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Original Article

Grading of Adductor Spasticity in Cerebral Palsy – A New Approach

Laisram Nonica[1], Goyal Vinay[2]

Abstract

Spastic cerebral palsy is the most common form of cerebral palsy. Spasticity in hip adductor causes discomfort, stiffness and difficulties in performing physical activities such as seating, transfers and walking. Grading of hip adductor spasticity is still a challenge in the field of rehabilitation. A simple method to assess hip adductor spasticity and use it as outcome measures of intervention is needed in general clinical practice.

We propose a visual method for grading hip adductor spasticity i.e grade 1= touch at ankle, grade 2 = crossing at ankle and grade 3 = crossing at knee in spastic cerebral palsy children. We followed 60 spastic cerebral palsy children over a period of three months on oral antispastic medication and found it very useful to assess response to drug. Intially hip adductor spasticity of grade 3 was observed in 10 %, grade 2- 8.33%, grade 1- 26.66% and 45% patients had no scissoring. After three months of drug therapy improvement was observed as grade 3 seen in 1 % , grade 2 - 7%, grade 1 - 23.33% and patients with no scissoring rose to 63.3%. These observations show that visual method for hip adductor spasticity is a simple and helpful method for grading response to therapeutic intervention.

Key words: **Cerebral palsy, spasticity, hip adductors.**

Introduction:

Hip adductor spasticity in cerebral palsy (CP) can lead to spastic hip dysplasia, hip subluxation and problems with perineal hygiene[1,2]. In management of hip adductor spasticity, measurement of spasticity is a difficult and unresolved problem, partly due to its complexity and the fact that there are many factors involved. Various assessment scales used are as follows[3]:

- Modified Ashworth scale
- Tardieu scale
- Adductor tone rating scale

Above mentioned scales for spasticity rating require expertise in handling of the child. The velocities needed to elicit spasticity are not fixed and inter-rater variability is possible[4]. During follow-up it may not be possible for the evaluating physician to use the same amount of force to elicit spasticity. This may increase the subjectivity of the grading.

Some scales are also time-consuming. We propose a visual method for grading hip adductor spasticity in spastic cerebral palsy children. Purpose of this study is to assess proposed grading response to oral antispastic medication and convenience with which it can be measured.

Author's affiliations:
[1] *MBBS, DCH, DPMR, DNB (PMR), Prof., Consultant and Head*
[2] *MBBS, DPMR, DNB (PMR), Senior Resident*
Dept. of Physical Medicine and Rehabilitation, VMMC and Safdarjang Hospital, New Delhi - 110029

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Correspondence:
Dr. Nonica Laisram MBBS, DCH, DPMR, DNB (PMR)
Prof., Consultant and Head, Dept. of Physical Medicine and Rehabilitation, VMMC and Safdarjang Hospital, New Delhi - 110029 E mail: drnonica@gmail.com

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Materials and Methods:

A prospective follow-up study was conducted in 60 spastic CP children of both sexes in the age group of 2-12 years who attended CP clinic in Department of PMR, VMMC and Safdarjang Hospital, New Delhi from May 2010 to December 2011. Baseline demographic and clinical data were recorded for each child including age, weight, spasticity distribution and GMFCS level. Baseline investigations including liver function test and kidney function test were recorded. Children were assessed for hip adductor spasticity by visual method.

Method of assessment:

Hold the child in vertical suspension and observe the position of the legs and scissoring pattern.

Grading is done as follow:

Participants: Sixty cerebral palsy with spastic diplegia children attending C.P. clinic in Department of Physical Medicine and Rehabilitation, Safdarjang Hospital, New Delhi, who fulfilled following criteria were eligible for the study. Children aged 2-12 years with Modified Ashworth's scale score of 1+ or higher in both legs were included. Children already on oral antispastic drugs, history of Botox injection in previous six months, contracture in lower limbs and orthopaedic procedure performed in lower limbs were excluded.

Treatment interventions: Patients were given Baclofen 2.5mg t.i.d in children <8 years and 5mg t.i.d. in children >8 years with weekly increment of 5 mg to a maximum of 40 mg/day in former and 60 mg/day in latter after taking informed written consent from their parents/guardians[5]. Follow-up was done at one and three months for grading of scissoring to assess hip adductor spasticity.

Statistical analysis: Demographic and clinical information of the subjects were maintained on the excel software. The analysis was done on MS excel as well as SPSS version 15. Prior to analysis all the entries were double checked for any error.

Results:

Demographic profile (n=60) (Table 1). Maximum children (41.66%) were in 2-4 years age group. Male preponderance with a sex ratio of 2:1 (male: female) was observed.

Grade of scissoring (n=60) (Table 2 & Figs 1-3). Pre-treatment 45% (27/60) of patients had no scissoring, 26.66% (16/60) were of grade 1, 18.33% (11/60) were of grade 2 and 10% (6/360) were of grade 3.

At end of one month, 51.66% (31/60) of patients had no scissoring, 15 (25%) were found to be grade 1, 11 patients (18.33%) had grade 2 and 3 patients (5%) was found in grade 3.

At the end of 3 months 38 patients (63.33%) were found to have no scissoring, 14 (23.33%) had grade 1 and 7 (11.66%) had grade 2 scissoring and 1 patient (1.6%) had grade 3.

Improvement in grade of scissoring at end of 1 and 3 months of therapy (n=60) (Table 3): At the end of 1 month out of 16 patients with grade 1, 4 had no scissoring. Out of 11 patients with grade 2 only 7 had similar grade

Fig 1– *Touching at Ankles*

Fig 2– *Crossing at Ankles*

Fig 3– *Crossing at Knees*

after one month, 3 out of 6 patients with grade 3 improved to grade 2 after one month.

At the end of 3 months of therapy, out of 16 patients with grade 1, 11 patients improved to no scissoring, 9 out of 11 patients with grade 2 improved to grade 1 and out of 6 patients with grade 3, 4 improved to grade 2 and 1 to grade 1.

Discussion:

Study population showed majority children in 2-4 years age group with a male preponderance with a sex ratio of 2:1 (M:F). Hip adductor spasticity is great hindrance in rehabilitation of spastic cerebral palsy children as it interferes in daily handling of child, perineal hygiene and achieving ambulation goal[1,2]. Current scales for spasticity require expertise and skill in handling of the child. The velocities needed to elicit spasticity in modified Ashworth's scale, Tardieu scale and adductor tone rating are not fixed and inter-rater variability is possible. During follow-up it may not be possible for the evaluating physician to use the same amount of force to elicit spasticity. This may increase the subjectivity of the grading. Some scales are also time-consuming. Baclofen is commonly used antispastic drug for managing spasticity. Evaluation of drug effects in patients suffering from muscle spasticity is difficult and must take into account many different factors. Assessment scales for grading of scissoring with minimum subjectivity factor has not been reported in literature so a useful criteria has been evolved in this study. After three months of baclofen therapy reduction in grade of scissoring was seen as intially 55% of patients had scissoring which was reduced to 36.66% after three months. Reduction achieved was seen both in grade of scissoring and number of patients with scissoring. There was steady and significant reduction in scissoring.

Results with baclofen are similar to Milla[6] who in a double blind cross over study of 20 children with spastic cerebral palsy observed that patients on baclofen performed significantly better than placebo in reduction of spasticity and in allowing both active and passive limb movements. Notable improvement was observed in scissoring. Sheinberg *et al*[7] in a double-blind, randomised cross-over pilot study of oral baclofen *versus* placebo on fifteen children with mean age 7. 4 years (SD = 2.7 years) and spastic quadriplegia (gross motor function classification system level IV or V) found that children scored significantly better on the goal attainment scale with baclofen compared with placebo.

Grading of adductor spasticity by visual approach provides a relatively easy and quick method of grading adductor spasticity and can be used to assess interventions to decrease spasticity including therapeutic response of oral antispastic drugs.

Conclusions:

Grading of adductor spasticity by visual approach is easy to perform, less time consuming, has less chances of

Table 1: *Age Distribution (n= 60)*

Age (years)	Total
2-4	25 (41.66%)
4-6	18 (30%)
6-12	17 (28.33%)
Total	60

Table 2: *Grade of Scissoring (n= 60) at Pre-treatment, One Month and Three Months*

Grade of scissoring	No scissoring	Grade 1	Grade 2	Grade 3	Total
Pre-treatment	27 (45%)	16 (26.66%)	11 (18.33%)	6 (10%)	60
At 1 month	31(51.66%)	15 (25%)	11 (18.33%)	3 (5%)	60
At 3 months	38 (63.33%)	14 (23.33%)	7 (11.66%)	1 (1.6%)	60

Grades of scissoring: *Grade 1 = Touch at ankle; Grade 2 = Crossing at ankle; Grade 3 = Crossing at knee*

Table 3: *Improvement in Grade of Scissoring at End of One and Three Months of Therapy*

Grade of scissoring	No of patients (Pre-treatment)	Grade of scissoring at end of 1 and 3 months of baclofen							
		No scissoring		Grade 1		Grade 2		Grade 3	
		At 1 mo	At 3 mo	At 1 mo	At 3 mo	At 1 mo	At 3 mo	At 1 mo	At 3 mo
Grade 1	16	4	11	12	5	0	0	0	0
Grade 2	11	0	0	4	9	7	2	0	0
Grade 3	6	0	0	0	1	3	4	3	1

Grades of scissoring: *Grade 1=Touch at ankle; Grade 2=Crossing at ankle; Grade 3=Crossing at knee; no=Months*

intra-and inter-observer variability. Also it requires less handling and disturbance to the child and can help in grading response to therapeutic interventions. It eliminates the elements of voluntary tightening commonly observed in handling which can interfere with spasticity assessment.

Hip adductor spasticity is common in cerebral palsy and baclofen can be used as effective antispastic agent. The present study shows that grading of hip adductor spasticity by visual approach is a simple, useful and quick method of assessing the problem and its management.

Limitation of study: This grading assessment can only be used for children who can be held in vertical suspension.

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Original Article

Assessment of Autonomic Dysfunction in Chronic Complete Spinal Cord Injury by Heart Rate Variability

Navin BP[1], Joshi Mrinal[2], Dube Amitava[3]

Abstract

Objectives: Non-invasive assessment of cardiac autonomic dysfunction in spinal cord injury (SCI) by means of heart rate variability analysis (HRV). Also, to assess the effect of postural change on neural outflow.

Setting: Rehabilitation research center, Sawai Man Singh Hospital, Jaipur.

Participants: 110 patients with SCI were screened, of whom, 12 patients aged between 20 and 30 years with chronic complete SCI and neurological level of T6 or above were included. An equal number of age and sex matched healthy individuals were the controls.

Interventions: Five minute ECG recording, first in supine position and then in sitting position was done.

Outcome measures: Frequency domain measures of heart rate variability.

Results: No significant differences were observed between both the groups in supine rest. On sitting, the absolute power of the low frequency (LF) and high frequency (HF) components were significantly less in the SCI patients than that in the controls. A significantly increased LF-to-HF ratio along with a higher mean heart rate (HR) was observed in the controls on postural change.

Conclusion: On change of posture, the controls showed a physiologically patterned response, which was not observed in the SCI patients. The loss of this homeostatic mechanism in the SCI subjects was observed, which may reflect a dysfunctional autonomic nervous system interplay in patients with complete SCI.

Key words: **Autonomic nervous system, autonomic dysreflexia, heart rate variability, spinal cord injury, sympathetic nervous system.**

Introduction:

Autonomic dysfunction causes life threatening disturbances in both the acute and chronic phases of spinal cord injury (SCI)[1]. Autonomic dysreflexia (AD) is a constellation of signs or symptoms in SCI above T5-T6 level in response to noxious or non-noxious stimuli below the level of injury[2]. It is caused by disconnection of spinal sympathetic centres from supraspinal control[3,4].

Author's affiliations:
[1] *MBBS, MD, Senior Registrar, Dept PMR*
[2] *MBBS, MD, DNB, MNAMS, Professor and Head, Dept PMR*
[3] *MBBS, MD, Professor and Head, Dept of Physiology*
Sawai Man Singh Medical College, Jaipur, India

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Correspondence:
Navin BP, Dept of Physical Medicine and Rehabilitation, SMS Medical College and attached Hospitals, Jaipur, Rajasthan, India. Pin - 302004. e-mail: dr.naveenbp@gmail.com

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Most tests of autonomic function as of this date have been developed for able bodied individuals and are not necessarily applicable to patients with SCI[5]. Autonomic tests have not been very well described in SCI patients[6]. Both in the acute and chronic stages of SCI, cardiovascular disorders are among the most common causes of death[7-9].

Heart rate variability (HRV) analysis, is an evaluation of the rhythmical beat to beat oscillations which provide a basis to appreciate the complex interplay between the neural outflow in sympathetic and parasympathetic systems[10,11]. The measures of heart rate variability may be used as reproducible indices of autonomic cardiovascular regulation in SCI[12].

Heart rate power spectra can be analysed in short term electrocardiogram (ECG) recordings[13]. The spectral analysis of heart rate variability is similar to the spectral analysis of visible light except that, the frequencies of interest in HRV are in a range of <1Hz[10]. Three main spectral components are observed in short term ECG recordings of 2 to 5 minutes: HF (high frequency),

LF (low frequency) and VLF (very low frequency) components[13]. The genesis and the constituent parameters of HRV have been an issue of contention and intrigue. Using pharmacological blockade, it has been observed that the vagal influences appear to be present in both the low frequency (LF) and high frequency (HF) components of HRV during supine and upright postures, while sympathetic activity contributes to the low frequency component of HRV only during upright posture[14]. The genesis of very low frequency (VLF) component is much less defined[15].

The objective of the study was to noninvasively assess cardiac autonomic dysfunction in patients with SCI by short term HRV analysis and to observe the effect of change in posture on the neural outflow.

Materials and Methods:

The present study was a hospital based comparative evaluation done in the Departments of Physical Medicine and Rehabilitation and Physiology at Sawai Man Singh Medical College, India, wherein patients in the indoor ward of the Department of Physical Medicine and Rehabilitation were recruited for the proposed research protocol. Ethical clearance was obtained from the institution's ethical clearance committee. Informed and written consent were taken prior to start of the study.

Patients with chronic (≥ 6 months post-injury) complete SCI, in the age range of 20 to 30 years with a neurological level of T6 or above were included in the study. As aging has an effect on parameters of HRV, a range of 10 years was chosen for age in the inclusion criteria. An equal number of age and sex matched healthy individuals acted as controls.

Patients with a traumatic brain injury, acute SCI (<6 months post-injury), non-traumatic SCI, incomplete SCI or those with systemic illness such as diabetes mellitus, renal failure, heart failure or cardiac arrhythmia were excluded. Patients with severe spasticity or pressure ulcers interfering with proper positioning were excluded. Patients were instructed to stop anticholinergics 12 hours prior to the study. Patients and controls were instructed to abstain from caffeinated drinks, tea, alcohol or smoking for at least 12 hours prior to the study. They did not perform physical exercise for at least 24 hours prior to the study and were asked not to take any solid food by mouth two hours prior to the study.

Neurological examination was done on the day of the study and ASIA impairment scale15 was used to evaluate the severity of neurological impairment. The participants were instructed to empty the bladder (if not on continuous bladder drainage by a suprapubic or transurethral catheter) then to relax, lie down quietly for about 20 minutes prior to the HRV testing, for stabilisation of the cardiovascular parameters. They were instructed to be awake throughout the period of study. Five minutes short term ECG based recordings with a sampling rate of 500Hz was done using HRV Soft_version1.1 (AIIMS and MICT, New Delhi) with an ambient room temperature maintained between 24°C and 25°C. The study was initially done in supine position followed by postural change to sitting position with both knees in flexion. The R-wave (QRS complex) fiducial point identification and manual editing was done. This was followed by offline analysis of the data in frequency domain. The data was expressed as mean±s.d.

Statistics: The statistical analyses were performed using "R" version 2.10.1[16] and RKWard[17]. Raw data was used for the analysis. Data was tested for normality using Kolmogorov and Smirnov distributions. Comparison between and within groups was performed using Wilcoxon rank-sum test with continuity correction. Unpaired t-test was used to compare the demographic variables between the patients and controls. The level of significance was set at $p<0.05$.

Results:

One hundred and ten patients with SCI were screened for fulfilling the inclusion and exclusion criteria. The present study comprised 12 male patients with a chronic complete SCI, whom eight patients were complete tetraplegics with a cervical SCI and four patients had complete paraplegia with thoracic SCI (Table 1).

There were no significant differences between age of the patients (mean 25.66 years, SD 2.6) and the controls (mean 25.08 years, SD 1.72). Although, we had assessed two female patients, we had to exclude them from the analysis for reasons that statistical comparisons could not be made due to the small sample size in this particular sex group. One male patient was excluded from the analysis due to the presence of ectopics in the ECG recording. Mean time since trauma to testing was 24.8±21.7 months.

A. Comparison between SCI patients and controls

Supine position: No significant differences could be observed between both the groups in frequency domain of HRV and mean heart rate (HR) in supine rest.

Sitting position: The absolute power of the low frequency (LF) and high frequency (HF) components were significantly less in the SCI patients (Figs 1 and 2) than

that in the controls (p=0.038 and 0.044, respectively). The mean heart rate (HR) was significantly higher in the SCI group than that observed in the control group (p=0.0001).

B. Effect of postural change in SCI patients

No significant differences could be appreciated in the frequency domain on change of posture from supine to sitting position in the SCI patients. The mean heart rate (HR) was significantly high in the sitting position (Fig 3) than in the supine position (p=0.004).

C. Effect of postural change in controls

A significantly increased LF-to-HF ratio was observed on sitting position (Fig 4) as compared to that in supine position (p=0.034).

A significant increase in power in the low frequency (LF) range expressed in normalised units (Fig 5) and a significant decrease in the power in the high frequency (HF) range expressed in normalised units (Fig 6) was observed (p=0.042). The mean heart rate (HR) was significantly high in the sitting position as compared to that in supine position (p=0.0038).

Discussion:

In 10 healthy subjects, using ganglion blockade it has been observed that the R-R variability under supine resting conditions with spontaneous breathing, at all measured frequencies is predominantly controlled by autonomic neural activity[18].

The present study observed no significant difference in resting heart rate in supine position between patients with complete SCI and that of controls. This finding is in agreement with the study by Gao *et al*[19] who observed a similar trend in their study on nine SCI individuals (lesion C4-T5). They demonstrated significantly low total body noradrenaline spillover with similar baroreceptor reflex sensitivity and haemodynamic profile compared to that observed in able-bodied controls at rest. Otsuka *et al*[20] noted that trained complete tetraplegic men had a lower heart rate at rest when compared with untrained

Table 1: *Characteristics of the SCI Patients*

Sl. No	Age (years)	Vertebral level	Neurological level	Autonomic dysreflexia (+ present; - absent)	Time since injury (months)
1	29	#C5	C5	+	60
2	24	#C5	C4	+	77
3	29	D/L C4-C5	C4	+	11
4	26	#C4-C6	C4	+	11
5	25	#D/LC4-C5	C5	+	22
6	21	#C7	C6	-	34
7	22	D/L C6-C7	C7	+	13
8	25	D/L C4-C5	C7	+	10
9	29	#T3, T10	T5	+	20
10	27	#T6	T5	-	16
11	25	#T2-T4	T5	+	12
12	26	#D/L T6-T7	T6	+	12

Table 2: *Values Expressed as Mean ± SD for Different Parameters of Heart Rate Variability in SCI Patients and the Controls during Rest and while Sitting*

Parameters	Supine patient	Supine control	Sitting patient	Sitting control
LFnu (normalised units)	46.47±21.29	50.61±9.51	62.87±22.28	58.98±16.83
HFnu (normalised units)	53.52±21.29	49.39±9.51	37.12±22.28	41.01±16.83
LF:HF	1.21±0.99	1.09±0.39	4.08±6.19	1.9±1.4
VLF power (msec²/Hz)	2097.8±4697	852.9±295	2990.4±5277	1189.24±1150.5
LF power (msec²/Hz)	689.02±926.13	677.53±294.7	478.91±353	791.27±404.1
HF power (msec²/Hz)	896.4±1135	762.99±654.94	312.73±31.74	569.86±347.56
Mean heart rate (HR in beats/minute)	75.16±11.43	67.33±9.17	91.16±7.29	72.33±8.6

tetraplegic men and controls. Moreover, no significant differences could be appreciated in the frequency domain parameters of HRV in supine position between the two groups in the present research work, which is in agreement with the previous studies of Otsuka *et al*[20] and Koh *et al*[21]. Otsuka *et al*[20] found no differences in the R-R interval power spectra among trained complete tetraplegic men, untrained complete tetraplegic men and that of the controls. However, in contrast to the findings of the present study, Guzzetti *et al*[22] observed significantly high power spectral density of HF component with absent or reduced LF component (expressed in normalised units) at rest in patients with complete quadriplegia than in the controls. In the present study, a LF component could be appreciated in patients with complete quadriplegia at rest. Claydon and Krassioukov[5] on the other hand observed a long R-R interval profile, increased HF power with a reduced LF:HF ratio in patients with cervical SCI implicating parasympathetic predominance in such patients.

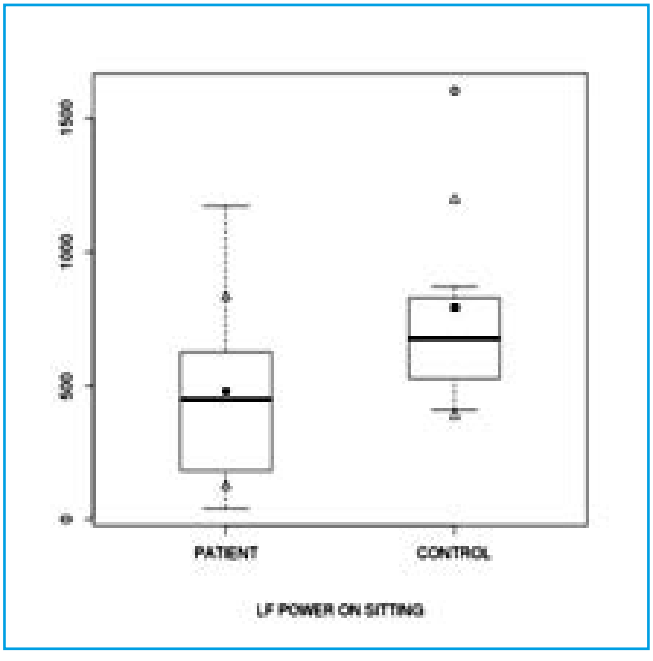

Fig 1

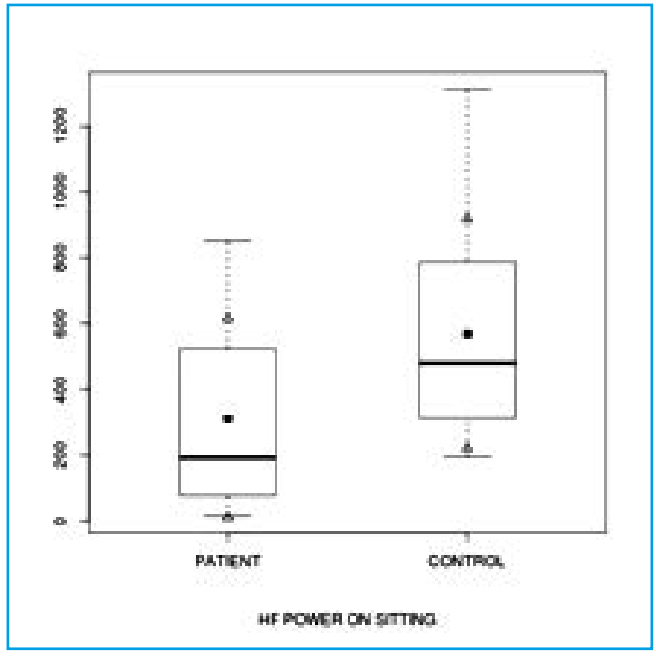

Fig 2

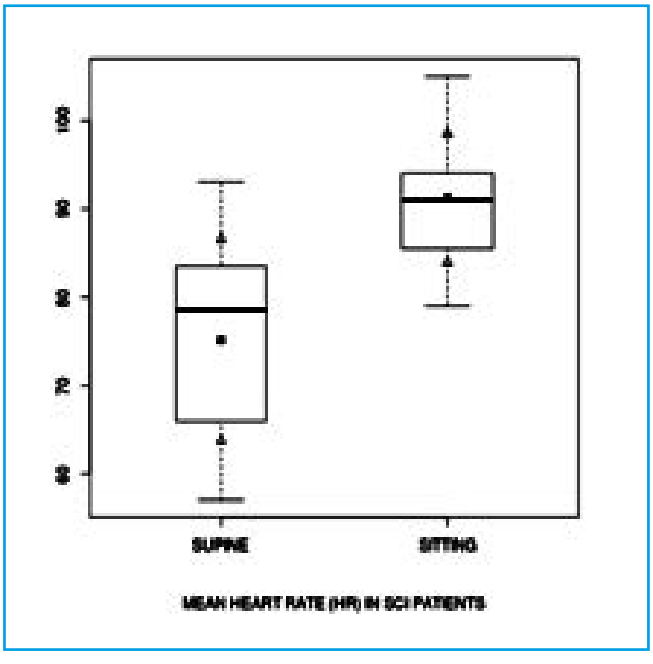

Fig 3

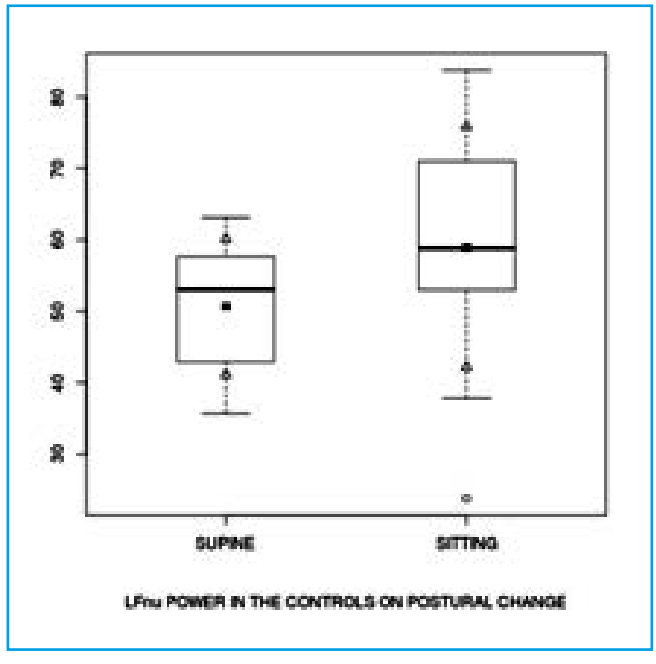

Fig 4

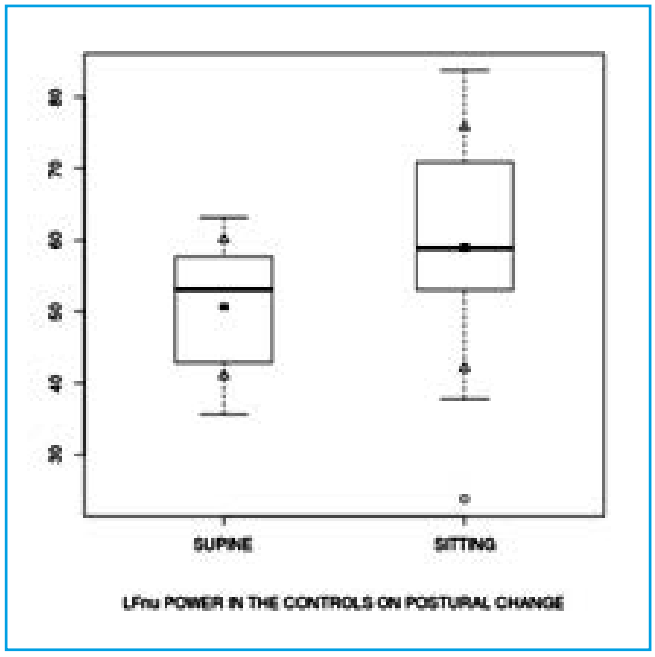

Fig 5

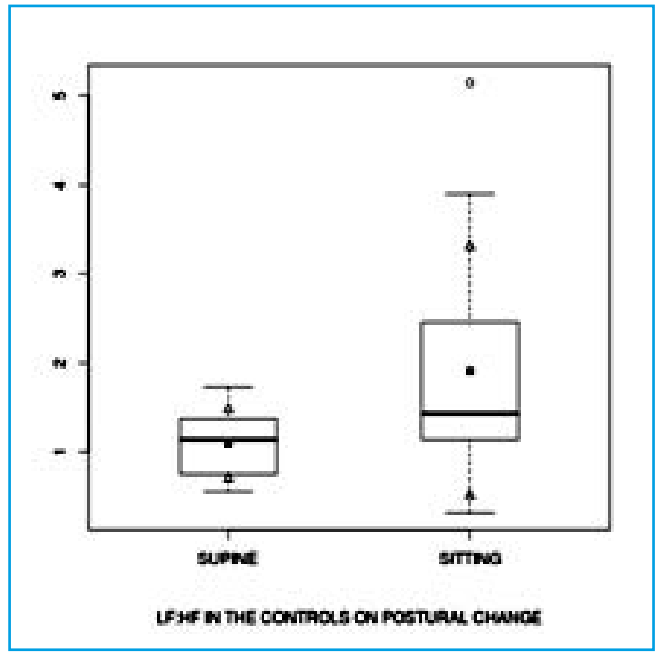

Fig 6

It is known that some of the autonomic disturbances are transient, whereas, others continue to persist for life[23]. A new balance is reached few months after SCI[23]. In the present study, all the SCI patients were in the chronic phase post-injury. A new balance in the stable chronic phase of SCI, probably offers an explanation to the comparable autonomic neural modulations as observed by the insignificant differences in the frequency domain measures of HRV at rest.

A significantly reduced absolute power of LF and HF components of the frequency domain of HRV along with a significantly high mean heart rate (HR) could be appreciated in complete SCI patients on sitting as compared to that observed in the control population. It has been suggested that an increase in heart rate (HR), in association with a decrease in the power of LF and HF in the upright position, reflects vagal withdrawal with little increase in sympathetic drive to the heart[5]. Wecht *et al*[24] have reported significantly low LF:HF ratio, low LF power and a reduced heart rate in tetraplegics as compared to that of controls. A blunted heart rate response to vagal withdrawal (as elicited through head-up tilt maneuver in the experimental design) in tetraplegics (5 of the 7 tetraplegics so studied had an incomplete lesion) was observed by Wecht *et al*[24] in their study and the plausible rationale attributed to the observed phenomenon put forward by them is a reduced sympathetic cardiac modulation, limited ability of vagal withdrawal to influence heart rate (HR) and/or altered SA node responsiveness to vagal withdrawal. However, in contrast to the above observations, an increase in heart rate with reduced absolute power of LF and HF components of HRV was observed in sitting position in patients with complete SCI in the present study, a finding that could be attributed to an intrinsic vagal withdrawal mechanism along with decreased sympathetic outflow.

Claydon and Krassioukov[5] observed that the R-R interval decreased significantly in SCI patients and controls in upright position. An higher heart rate in both trained and untrained persons with tetraplegia on change of position from supine to 60 degree was observed by Otsuka *et al*[20]. The observation in the present study, is similar to the above studies.

In the upright position, an increase in normalised LF power and LF:HF ratio along with a decrease in the normalised HF power has been observed in the controls but not in SCI patients[5]. Similar results have been noted in the present study, a finding that reflects increased sympathetic with subsequent reduced parasympathetic modulation of the heart due to baroreflex mechanism.

Conclusions:

On change of posture, the controls showed a physiologically patterned response, which was not observed in the SCI patients. The loss of this homeostatic mechanism in the SCI patients was observed. SCI patients with a complete lesion may exhibit a dysfunctional autonomic nervous system interplay, wherein, the sympathovagal interplay

seems to be working on a different neuronal work-space which seems to be characteristic of SCI patients, as compared to the control population in the present study. The small sample size is an important limitation of the present study. Further research to demonstrate the effects of rehabilitation interventions on the cardiovascular autonomic control in SCI patients is needed.

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Prof (Dr) Rathindranath Haldar

Department of Physical Medicine & Rehabilitation,

Institute of Post Graduate Medical Education & Research & SSKM Hospital,

244, AJC Bose Road, Kolkata - 700020.

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Editorial

World Health day 2015- Food Safety

"From Firm to Plate make Food Safe"

World Health Day celebrated on 7th. April, with WHO highlighting the challenges and opportunities associated with food safety under the slogan "From Firm to Plate make Food Safe."

Food production has been industrialized and its trade and distribution have been globalized. These changes introduce multiple new opportunities for food to become contaminated with harmful bacteria, viruses, parasites, or chemicals.

A local food safety problem can rapidly become an international emergency. Investigation of an outbreak of food borne disease is vastly more complicated when a single plate or package of food contains ingredients from multiple countries.

Unsafe food can contain harmful bacteria, viruses, parasites, or chemical substances, and cause more than 200 diseases – ranging from diarrhea to cancers. Examples of unsafe food include undercooked foods of animal origin, fruits and vegetables contaminated with faeces, and shellfish containing biotoxins.

Efforts to prevent such emergencies can be strengthened, however, through development of robust food safety systems that drive collective government and public action to safeguard against chemical or microbial contamination of food. Global and national level measures can be taken, including using international platforms, like the joint WHO-FAO International Food safety Authorities Network (INFOSCAN), to ensure effective and rapid communication during food safety emergencies.

At the consumer end of the food supply chain, the public plays important roles in promoting food safety, from practicing safe food hygiene and learning how to take care when cooking specific foods that may be hazardous (like raw chicken), to reading the labels when buying and preparing food. The WHO Five Keys to Safer food explain the basic principles that each individual should know all over the world to prevent food borne diseases.

It often takes a crisis for the collective consciousness on food safety to be stirred and any serious response to be taken. The impacts on public health and economies can be great. A sustainable response, therefore, is needed that ensures standards, checks and networks are in place to protect against food safety risks.

WHO is working to ensure access to adequate, safe, nutritious food for everyone. The Organization supports countries to prevent, detect and respond to food borne diseases outbreaks- in line with the Codex Alimentarius, a collection on International food standards, guidelines and codes of practice covering all the main foods.

Food safety is a cross-cutting issue and shared responsibility that requires participation of non-public health sectors (i.e. agriculture, trade, and commerce, environment, tourism) and support of major international and regional agencies and organizations active in the fields of food, emergency aid, and education.

– R. N. Haldar

Pictorial CME

LMN Type of 7th Cranial Nerve Palsy with Cutaneous Manifestations

Pramanik R

A fifty-year old long standing poorly controlled diabetic patient presented to PMR OPD for management of sudden onset right sided facial muscle weakness preceded by a febrile weakness for 3 days. On closed questionnaire he also complained about an earache along with burning sensation inside the oral cavity for last few days. When we examined the patient we saw a classical lower motor type of right sided 7th cranial nerve palsy with unilateral partial ptosis (Fig 1), deviation of angle of mouth (Fig 2), etc.

Then we noticed erythematous rashes along with few vesicles and pustules over his right pinna which was quite painful as per patient history (Fig 3) on inspection of oral cavity we also found a rash over his right side of palate which was macular and vesicular in nature (Fig 4). On further examination 5th and 6th cranial nerve was normal along with normal corneal reflex but Rinne's and Weber test elicits a sensorineural type of deafness in the same side which was confirmed later on by audiometry.

We did a CT brain to rule out any CP angle pathology which was normal (Fig 5) hence the diagnosis of Ramsay Hunt Syndrome was established. Patient was managed conservatively with acyclovir short course of prednisolone and methylcobalamin. Patient responded well to the treatment and cured completely within 2 weeks of time without any residual disability.

Fig 1– *Right Sided 7th Cranial Nerve Palsy with Ptosis*

Fig 2– *Deviation of Angle of Mouth*

Fig 3– *Rashes over the Pinna*

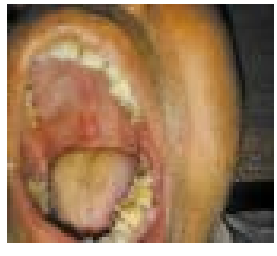

Fig 4– *Rash over Right Side of Palate*

Fig 5– *CT Scan Normal*

Author's affiliations:
MD, MRCP (UK), Associate Professor, PMR, IPGME & R, Kolkata

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PG Forum

REHAB CHALLENGES

A 6 months old female child presented to PMR OPD with dorsolumbar scoliosis (Fig 1) noticed by parents 2 months ago. The baby was otherwise asymptomatic apart from poor sitting balance with support. When we examined the baby we saw a hollowness (Fig 2) in left infra-axillary area. On further examination there was no objective neurological deficit and the curvature persisted on sitting.

On further imaging on x-ray showed a Cobbs angle of 35°. Chest x-ray (Fig 3) showed absent 7, 8, 9 ribs. Considering the congenital absence of ribs we suggested a CT abdomen and thorax (Fig 4) which confirmed the absent rib without absent of any lung segment and other organ anomaly.

We counselled the parents regarding further management and prognosis and put her on posture correction and exercise therapy. But the dilemma started with the prescription of spinal orthosis for the scoliosis.

Please opine regarding orthotic prescription of this young girl.

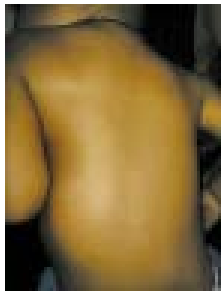
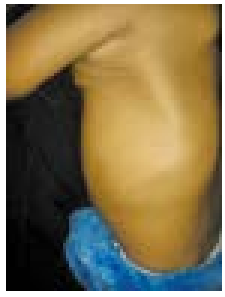


Fig 1



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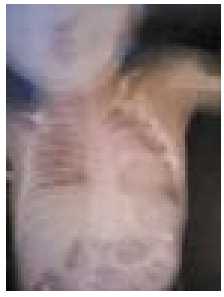

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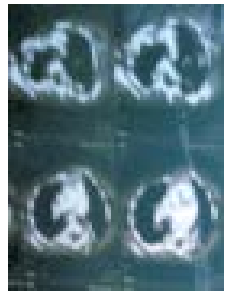

Fig 4

Medical Philately

2004 Indian Institute of Social Welfare and Business Management Kolkata

Country	India
Date	2004
Disability	Wheelchair
Meta	stamp, digital disability, outside centre, India, 2004, Access, Wheelchair, car, plane, tow truck
Number	sg2200
Theme	Access

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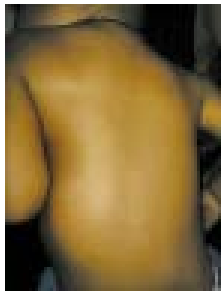

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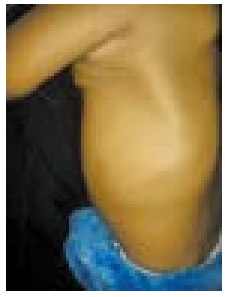
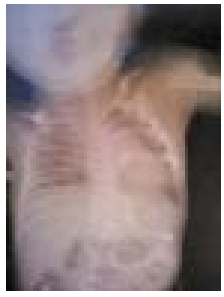


Fig 2



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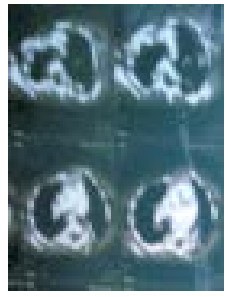

Fig 4

Medical Philately

2004 Indian Institute of Social Welfare and Business Management Kolkata

Country	India
Date	2004
Disability	Wheelchair
Meta	stamp, digital disability, outside centre, India, 2004, Access, Wheelchair, car, plane, tow truck
Number	sg2200
Theme	Access

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REHAB QUIZ

1. **After a meniscus repair, your patient should be non-weight bearing for**
   a) 7-10 days
   b) 2-3 months
   c) 4-6 weeks
   d) 1-2 days

2. **Posterior interosseous nerve syndrome stems from compression at**
   a) Arcade of Struthers
   b) Arcade of Frohse
   c) Lacertus fibrosis
   d) Ligament of Struthers

3. **If you can probe a foot ulcer and see bone, what is the likelihood of there being osteomyelitis?**
   a) 70%
   b) You cannot estimate from probing alone
   c) 100%
   d) 50%

4. **The most frequent site of tendon rupture in a rheumatoid arthritis patient occurs where?**
   a) Long head of the biceps
   b) Supraspinatus
   c) Lister tubercle
   d) ECRB tendon

5. **Which of the following orthoses is designed to manage spondylolisthesis in an active teenager?**
   a) LSO (Corset)
   b) LSO (Knight)
   c) Jewitt
   d) LSO (Anterior Overlap)

6. **Which of the following muscles would be MOST suitable for myoelectric control of the elbow joint by a shoulder disarticulation amputee?**
   a) Rhomboid major and sternocliedomastoid
   b) Rhomboid major and subscapularis
   c) Pectoralis major and trapezius
   d) Pectoralis major and corachobrachialis

7. **When the counter of the shoe fits too tightly on a SACH foot, which of the following problems can result?**
   a) Posterior lean of pylon
   b) Less compression of the heel
   c) Decrease in push-off resistance
   d) Decrease in external rotation of the foot

8. **A 23-year-old, wrist disarticulation amputee intends to return to work as a carpenter. Which terminal device will offer the largest range of tool handling capabilities?**
   a) Dorrance 555
   b) Dorrance 7
   c) Dorrance 88X
   d) Dorrance 12P

9. **A unilateral transradial prosthetic patient complains that the axilla loop of his harness is uncomfortable. The most common reason for this complaint is that the cross point is**
   a) Too close to the amputated side.
   b) Too close to the sound side.
   c) Superior to C7.
   d) Inferior to C7.

10. **A transtibial amputee has an anatomical A-P measurement of 95 mm (3-3/4). What is the correct A-P measurement of the positive model for a PTB hard socket?**
    a) 95 mm (3-3/4)
    b) 97 mm (3-7/8)
    c) 101 mm (4)
    d) 103 mm (4-1/8)

ANSWERS

Answer of December 2014

1c, 2b, 3c, 4c, 5d, 6b, 7d, 8a, 9d, 10a

Case Report

Tibialis Posterior Tendon Transfer in Post Injection Common Peroneal Nerve Palsy in a Paediatric Patient–A Case Report

Deepak Kumar[1], Pebam Sudesh[2]

Abstract

Post injection foot drop is due to common peroneal nerve damage at site of injection (gluteal region) in which dorsiflexor of foot EHL, EDL and tibialis anterior are weakend or paralysed. It can be managed by reconstructive surgery; tibialis posterior tendon transfer to EHL, EDL and 2nd metatarsal. Here objective is rehabilitation of post injection common peroneal nerve palsy foot drop in a paeditaric patient. Our method and outcome measure as first rehabilitation programme for foot drop paediatric patient (common peroneal nerve palsy) thereafter reconstructive surgery of tibialis posterior transfer to EHL, EDL and 2nd metatarsal. Last we re-educate them to tibialis posterior contraction for dorsiflexion of foot. Our result was patient was able to walk similar as normal, able to elevate her toes and foot. Patient was happy and confident with her functional foot. But patient was advised to avoid heavy work, sprinting, and active aggressive game (like foot ball). Our conclusion is patient gets benefited by this procedure.

Key words: **Foot drop, post injection nerve palsy, tibialis posterior tendon transfer.**

Introduction:

Foot drop is characterised by stepage gait, which can be detected before the patient enters the room[1]. Foot drop is due to significant weakness in dorsiflexor of toes and ankle power less than or equal to 2/5. Dorsiflexors of foot is EHL, EDL and TA. There is weakness in dorsiflexors i.e common peroneal nerve damage by any means. There is high stepage gait, high as climbing steps. This type of patient can be assessed or confirmed by simple manoeuvres, seating over couch with leg hanging down freely, foot hanged down without normal tone. Patient is unable to lift his foot, toes and also high stepping gait as in this case. But in some cases wasting of foot and leg muscle are also seen which was not significant in this case.

Author's affiliations:
[1] *MD, Associate professor**
[2] *MS, Associate professor***
*Department of Physical Medicine and Rehabilitation, Dr. R M L Hospital and PGIMER, New Delhi
**Postgraduate Institute of Medical Education and Research, Chandigarh, India

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Correspondence:
Dr Deepak Kumar, Assistant professor
Department of Physical Medicine and Rehabilitation, Dr. R M L Hospital and PGIMER, New Delhi
Tel No; +91-8287429549, Email: Deepdixit7200@gmail.com

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Case report:

A seven years old girl came to pediatric orthopaedic department OPD with complaint of high stepping gait and unable to elevate her foot. She was reffered to Physical Medicine and Rehabilitation department for evaluation and further management. She had taken some kind of antibiotic in gluteus intramuscular injection. Then after morning she was not able to elevate her toes and foot. Then she had taken various types of treatment but not benefited. Birth history, immunisation history, milestone, family history and IQ were within normal limit. Clinical examination showed power of foot was 2/5 of right toes and foot dorsiflexors, inversion of right foot was 5/5 but left side power was within normal limit. Muscle atrophy was not significant. There was no sensory involvement. Routine examination of blood was within normal limit. Other some specific test Ca, Po4, alkaline phosphatase, vitamin D3, LDH, CKMB and protein albumin, globulin were within normal limit. Electrodiagnostic changes showed permanent damage of common peroneal nerve and tibial nerve innervation was normal.

Method of Rehabilitation Programme and Reconstruction:

Foot drop stops splint AFO, flexion extension exercise of

toes and ankle to prevent contracture of TA. There was special training to isolated contraction of TP muscle for 2 weeks (Fig 1). Patient went to planed reconstructive surgery. Now briefly reconstruction steps position of patient as supine right lower limb laterally rotated for surgery. Isolation and division of distal insertion of TP (Fig 2) done then withdrawal of resected TP tendon in lower leg (Fig 3). Now one different thing was TA resected 5cm proximal to insertion (Fig 4). There was exposure of toe extensor EHL, EDL and also 2nd metatarsal of foot (Fig 5). Then splitting of TP tendon in two long slips and one of them was re-routed sutured to EHL, EDL. The 2nd different thing was in our case in which another tendon slips reinforce the 2nd metatarsal bone with attaching TA. In our case merged two different methods Ober[2] and Srinivasan *et al*[3] gives better result. Postoperatively lower limb was kept in elevated position for 72 hours, as usual by method Ober[2] after tendon transfer plaster of paris for 4 weeks (Fig 6). Then patient went to retraining rehabilitation programme for re-education of TP contraction for 4 weeks. 1st week patient contract tibialis posterior in gravity eliminate position, 2nd week contraction of TP against gravity with leg hanging down, 3rd week partial weight bearing allowed in parallel bar, last 4th week permitted full weight bearing in parallel bar practice "heel to toe" pattern. After 2 months patient was practising "heel to toe gait" 3 times daily and AFO provided for 6 months.

Fig 1- *Spenil Training to Isolated Conduction of TP Muscle*

Results:

Patient is able to walk similar as normal but under supervision "heel to toe" gait initially but later due to

Fig 2- *Isolation and Division of TP Muscle*

Fig 3- *Withdrawing of Respected TP Tendon*

Fig 4- *TA Resected 5cm Proximal to Insertion*

Fig 5- *Exposure of Toe Extensor*

Fig 6- *Tendon Transfer Plaster of Paris*

lack of practice intial contact of whole foot on stance phase. She can elevate her foot and ankle little amount. She is happy and confident with her functional foot. There is limitation not able to do heavy activities like sprinting, football, jumping, etc. There was no heel to toe gait but foot drop was corrected and high steping gait was removed.

Discussion:

There was a data of south East Asia more than 5 injections per capita/year. It has also been observed that nerve is within the reach of standard needle even when injection is given in the upper outer quadrant of the buttock[4]. Male > female, 50 % of these injections are administered by unregistered health care worker. Commonly involved nerves are common peroneal nerve, radial nerve and sciatic nerve. We should wait for spontaneous recovery by conservative protocol for 18 months to 24 months then proceed for reconstructive surgery.

The evolution of tendon transfer techniques for limb deformities was one of the remarkable advances in reconstructive surgery of the extremities and principles were developed over 200 years along with those for flexor tendon grafting[5]. Brand in CMC Vellore, India applied the principles of tendon transfers for surgical correction of leprosy deformities and perform the 1st claw hand correction. There are two forms of tendon transfer in lower limb TP which is either to transfer into tarsal bone[2] or splits into two slips for insertion to the tendon of EHL and EDL[3]. Before that conservative management is also important as below[6,7].

It is the usual practice after tendon transfer surgery to immobilise the part with plaster of Paris cast for 4-6 weeks[8]. Then patient undergoes 4 weeks training programme for early and best recovery.

Conclusions:

This type of procedure can give benefit to foot drop patient but there needs more work over same procedure.

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Original Article

Clinical and Imaging Evaluation of Efficacy of Visco-supplementation in Degenerative Osteo-arthritis Knee – A Prospective Interventional Study

Nandi Jaydeep[1], Kothari SY[2], Sharma Rajendra[3], Borah Diganta[4], Thukral BB[5], Gupta Rohini[6]

Abstract

In this study 30 patients with osteo-arthritis (OA) knee (total 55 knees) were given weekly injections of high molecular weight (HMW) hyaluronic acid (HA) for 3 weeks. The subjective parameter was Western Ontario and McMaster Universities Index of Osteoarthritis (WOMAC) score which improved from 97.67±21.4 at baseline to 61.03±24.8 at six months follow-up (p=0.0001). Also the mean range of motion (ROM) of the involved knees was 125.73± 10.8 degrees at baseline and it increased to 132.64±5.2 degrees after six months (p=0.0001) of injection treatment. The objective parameter of disease modification was MRI based semi-quantitive Whole-organ Magnetic Resonence Imaging Score (WORMS) score. The mean of total WORMS score in medial femorotibial joint (MFTJ) and patello-femoral joint (PFJ) improved from baseline (28.382±10.446; 22.64±5.969) to final follow up (27.46±10.32; 21.76± 6.182) which was quite significant (p=0.0321; p=0.0294) and implies a reduced rate of cartilage destruction after injection HA though there is no regrowth of cartilage as such.

Key words: **Osteo-arthritis knee, injection hyaluronic acid, viscosupplementation, magnetic resonance imaging, WORMS scoring.**

Introduction:

American College of Rheumatology has defined osteo-arthritis (OA) as a "heterogeneous group of conditions that lead to joint symptoms and signs which are associated with defective integrity of articular cartilage, in addition to related changes in the underlying bone at the joint margins" like, subchondral bone thickening (sclerosis), marginal osteochondral outgrowths (osteophytes) and joint deformity[1]. In the Version 2 estimates for the Global Burden of Disease 2000 study, published in the World Health Report 2002, OA is the 4th leading cause of years lived with disability (YLDs) at global level, accounting for 3.0% of total global YLDs. Worldwide estimates indicate that 9.6% of men and 18% of women ≥60 years have symptomatic OA with impaired mobility[2].

Conservative treatment options include pharmacotherapy (analgesics and NSAIDs), orthotic support (knee braces and shoe wedges), local heat and muscular strengthening exercises. There are few potentially structure modifying drugs which include oral diacerin, glucosamine sulphate and intra-articular hyaluronic acid[3]. The term hyaluronan (as an alternative to HA) as well as the concept of visco-supplementation was first proposed by Balazas. United States Food and Drug Administration (FDA) approved injection hyaluronic acid for OA knee in 1997[4]. Visco-supplementation with HA allows for restoration of the elastoviscous properties of synovial fluid along with possible anti-inflammatory and antinociceptive properties

Author's affiliations:
[1] *MD (PMR)**
[2] *MS (Ortho), DNB (PMR), Special D.G & Prof***
[3] *MD (PMR), Prof. & Director****
[4] *MD (PMR), DNB (PMR), Asst. Professor***
[5] *MD (Radio) FICR, Professor & Head***
[6] *MD (Radio), Assoc. Professor***
*NIOH, Bon-hooghly, Kolkata
** VMMC & Safdarjang Hospital, New Delhi
*** AIIPMR, Haji Ali, Mumbai

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Correspondence: Dr.Jaydeep Nandi, MD (PMR), Senior Resident, National Institute for the Orthopedically Handicapped, Bon-Hooghly, Kolkata 700090
Email: jaydeepnandidgp@gmail.com, Phone: 9051363619

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and stimulation of in-vivo HA synthesis. HA is generally obtained commercially either from an avian source or from bacterial fermentation, and is of two types (a) Low molecular weight hyaluronic acid : 0.5-2 million daltons (MDa) and (b) high molecular weight / cross linked hyaluronic acid : 5-7 million daltons (MDa)[5].

Multiple studies have been conducted to evaluate the efficacy of intra-articular hyaluronic acid injections[6]. The largest and most comprehensive meta-analysis on intra-articular HA is the 2006 Cochrane review[7] which reviewed 76 trials on HA.7 At 5 to 13 weeks post injection period, improvement of 11 to 54% for pain and 9 to 15% for function was observed. In general, comparable efficacy was noted against NSAIDs and greater long term benefits were noted in comparisons against intra-articular corticosteroids. Pooled result of RCT's within the period 2004-2009 shows that effect sizes for pain relief from intra-articular HA have diminished and there was greater heterogeneity of outcomes and more evidence of publication bias[8]. This led us to review the clinical effect of intra-articular HA in a prospective study design.

MRI is now recommended by OARSI for clinical trials that involve cartilage morphology assessment as outcome variable[9]. MRI based studies by Anandacoomarasamy *et al*[10] and Wang *et al*[11] concluded that HA have a beneficial effect on knee cartilage preservation. But, other similar studies by Prasad *et al*[12] and Kosuwon *et al*[13] reported mostly a lack of response. In the above context we undertook our trial utilising for the first time, a MRI based morphological, semi-quantitive, whole-organ score viz. WORMS[14] (whole organ magnetic resonance imaging score) as the cartilage assessment tool for any HA effectiveness trial.

Materials and Method:

After getting the ethical clearance of the Institutional Review Board of VMMC and Safdarjang Hospital, New Delhi we conducted our study in the period from October 2010 to March 2012. By nature it was a prospective interventional one group pretest post-test study. Patients of 30-70 years and either gender diagnosed with primary OA knee of tibiofemoral joint as defined by the ACR clinical criteria[15] with Kellgren-Lawrence[16] radiological grade I, II or III having pain >40mm on >2 items of WOMAC[17] scale for at least 15 days in the month prior to start of the study were enrolled into the study after informed consent. Patients having secondary OA, ipsilateral cruciate or collateral ligament injury within past 3 months, intra-articular treatment with any product or joint lavage and arthroscopic procedure within prior 6 months, any knee surgery within prior 12 months, any overlying skin infection or joint infection, any contra-indication for MRI e.g. metal implants, claustrophobia, any allergy to avian protein (e.g. egg, chicken, feather, etc), any history of crystalline arthropathy or inflammatory arthritis or venous or lymphatic stasis were excluded from the study. Also excluded are pregnant or nursing mothers, morbid obese ones (BMI>40), patients with unstable medical condition or who are on anticoagulation therapy or simply unwilling to participate.

Methodology of Intervention:

All patients enrolled within the study received 3 doses of HMW intra-articular HA injected in the affected knee/ knees (Fig 1) at an interval of 1week with each dose equivalent to 2.5 ml, after aspiration of any joint effusion (if necessary). Any adverse effect (if any) is noted during each injection procedure. We used injection containing purified sodium hyaluronate with molecular weight of 5.03×10^3 g/mol (i.e., 5.03 million daltons) obtained by biofermentation of bacterial source viz. *Streptococcus zooepidermicus*. Pain killers or other osteo-arthritis medications were not allowed throughout the study period of 6 months, except paracetamol (maximum dose of 2g/ day), when the pain was unbearable and the number of tablets/day were noted. All the patients were encouraged to lose weight, taught quadriceps strengthening exercises and general precautions in activities of daily living (ADL) as was deemed necessary. The exercise regimen was straight leg raising, keeping knee extended with each short arc extension having 6 seconds holding time. The exercise was repeated 30 times in each sitting and was done twice a day throughout the study period.

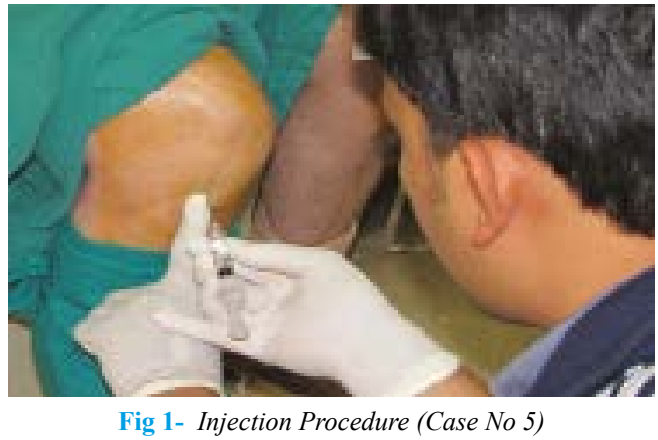

Fig 1- *Injection Procedure (Case No 5)*

Tools of Measurement:

Each patient was evaluated in terms of tools of measurement and the outcome was determined by the

assessment of both symptomatic and disease modifying efficacy parameters:

1. Symptomatic efficacy parameter was WOMAC[17] (Western Ontario and McMaster Universities Index of Osteo-arthritis) as well as ROM assessed on baseline (day 0), day 45, day 90 and day 180.
2. Disease modifying efficacy parameter was MRI grading of cartilage thickness (Fig 2) and other bony features as per WORMS[14] (whole-organ magnetic resonence imaging score) criteria assessed at baseline (day 0) and at the end of study period (180 days). MRI examination was carried out with 1.5 Tesla Philip Brilliance MRI machine in the radiology department using appropriate sequences viz. sagittal T1-weighted 3D spoiled gradient recalled echo (SPGR) with fat suppression (3D WATSc), sagittal T2-weighted TSE with frequency selective fat suppression (spectral pre-saturation with inversion recovery, SPIR), sagittal T1-weighted spin-echo (T1W-TSE), coronal T1-weighted spin-echo (T1W-TSE) and axial T1-weighted spin-echo (T1W-TSE). Five independent articular features viz. cartilage signal and morphology, sub-articular bone marrow abnormality, sub-articular cysts, sub-articular bone attrition and marginal osteophytes are scored in 3 different zones viz. medial femorotibial joint (MFTJ), lateral femorotibial joint (LFTJ) and patellofemoral joint (PFJ).

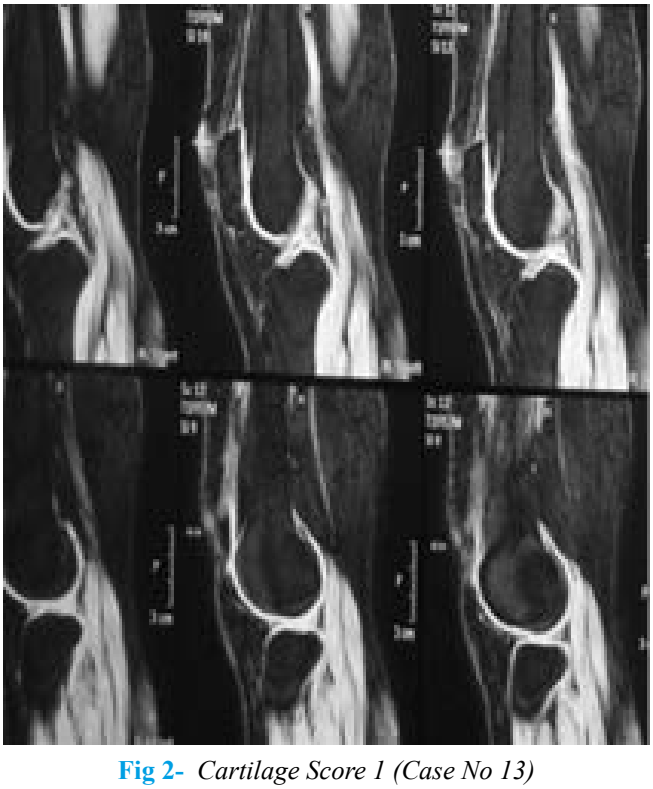

Fig 2- *Cartilage Score 1 (Case No 13)*

Statistical Analysis:

Data obtained of all patients who completed the stipulated follow-up were compiled and analysed using MS excel as well as SPSS version 17. Descriptive statistics including mean and standard deviation (SD) were found for each quantitative variable. Also frequency distributions were found for each of the qualitative variable. For quantitative data, the mean values across various follow-ups were compared using the Student's paired t test. The results were considered significant at 5% level of significance, i.e. $p<0.05$.

Results:

Forty-three consecutive patients with primary OA of the knee satisfying the inclusion and exclusion criteria participated in the study but only 30 completed the 6 months follow-up. Consequently, we had a total study population of 30. Among the total number of 30 patients, 25 had bilateral involvement and the rest 5 had unilateral involvement. Hence, the total knee count comes out to be 55.

The total WOMAC score is obtained on summation of the pain, stiffness and function subscores of each of the 30 patients. The values were 97.67±21.37, 52.87±15.69, 48.70±18.51 and 61.03±24.79 at baseline, second visit, third visit and final visit respectively (Table 1). Thus, there is significant decrease in WOMAC score on comparing baseline with any of the subsequent visits ($p=0.0001$). But, in between the third and fourth visit there is increase in WOMAC score with high statistical significance ($p=0.0001$) emphasizing that the effect of visco-supplementation is gradually plateauing at 3-6 months.

Table 1: *WOMAC Score at Baseline, 45 Days, 90 Days and 180 Days Follow-up*

Days	No of cases	Mean	Standard deviation
Baseline (WOMAC 1)	30	97.67	21.37
45 days (WOMAC 2)	30	52.87	15.69
90 days (WOMAC 3)	30	48.70	18.51
180 days (WOMAC 4)	30	61.03	24.79

The mean ROM was found to be 125.73±10.819, 131.73±735, 132±4.495 and 132.64±5.169 (Table 2). 5.169 degrees respectively at first, second, third and fourth visits. Thus, there was significant increase in ROM when baseline value was compared to the values at second, third and fourth visits ($p=0.0001$), although there was slight decrease in mean ROM in between the third and fourth visits which was not significant ($p=0.742$).

Table 2: *ROM at Baseline, 45 Days, 90 Days and 180 Days Follow-up*

ROM	No of cases	Mean in degrees	Standard deviation
Baseline	55	125.73	10.819
45 days	55	131.73	4.735
90 days	55	132.73	4.495
180 days	55	132.64	5.169

The mean of total WORMS score in MFTJ and PFJ improved from baseline (28.382±10.446; 22.64±5.969) to final follow-up (27.46±10.32; 21.76±6.182) which was quite significant (p=0.0321; p=0.0294). Although, there was decrease in WORMS score in LFTJ from first visit (24.73±7.509) to final visit (23.73±7.509), the difference was not statistically significant (p=0.1209) (Table 3).

Table 3: *Progression of WORMS Score at Baseline and Six Months Follow-up*

WORMS score	MFTJ	LFTJ	PFJ
Total WORMS score at first visit	28.382 ± 10.446	24.73 ± 7.509	22.64 ± 5.969
Total WORMS score at six month	27.46 ± 10.32	23.73 ± 7.509	21.76 ± 6.182
P value	0..0321	0.1209	0.0294

As a whole the injection procedure was quite safe and without any serious adverse effect. Three patients (10%) had transient pain on the first day of injection that required rescue analgesics and ice therapy. Significantly, the first two patients participating in this study were among them. This suggests an initial learning curve of the injection procedure.

Discussion:

Altman and moskowitz[18] in their study noted that HA treated patients had lower mean WOMAC pain, stiffness and physical function subscore at week 26 when compared with oral naproxen (though not statistically significant). Similarly, Phiphobmonkgol *et al*[19] also reported that all three efficacy parameters of WOMAC scale became significantly better than baseline after the second injection of HA (out of a 3 injection regime like our study), showed further improvement at 8 weeks and maintained thereafter up to 6 months of follow-up. Our findings closely corroborates that of literature with significant WOMAC score improvement occurring up to 3 months with the effect maintained till the end of study.

Literature predicts significant improvement in joint function as measured by flexion movement (ROM) of the knee[20,21]. The present study also reports similar improvement in knee flexion movement when the baseline value is compared with subsequent visits. Leardini *et al*[22] noted that the improvement occurred from the first injection itself; progressive improvement is seen up to 2 months and then it was maintained, although not to the same degree, for as long as 1 year. The present study also noted maximum benefit at about 45 days, after which the benefit is sustained for almost 6 months.

We found that the MRI based WORMS score at six months improves from baseline at patellofemoral and medial tibiofemoral joint while there is somewhat deterioration at lateral tibiofemoral joint, which implies a reduced rate of cartilage destruction after injection of hyaluronic acid though there is no regrowth of cartilage as such. This corroborates well with Anandacoomarasamy *et al*[10] who demonstrated that both the cartilage and the synovial membrane were improved when measured arthroscopically 6 months after the injection. Listrat *et al*[23] in their arthroscopy based study observed that cartilage destruction was significantly reduced in HA treated knee. MRI based studies done by Anandacoomarasamy *et al*[10] and Wang *et al*[11] reported preserved cartilage both on volumetric and cartilage defect scores after treatment with hyaluronic acid up to a six months follow-up.

Results of retrospective study of 336 patients treated by 5 Canadian rheumatologists over 2.5 years suggested that incidence of local side effects depends upon the injection technique: with a medial approach and a partially flexed knee, the incidence was 5.2%; with a straight medial approach, 2.4%; and with a straight or lateral approach (as practised by us), 1.5%[24]. The higher incidence of local pain in our study may be due to increased pain perception in the Indian population[25].

Conclusions:

From this study we can conclude that injection HA is a safe and effective treatment for OA knee. The beneficial effect of viscosupplementation reaches peak at 3 months and is maintained up to 6 months. There is no severe adverse effect of injection hyaluronic acid. Only a few case of local pain are reported which can be managed quite effectively. Regarding disease modification role viscosupplementation maintains the cartilage integrity at least in MFJ and PFJ of OA knee joint for a period of minimum 6 months. Though there is suggestion of structural improvement of cartilage on injection HA, further studies are needed with randomisation, control group and larger number of study population to settle the dispute.

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