) is a common complaint amongst patients attending Physical Medicine Department and one of the most expensive conditions if both loss of productivity and health care cost are considered[1]. It is defined by pain that lasts longer than 12 weeks[2]. There has been a distinct sub-group of such patients in whom pain persists for long indefinite periods without apparent cause despite detailed assessment and investigations.

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Chronic low back pain has been viewed as a bio-psychosocial phenomenon in which all these factors dynamically interact with each other[3].

Psychological factors such as distress, depressed mood and somatisation were reported to be associated with low back pain. Their presence could predict the transition from acute to chronic low back pain as well. Their role in onset, severity, exacerbation and continuation of pain was also reported[4,5].

Review of literatures regarding psychopathogical comorbidity of chronic low back pain has documented increased prevalence of depression, anxiety, substance abuse, somatisation and personality disorders in cases of CLBP compared to the general population[6]. It was also noted that unrecognised and untreated psychopathology can significantly interfere with successful rehabilitation of back pain patients and also increase pain intensity and disability thus serving to perpetuate pain related dysfunction[6]. Depression and anxiety have been associated with magnification of medical symptoms whereas emotional distress has been connected to physical symptoms by means of autonomic arousal, vigilance and misinterpretation of somatic amplification. Less effective treatment outcome has also been shown to be related to

untreated depression.[6]

The present study thus planned to find out the association between chronic low back pain and psychiatric morbidity in a semi-urban setting of Bankura Sammilani Medical College, Bankura in the Bankura district of West Bengal.

Material and Methods

The study was conducted in the Physical Medicine and Psychiatry OPD of Bankura Sammilani Medical College and Hospital. The study population consisted of 100 consecutive patients attending the Physical Medicine outdoor with chronic low back pain lasting for more than 12 weeks. Age, sex and economic condition matched controls who were free from any chronic pain were recruited from the same OPD. Patients who could read and write Bengali fluently and willing to participate in the study were included.

After taking informed consent of the individual patient, his/her sociodemographic data was collected using a semi-structured questionnaire. Next they were administered the validated Bengali version[7] of GHQ-288 by a trained Psychiatrist/ Psychologist as a screener for mental disorder. The General Health Questionnaire (GHQ) is used to detect psychiatric disorder in the general population and within community or non-psychiatric clinical settings such as primary care or general medical outpatients. In the GHQ-28 the respondent is asked to compare his recent psychological state with his usual state. It is therefore sensitive to short-term psychiatric disorders but not to long-standing attributes of the respondent. All items have a 4- point scoring system using GHQ scoring (0-0-1-1). The GHQ-28 contains 28 items that, through factor analysis, have been divided into four sub-scales. The four sub-scales, each containing seven items, are as follows:

A – somatic symptoms (items 1-7)

B – anxiety/insomnia (items 8-14)

C – social dysfunction (items 15-21)

D – severe depression (items 22-28)

There are no thresholds for individual sub-scales. Individual sub-scales are used for providing individual diagnostic or profile information. For identifying caseness with GHQ-28, the total of the sub-scales is used. Total GHQ score is 28, cutoff threshold for identifying 'caseness' is 4.

If the patient scored more than 4 on the GHQ, a standardised diagnostic interview-SCID-I9 (Structured Clinical Interview for DSM-IV Axis-I disorders) using DSM-IV-TR10 diagnostic criteria was done for diagnosing the particular psychiatric disorder. The SCID is a semi-structured interview used for making the major DSM-IV diagnoses. The DSM (Diagnostic and Statistical Manual of Mental Disorders) is a manual published by the American Psychiatric Association to provide a standard criteria for the classification of all categories of mental disorders. Latest text revision is DSM-IV-TR (2000). Each psychiatric diagnosis is organised into five dimensions (axes) relating to different aspects of disorder or disability which allows clinicians and psychiatrists to make a comprehensive evaluation of the patients level of functioning. Results were compared with appropriately matched healthy controls.

The outcome variable were the GHQ caseness i.e. study subjects with GHQ scores more than 4 and specific psychiatric disorder-based on standardised diagnostic interview with DSM-IV –TR criteria.

Results

Final analysis was done with 100 cases and 100 controls. In both cases and controls, females (57.0%)

Table 1 — *Comparison of cases and controls according to background characteristics and GHQ score*

Variables	Cases	Controls	p value
Age (years)	36.1 ± 1.73	36.9 ± 1.57	0.188
Formal education (years)	9.6 ± 0.73	10.0 ± 0.67	0.108
Total income (Rs.)	6371.0 ± 891.1	6407.0 ± 767.4	0.10
Family size	4.9 ± 0.26	4.4 ± 1.9	0.002
GHQ score	14.4 ± 0.99	3.6 ± 0.80	0.032

outnumbered males (43.0%). There was no significant difference in age, formal education and total family income between cases and controls. However average family size was more in cases than controls (p=0.032). The average GHQ score of cases were significantly higher than that of controls. (Table 1)

Table 2 revealed that the prevalence of GHQ caseness and psychiatric morbidity was higher among females than male in both cases and controls.

The patients with CLBP were 2.8 times more likely to have GHQ caseness (unadjusted OR= 2.83; 95% CI 2.16-3.70) and 4.1 times more likely to have any psychiatric disorders (unadjusted OR= 4.14; 95% CI 2.85-6.01) compared to their controls. There were significant differences of average family size between cases and controls. After adjusting for family size using Mantel-Haenszel test, the corresponding adjusted OR for GHQ caseness and any psychiatric disorder were 3.32 (2.50-4.42) and 5.40 (3.22-7.59) respectively.

Table 3 showed that patients with CLBP were almost 32 times more likely to have somatoform disorders (95% CI 10.9-98.4), 95 times more likely to have depression (95% CI 21.4-494.0), 20 times more likely to have generalised anxiety disorder (95% CI 6.3-71.1) and 17 times more likely to have other psychiatric disorders (95% CI 1.1-542.1) than their controls.

Table 2 — Prevalence of GHQ caseness and psychiatric morbidity among cases and controls

Gender	No of cases (%)	
	GHQ caseness	Any psychiatric morbidity
Cases :		
Male (n=43)	42 (97.7)	38 (88.4)
Female (n=57)	57 (100.0)	53 (93.0)
Controls :		
Male (n=43)	11 (25.6)	8 (18.6)
Female (n=57)	24 (42.1)	14 (24.6)

Discussion

The results of the present study demonstrated significant association between psychological comorbidity and chronic low back pain. High prevalence of GHQ caseness and psychiatric morbidity among CLBP cases were consistent with findings of earlier studies using structured clinical interview[11,12].

More number of women compared to men reported screener positivity (GHQ) and psychiatric comorbidity, especially in a setting of chronic pain was reported in the present study. It was found to be consistent with an earlier study[13].

Psychological comorbidity in chronic low back pain varies among several Axis-I conditions like somatoform disorders, anxiety disorders, depression, substance abuse etc.[11,14] In the present study somatoform disorder was the most common psychiatric diagnosis followed by depression and anxiety disorder. Polatin *et al*[11] reported that in cases of chronic low back pain, somatoform disorder was the commonest psychiatric comorbidity with CLBP followed by depression, substance abuse and anxiety disorder[11].

Table 3 — Association of psychiatric disorders and chronic low back pain

Gender	No of cases (%)				
	No psychiatric diagnosis	Somatoform disorder	Depression	Generalised anxiety disorder	Other psychiatric disease
Cases :					
Male	5 (11.6)	17 (39.5)	12 (27.9)	7 (16.3)	2 (4.7)
Female	4 (7.0)	20 (35.1	21 (36.8)	12 (21.1)	0 (0.0)
Total	9 (9.0)	37 (37.0)	33 (33.0)	19 (19.0)	2 (2.0)
Controls :					
Male	35 (81.4)	3 (7.0)	1 (2.3)	3 (7.0)	1 (2.3)
Female	43 (75.4)	7 (12.3)	2 (3.5)	5 (8.8)	0 (0.0)
Total	78 (78.0)	10 (10.0)	3 (3.0)	8 (8.0)	1 (1.0)
Unadjusted OR	1.00	32.1	95.3	20.6	17.3

Present study revealed that more than one-third cases with CLBP had somatoform disorders. In three earlier studies, the corresponding figure ranged from 16-26%[8,14,15].

Next to somatoform disorders, depression has been reported in around 30% of the CLBP patients in this study. The corresponding figure reported by other researchers ranged from 18-30%.[6,16,17]. The association between depression and medically unexplained pain has been investigated extensively. Depression has been shown to be positively associated with somatisation and somatoform disorders, in which medically unexplained pain may arise[18,19,20,21]. Numerous hypotheses have arisen to explain the mechanisms by which depression might play a role in the aetiology of otherwise unexplained pain[18, 20].

Generalised anxiety disorder is the other comorbidity which has been shown to be significantly different among cases (19%) and controls (8%) in our study. Manchikanti *et al*[6] showed that generalised anxiety disorder was present in 40% cases compared to 14% controls. Whereas, other studies reported 15% and 20% of chronic pain patients had the same psychiatric disorder[12,22]. Asmundson *et al*[23] showed that 18% of patients with current musculoskeletal pain had comorbid anxiety disorder which was similar to the present study.

Other than the above psychopathological disorders the present study has evaluated certain other disorders namely substance abuse, psychosis NOS and eating disorder in a small percentage of cases as well as controls. Previous studies however has shown substance use disorders to be one of the most common diagnoses along with major depressive disorder, personality disorder and generalised anxiety disorder[12,13].

Conclusion

The present study documented the association between chronic low back pain and psychiatric morbidity in the study population. Common psychiatric disorders associated with CLBP in this study were somatoform disorder, depression and anxiety disorders. It would be prudent to evaluate most, if not all, patients suffering from CLBP for psychopathology as a part of integrated, multimodal pain management strategies.

Further research in order to explore the temporal relation of CLBP with psychiatric morbidity is needed to be undertaken.

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Case Report

Primary hyperparathyroidism with neuromuscular disease

B Ramachandran, Ganesh A Joshi* S Y Kothari*, M N Gowda**, S L Yadav**, U Singh***

Neuromuscular disease in Hyperparathyroidism is a known entity but it needs a very high index of suspicion to diagnose it. such a case is being presented here of a patient who attended our OPD for rehabilitation without a definitive diagnosis.

Anju 22 Female R/O Saharanpur, Uttarpradesh

Presented To Dept Of Rehabilitation, Safdarjung Hospital With the Following Complaints.

Genaralised bony pain — 3 Years
Inability to stand and walk — 2 Years
Deformities of both hips and knees — 6 Months

History of present illness : Patient was apparently all right 3 years ago. Generalised bony pains started in both the feet and later spread to all over the body. Pain was present throughout the day; it increased on movement, progressively worsening in severity, moderate temporary relief with analgesics, which the patient took on and off. Pain interfered with routine household work. Patient developed difficulty in walking due to pain and weakness. Initially patient managed indoor walking with the support of the walls, later the patient was only able to crawl inside the house and started using a wheelchair for outdoor mobility, the wheelchair being propelled by her attendant.

Patient has noticed deformities of both the hip and knee joints with restricted range of movements for the past 6 months, as she is unable to straighten the joints fully.

There has been a gradual decrease in ability to stand for more than 3 to 5 minutes. There is history of weakness of both upper and lower limbs more in the proximal muscles as also difficulty in prone lying.

There is no history of fever, cough, weight loss, pain abdomen, giddiness, skin lesions, joint swellings or trauma.

Past history : No history of diabetes mellitus, hypertension, bronchial asthma, or pulmonary tuberculosis. No similar illness in the past.

Patient had a full term normal delivery 15 months ago and breastfed her baby for 8 months.

Personal history : Vegetarian.

Family history : Nothing significant.

Treatment history : Patient used to take analgesics on and off for bony pains. Patient was on calcium supplement and vitamin D3 for suspected osteomalacia, pending electrophysiological studies for the diagnosis of her neuromuscular problem.

Medicosocial history : Married for 3 years, patient has a 15-month-old daughter, she had been doing tailoring 3 years ago but not doing any work now due to the illness.

Her husband is working in a welding shop and also sells vegetables part-time earning Rs1000 per month.

Activities of daily living :

Feeding – Independent

Toileting and bathing – Partially dependent

Mobility – Wheelchair propelled by attendant, totally dependent.

FIM score; see chart.

General Physical Examination :

Moderately built and poorly nourished,

BP and Pulse: 120/78 mmHg and 86 per minutes.

CVS and RS clinically NAD.

PA: no organomegaly and no tenderness.

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**AIIMS

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CNS:

(1) Higher mental functions – normal

(2) Cranial nerves: Normal, strabismus left eye seen.

Upper Limbs :

Bulk wasting proximal>distal

Tone Normal.

Power: Shoulder 4/5 bilaterally.

Elbow 4/5 bilaterally.

Wrist 3/5 bilaterally.

Handgrip N right side weak on left side.

Sensory normal.

DTRS normal.

Trunk power fair.

Lower limbs

Bulk wasting of thigh muscles bilaterally.

Tone normal.

Power Hip 3/5 bilaterally.

Knee 4/5 bilaterally.

Ankle 4/5 bilaterally.

Musculoskeletal system :

Generalised bony tenderness is present.

Both upper limbs ROM is full.

Both lower limbs: Hips painful range of movement in all directions.

Flexion contracture 15° bilaterally.

Knees genu varum seen.

15-20° flexion contracture seen bilaterally.

on investigations CBC and urine normal.

Serum Ca 11.6 mg%

Serum phosphates 1 mg%

Se alkaline phosphatase 3918 iu

X-Rays showed triradiate pelvis with loser's Zones. A provisional diagnosis of metabolic bone disease/Hyperparathyroidism/?Osteomalacia was made and the patient referred to AIIMS for further investigations.

Patient admitted to the Department of PMR, AIIMS on 2.9.2000.

On reevaluation and investigation further findings came forth.

Serum Ca 11,

Serum phosphates 2.2

Serum alkaline phosphatase 2367,

24-hour urinary calcium 440 mg

Serum parathormone 820 picograms/ml (n=11 to 84 picograms/ml.)

X-rays revealed in ulna, radius and scapula.and subperiosteal resorption on radial side of phalanges.

Thallium Technetium Subtraction scan showed mildly increased radiotracer uptake in the region of inferior pole of right lobe of thyroid suggestive of right lower parathyroid adenoma.

During this period of investigation oral calcium supplement was stopped,

Rehabilitative measures were started which included

ROM exercises to both upper and lower limbs

prone lying :

gentle passive stretching b/l hips and knees.

tilt table standing.

A diagnosis of parathyroid adenoma-hyperparathyroidism with neuromuscular disease was made and the patient was transferred to Department of Surgery.

The patient underwent right inferior parathyroid adenoma excision on 16.9.2000, which on biopsy showed features of parathyroid hyperplasia.

Postoperative period was uneventful. Patient attended the PMR Department for Tilt table standing.

Gait training on parallel bars.

ROM exercise for both upper and lower lilmbs.

At discharge :

Patient had no bony pain, she was able to stand independently and walk a few steps, and flexion deformities of hips and knees had reduced. She was given a home exercises programe for increasing endurance and increasing the walking time and distance.

Investigations at discharge:

Serum calcium -8.9 mg%, phosphate-1.5mg%, alkaline phosphatase- 406iu.

Follow-up at 3 months :

Patient was able to negotiate stairs, sit cross-legged squat and had become independent in ADL .She was able to take care of her baby at home walk 200-300 metres before feeling tired and was planning to take up some vocation.

Investigations :

Serum calcium-8.6mg%, phosphate-3.0mg%, alkaline phosphatase -216mg%.

Discussion

Neuromuscular disease in hyperparathyroidism is a known entity and is reversible if the cause is removed. The differential diagnoses form a list of orthopacdic and neurological disorders. These include rheumatoid arthritis and its differential diagnoses, metabolic bone disorders, motor neuron disease, myopathy and electrolyte imbalances.

The primary step in management is identification and treatment of the cause of the disability. The diagnosis of primary hyperparathyroidism with neuromuscular disease was made duly confirmed and the patient got operated for removal of the offending parathyroid gland. The strategies of ROM and attention to contractures were essential in the overall view but could not have tackled the disease process .The importance of search for the cause of the disability is highlighted here with the help of this paper so as to impart definitive management and for complete and comprehensive rehabilitation.

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INTERNATIONAL YEAR OF DISABLED PERSONS

Case Report

Pregabalin and amitriptyline for treatment of below level central neuropathic pain following spinal cord injury : a case report

Nitin Pandey, Navnendra Mathur***

Abstract

Central neuropathic pain is an unsolved mystery in terms of pathophysiology and treatment. Various pharmacological agents have been tried but without consistent effectiveness. This case report describes effective use of combination of pregabalin and amitriptyline in central neuropathic pain following spinal cord injury.

key words **: Pregabalin, amitriptyline, spinal cord.**

Prevalence of postspinal cord injury pain is variable but averages 65% with onethird of the cases rating their pain as severe[1]. Demirel *et al*[2] reported incidence of pain following spinal cord injury to be 61%. Rintala *et al*[3] stated that prevalence among community based sample in spinal cord injured males was 75%, and central pain was found in 10.1% of the cases. New *et al* reported neuropathic pain as the most common pain category during inpatient rehabilitation. Finnerup *et al*[4] found pain and dysaesthesia at or below the level in 67% spinal cord injury cases and mechanical and thermal dysaesthesia or allodynia in 48% of the cases suggesting neuropathic pain may be the major component of the total pain experience. It has been found that 23% of the cervical and high dorsal injury cases and 37% of lower dorsal and lumbosacral injury cases were willing to trade possible recovery for pain[5]. Various drugs have been tried but none of them provided consistent benefit. Carbamazepine with amitriptyline studied in a case report provided better relief to the patient than either of the drug alone[6].

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Case report

A 24-year-male met a road traffic accident on October 19, 2006, which resulted in wedge compression fracture of C5 vertebra and C4 complete quadriplegia. Patient was managed conservatively at Department of Physical Medicine and Rehabilitation, SMS Hospital, Jaipur. Since November 16, 2006 patient started feeling abnormal sensations in bilaterally below knee anteriorly and mid thigh to soles and back posteriorly. There was a hot burning sensation and feeling of pins and pricks. This sensation was spontaneous without any aggravating factor and was slightly relieved by tepid sponging and range of motion (ROM) exercises. The discomfort was intermittent and worse at night.

On November 26, 2006 pregabalin was prescribed 75 mg twice daily, at this point of time the pain score on visual analogue scale was 5.2. The drug was titrated over a period of about 12 weeks to a maximum of 600mg per day. At the maximum dose patient reported decrease in intensity of pain but discomfort persisted. Amitriptyline 25 mg twice daily was added to a dose of 75 mg twice

daily of pregabalin. After 12 weeks of treatment patient showed complete relief in symptoms like burning and pin- prick sensations, with improved sleep. At this stage amitriptyline was withdrawn and pregabalin 75 mg twice daily was continued. After 4 weeks patient again complained of abnormal sensations of hot burning type. On addition of amitriptyline 25 mg bid patient showed a complete relief after two weeks. On withdrawl of pregabalin symptoms reappeared after two weeks. No side-effects to the drugs were observed.

Discussion

Central neuropathic pain is a disabling condition physically as well as emotionally in patients with spinal cord injury. Different pharmacological strategies were experimented over the years but none of them is an established modality of treatment of central neuropathic pain following spinal cord injury.

Pharmacological agents like tricyclic antidepressants and anticonvulsants have been tried but none of the agent has strong hold in treatment protocol for central neuropathic pain following spinal cord injury. Amitriptyline exerts its effect in two ways-inhibiting uptake of serotonin and norepinephrine and degradation of endogenous opioids inhibition to make them more available to modulate pain messages and thus provides pain relief with antidepressant action.

Pregabalin has both anticonvulsant and anxiolytic effects. Its effect appears to be mediated by its binding to a2d subunit of voltage gated calcium channels which is thought to modulate calcium ions into hyperexcited neurons with a subsequent reduction in release of neurotransmitters such as glutamate and substance P. According to Siddall *et al*[7] pregabalin showed a significant reduction in pain scores and improved sleep in spinal cord injured patients in a placebo controlled trial.

Both amitriptyline and pregabalin afford some benefit when administered alone for central neuropathic pain in spinal cord injured patients but fails to provide a consistent and complete relief, which is obtained by the combination of these two drugs. As we know the pathophysiology is multifactorial, so this enemy is required to be challenged at all the neurochemical fronts. Pain perception is modulated by hyperexcitation of the spinothalamic neurons[8], which in turn can be due to excitation of sodium channels[9], calcium channels[10] or neuroinflammation[11]. So a multifaceted action provided by the combination through action of these two drugs on monoamine uptake, endogenous opioids and volatage gated calcium channels and substance P is the likely reason of better outcome in neuropathic pain associated with spinal cord injury. Thus an overall improvement in patient's status can be expected with this combination in terms of pain relief, anxiolytic and antidepressant effects and improved sleep. Further studies are needed to document the effect of this combination in a larger number of patients.

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REHAB QUIZ

1. Which is not seen in flexion synergy pattern of recovery of stroke patient?

A) Hip flexion
B) Hip abduction
C) Knee flexion
D) Ankle inversion

2. LSO Knight and chair back orthoses can be used in all except

A) Spondylolisthesis
B) Unstable fracture in upper lumbar area
C) Degenerative disc disease
D) Herniated disc disease

3. All are selected treatment methods of aphasia except

A) Language oriented treatment
B) Visual action therapy
C) Auditory action therapy
D) Oral feeding for aphasia

4. Level 3 patient's ability of Rancho Los Amigo levels of cognitive function is

A) Generalized response
B) Localized response
C) Confused: agitated
D) Confused: inappropriate

5. Colour of distal inches of visual impairment cane is

A) White
B) Red
C) Black
D) Blue

6. All are specific indications of hypouricaemic agents except

A) Persistent hyperuricaemia
B) Presence of secondary causes of hyperuricaemia
C) Clinical or radiological tophi
D) Uric acid crystal in synovial fluid

7. All the parameters of lung function test are reduced in obstructive lung disease except

A) Vital capacity
B) Forced expiratory volume
C) Maximal voluntary ventilation
D) Residual volume

8. All are standard treatment options of areflexic bladder except

A) Crede's manouvres
B) Clean intermittent catheterisation
C) Cholinergic agonist
D) Alpha adrenergic blocker

9. Which technique uses vestibular stimulation as a primary system utilised to affect a motor response in CP child?

A) Bobath technique
B) Rood technique
C) Ayre's technique
D) Vojta technique

10. Which bone is involved in Kienbock disease?

A) Scaphoid
B) Lunate
C) Navicular
D) Pisiform

Please send the answer to the editor with your name, address of communication.
The right responder will be acknowledged in next issue of journal.

REHAB CHALLENGES

A female patient aged 62 years who was suffering from bilateral knee pain for last few years was treated in different hospitals without relief of her pain and was finally referred to PMR OPD. On examination and with help of appropriate investigations she was found to have osteo-arthritis of both knees with reduction of medial joint space with bilateral varus deformity of knee and bilateral calcaneovarus with pes planus deformity of feet.

She was treated outside with orthotic management in the form of shoe modification with lateral heel-sole wedge and bilateral functional open patellar knee brace with mediolateral hinge joint along with NSAIDs and daicerin –glucosamine combination therapy and exercise regimen. But subsequently she was complaining of appearance of ankle and mid-foot pain though there was reduction of knee pain.

On subsequent visit it was seen that no improvement of deformities and a new onset foot pain was developed. This foot pain probably was caused by application of lateral heel-sole wedge to an already deformed foot (bilateral calcaneovarus with pes planus deformity). But the above treatment was helpful in reducing the osteo-arthritic knee pain.

Opinion from the reader regarding best possible orthotic management of this patient.

NB : Please send the opinion to the editor with your name, address of communication. The right responder will be acknowledged in next issue of journal.

Original Paper

Rickets in cerebral palsy children

S Bhatnagar, N Purohit**, N Laisram***, R K Preenja****, S Y Kothari******

Abstract

A cross sectional prospective study was conducted to find the presence of rickets in 60 children with cerebral palsy (CP). The diagnosis of rickets was made on the basis of clinical profile, biochemical studies and radiological studies. Statistical analysis was done using chi-square test.

Rickets was found in 15 % (n= 9) of cerebral palsy patients included in the study. Maximum cases of CP were between the age group of 1-2 years with male to female ratio of 1.3:1. Spastic quadriparesis (43.33%) cases dominated the study. Maximum cases of rickets, 33.33% (3 out of 9) were in the age group of 1-2 years. Male to female ratio in rickets cases was 1.25:1. Of all children having rickets, 44.5 % (4 out of 9) had spastic hemiparesis followed by 33.33% (3 out of 9) having spastic quadriparesis; 66.66% (6 out of 9) cases diagnosed with rickets were found in children who had achieved walking (of them 5 were of healed rickets and 1 case was of active rickets). Rest of the cases were found in children who had not achieved ambulation. Of 9 cases diagnosed as rickets, 2 were on anti-epileptic drugs.

Many studies suggest that insufficient energy and nutrient intake occurs in children with CP due to oral and neuromotor problems. According to our study, ricket is not as common as expected in children with CP (15.0%). Since prescription of high doses of vitamin D in absence of a deficiency can result in toxicity, every child with CP should be completely investigated for rickets before prescribing calcium and vitamin D supplements.

key words **: Cerebral palsy, rickets.**

Cerebral palsy (CP) describes a group of developmental disorders of movement and posture, causing activity limitation, that are attributed to non-progressive disturbances occurring in the developing foetal or infant brain. The motor disorders of CP are often accompanied by disturbances of sensation, cognition, communication, perception, and/or behaviour, and/or by a seizure disorder.[1] It is one of the leading causes of neuromotor disability in children.[3]

Many studies suggest that insufficient energy and nutrient intake is common in such children which may have adverse health effects and lead to deficiency disorders like rickets.[2]

Materials and Methods

Sixty consecutive children diagnosed as CP of either sex fulfilling the inclusion criteria and agreeing to participate in study were taken from those attending as outpatients in the department of Physical Medicine and Rehabilitation, VMMC and Safdarjang Hospital, New Delhi. The inclusion criteria were: (1) age group: 0 – 15 year. (2) sex: both males and females (3) willingness to participate.

They were investigated for presence of rickets on the

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basis of clinical profile, biochemical studies (serum calcium, phosphorus and alkaline phosphatase) (Table 1) and radiological studies (x- rays of bilateral wrist joints and knee joints). Radiological diagnosis was taken as definitive one; clinical and biochemical findings were used to corroborate the diagnosis.

Statistical analysis was done using chi-square test.

Results

Mean age of 60 patients was 3 years 9 months (range 9 months to 11 years). Maximum cases of CP were between the age group of 1-2 years (Table 2). There were 34 males (56.66%) and 26 females (43.33%) in the study (M:F ratio1.30:1) (Table 3).

Of the 60 patients diagnosed as CP, 26 (43.33%) were of spastic quadriparesis, 19 (31.66%) of spastic diplegia, 12 (20%) of spastic hemiparesis and 3 (5%) of mixed type.

Rickets was found in 9 (15%) out of 60 cerebral palsy patients included in the study. Maximum cases of rickets, 3 (33.33%) out of 9, were in the age group of 1-2 years. Of these 9 patients, 5 were males and 4 females (M:F 1.25:1). Four (44.5%) out of the nine patients had spastic hemiparesis, 3 (33.33%) had spastic quadriparesisand 2 (22.22%) had spastic diplegia.

Six out of 9 (66.66%) cases diagnosed with rickets were found in children who had achieved walking. Rest of the cases were found in children who had not achieved ambulation.

Out of 9 cases diagnosed as rickets, 2 were on anti-epileptic drugs but none of them had any difficulty in feeding.

Discussion

In our study, male to female ratio was found to be 1.3:1. Erkin *et al*[4] found the male to female ratio 1.45:1. In a similar study conducted by Pharaoh *et al*[5] the male to female ratio was 1.4:1. Studies have reported higher incidence of several developmental brain disabilities including mental retardation, autism, attention deficit, hyperactivity disorder and cerebral palsy as well as structural differences in brain of male children born prematurely.[6] Evidence is accumulating to suggest cellular pathways leading to neuronal death after an infant brain injury are different in males and females, and that this is influenced by sex chromosomes, not sex hormones as its effect may occur later in life.[6]

Table 1 — *Reference values of alkaline phosphatase (in SI units)*[3]

Age group (in years)	Male	Female
1 - 9	145 - 420	145 - 420
10 - 11	130 - 560	130 - 560
12 - 13	200 - 495	105 - 420
14 - 15	130 - 525	70 - 230
16 - 19	65 - 260	50 - 130

Out of 60 patients included in our study, spastic quadriparesis dominated the study constituting 43.33% followed by 31.66% of spastic diplegia, 20% of spastic hemiparesis and 5% of mixed type. In a retrospective study of 544 CP cases by Srivastava *et al*,[7] spastic quadriparesis comprised maximum number of cases (34.9%) followed by hemiplegia (28.7%) and diplegia (21.9%). Sharma *et al*[8] in their study of 480 cases found 54% diplegia, 15% quadriplegia, 11.8% double hemiplegia, 8.6% hemiplegia and 3.9% of mixed type.

Henderson[9] in his study observed reduced levels (<10 ng/ml) of calcidiol in 19% non-institutionalised children with CP which was significant but found to vary greatly with seasons. Low levels of calcitriol (<20 pg/ml) in 2% of their patients were comparable to normal paediatric subjects despite anticonvulsants and poor nutrition.

Maximum cases (3 out of 9) of rickets in our study

Table 2 — *Type of CP and rickets*

Type of CP	Rickets	No rickets	Total No of cases (%)
Spastic quadriparesis	03	23	26 (43.33%)
Spastic diplegia	02	17	19 (31.66%)
Spastic hemiparesis	04	08	12 (20%)
Mixed (spastic + dyskinetic)	0	03	03 (5%)

Table 3 — *Age distribution and rickets*

Age groups (in years)	Rickets (n=9)	No rickets (n=51)	Total (n=60)
0 - 1	0	8	8
1 - 2	3	10	13
2 - 3	2	6	8
3 - 4	1	4	5
4 - 5	1	4	5
5 - 6	0	7	7
6 - 7	0	4	4
7 - 8	0	2	2
8 - 9	1	0	1
9 - 10	0	2	2
10 - 11	1	3	4
11 - 12	0	1	1

Table 4 — *Sex distribution and rickets*

Racket/No racket	Male	Female
Rickets	05 (14.7%)	04 (15.4%)
No rickets	29 (85.3%)	22 (84.6%)
Total	34	26

Table 5 — *Milestones achieved and presence of rickets*

Milestone achieved	Rickets	No rickets	Total
No ambulation	03 (10.7%)	25 (89.3%)	28
Ambulation	06 (18.75%)	26 (81.25%)	32

were in 1-2 years age group. Out of 34 male patients, 5 (14.7%) had rickets while 4 females out of 26 (15.38%) had rickets. This difference was statistically insignificant.

Of 9 children with rickets, 6 had achieved walking (5 healed rickets and 1 active rickets).

Prevalence of rickets was 10.7% (3 out of 28) in non-ambulatory group and 18.75% (6 out of 32) in ambulatory group (Table 2), the difference being insignificant. Feeding difficulties were absent in our patients.

Two of these 9 patients were on anti-epileptic drugs. Morijiri and Sato[10] found that anticonvulsant drugs depressed serum 25 - OHD levels, but this was not the major factor in development of rickets. The vitamin D supplementation increased their serum

25- OHD level which could not be maintained unless they were exposed to sunlight.

Bereket[11,12] found varying prevalence of rickets (4-27 %) in different regions of India due to ethnic, socio –cultural and economic diversity. In our study, rickets was not found to be more common in CP children.

Conclusion

Rickets is not common in children with CP. Since prescription of high doses of vitamin D in absence of a deficiency can result in toxicity, every child with CP should be completely investigated for rickets before prescribing calcium and vitamin D supplements. However, insufficient energy and nutrient intake occurring in children with cerebral palsy due to oral and neuromotor problems has been reported to cause rickets.

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Review Article

Understanding robotics in rehabilitation

*Joy Singh Akoijam**

Robotics is penetrating into the realm of rehabilitation very slowly and is seen to be a "future technology." The main reason is its emergence as a viable alternative solution to ease functional difficulties of persons with disabilities. Current rehabilitation approaches like cost containment and shorter hospital stay have truly deviated from our earlier rehabilitation attempts to restore lost motor abilities in the paretic limb and teaching of compensatory techniques to improve functional skills. However, potential users as well as most rehabilitation experts do not know the actual capabilities of robots or are unaware of the existence of rehabilitation robots.

The term "robot", a Czech word for a slave was first used in Capek's "Rossums Universal Robots" in the 1920's[1]. Since then, there has been lots of progress made in robotics. Presently there are more than 750000 robots in industrial use. The Robot Institute of America defined a robot as "a re-programmable, multifunctional manipulator designed to move material, parts, tools or specialised devices through variable programmed motions for the performance of a variety of tasks". Rehabilitation robotics has been defined as a special branch of robotics which focuses on machines that can be used to help people recover from severe physical trauma or assist them in the activities of daily living.

The progress in surgical and medical robotics has been very dramatic with the invention of robots for high profile neurosurgery, cardiac surgery, orthopaedic surgery and endoscopic surgeries.

The first application of robotic technology to rehabilitation at CASE Institute of Technology was recorded in the early 1960's when the integrated circuit had just been invented[2]. The first International Conference on Rehabilitation Robotics was held in 1990 at AI DuPont Institute, Delaware. The use of robots in rehabilitation has been studied in major areas of assistive devices, mobility, prosthetics and orthotics, education, communication and robot mediated therapy. Therefore, rehabilitation robots fall into two main classes: robots designed to compensate for lost skills, including manipulation, self-feeding, or mobility; and those developed to remediate or retrain lost motor function after a disabling event such as stroke. Most of the recent studies are on uses of robotics in the management of stroke patients.

For convenience, the use of robotics in rehabilitation can be discussed under the following headings:

Assistive :

The potential uses of assistive robots in rehabilitation may be identified as follows[3];

(i) Eating and drinking
(ii) Personal hygiene – washing, shaving and applying make up
(iii) Work and leisure – computer use, equipment such as hi-fi and video systems, games
(iv) Mobility – opening doors and windows
(v) Reaching – up to shelves, down to the floor

Robots may be grouped into three based on the mobility of the device.

(i) Devices that operate in a fixed site (e.g, Handy I, DeVAR IV)
(ii) Devices that can be moved around from one location to another (e.g, Wessex robot, KARES II robot system)
(iii) Devices that are attached to a wheelchair (eg, Manus, Raptor)

A mobile assistive robot can be instructed to fetch an item or to place a book on the shelf. Different media (human machine interface device) can be used to

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communicate such command to the controlling computer. The chosen solution may be a combination of different media like natural language speech recognition, joystick, some form of scanned system etc and will also depend on the abilities of the user.

Mobility

Automatic guided vehicle (AGV), also referred to as smart wheelchair, is a power wheelchair whose mobility is controlled by the sensors which can detect objects in the environment. This technology has a great potential in addressing the mobility needs of the persons with wide range of disabilities. DX wheelchair bus system, omni-directional wheelchair and iBOT wheelchair are few examples of AGV.

iBOT wheelchair may be driven in a conventional way with the gyroscopic sensors and processors allowing the chair to balance on two wheels or to climb stairs giving the much needed stability and security. MELDOG developed a mobility aid which would function the same way as a guide dog for a blind person by guiding them around the streets, downloading a basic map and using landmark sensors[4]. However, with the increasing miniaturisation of electronics and GPS positioning, it is very possible to develop a body worn device to minimise the mobility difficulties for disabled persons.

Prosthetics and orthotics has been closely associated with rehabilitation robotics[1]. There have been lots of work done on prosthetic arm and hand with minimal use of robotic technology. Utah artificial arm and dextrous hand developed by Jacobsen, Leverhulme hand and Southampton hands are important milestones in the development of functional hand. Robotic prostheses or orthoses may be powered or non-powered. Two main issues which are critical in powered prosthetics and orthotics are miniaturisation and adequacy of the power supply. Both issues are critical for a hand prosthesis, where the complete system has to fit within the outline of a human hand and the energy requirement is far greater. Presently, compressed CO_2 has also been used as a power supply besides electrical batteries.

Among non-powered prosthesis, Blatchford's intelligent knee prosthesis uses sensors to regulate the swing of the knee depending on the speed of walking.

Movement Therapy :

Robots can be used to replicate the exercise regime used by the physiotherapist. The use of robotics to provide movement therapy for the rehabilitation of patients following stroke has been an area of major growth within the rehabilitation robotics.

The following are the three main areas where robots are used for stroke rehabilitation[5];

(i) Passive mobilisation to maintain range of motion at the joints

(ii) Active assisted where robot assist the movement initiated by the patient

(iii) Active resisted where robot resist the movement generated by the patient

MIME system[6] used either active or passive mode or a bilateral mode where patient attempts to move both the affected and unaffected limbs. A similar MIT-Manus system[7] is available as commercial product. The robot seems to be as effective as conventional therapy though faster and earlier improvement was noted in the robotic group. Beyond stroke, robot arms are used in the rehabilitation of joints following surgery[8].

Education :

Robots can be used in the education of persons with physical and learning difficulties. The Cambridge University Educational (CUED) robot[9] with a vision recognition system allowed the child to interact with their environment in various ways ranging from dropping a toy brick onto a drum, to painting or playing board games. AnthroTronix developed telerehabilitation tools to motivate and integrate therapy, learning and play.

Communications :

Many of the physically disabled persons encounter difficulty to read a book, magazine or newspaper. Assistive robot makes difficult task like page turning possible.

Dexter hand[10], a finger spelling hand designed for hearing and vision impairments enables to input text, for example at a keyboard which is then converted to finger spelling by Dexter to communicate with another person who uses finger spelling.

Conclusion :

Though integration of robotic technology into rehabilitation practice is presumed to be a possible "future

technology" to ease functional difficulties of persons with disabilities, its ultimate role is still controversial. However, it is believed that robotic systems provide some measurable benefits, but the magnitude of these benefits is still rather modest. Again, to holistically address limitations in the functions, activities and participation, the integration of novel technologies with conventional rehabilitation methods seems prudent.

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