



Indian Journal of Physical Medicine and Rehabilitation

IJPMR

Archives

IJPMR 2015 Jun 26 (2)

IJPMR 2015 June; Volume 26 (Number 2)

Contents

Editorial

Post graduate medical education. Joshi M.

Original Articles

i) Traumatic thoracolumbar spine injury - a demographic study. Kumar D, Gupta AK, Sharma VP, Srivastava RN, Ahmed J, Singh S.

ii) A comparative study on effectiveness of intra-articular injection of high molecular weight hyaluronate, steroid and high molecular weight hyaluronate plus steroid in osteo arthritis knee. Basak A, Pramanik R, Das P, Ballav A.

iii) A feasibility assessment of international classification of functioning, disability and health (ICF) tool for locomotion in rural community of northern India. Kumar D, Bansal P, Bhardwaj A.

iv) Concurrent and discriminative validity of the mini balance evaluation systems test (miniBESTest) in people with Parkinson's Disease. Margaret KY Mak.

v) Effect of caudal epidural steroid injection in chronic low back pain due to prolapse intervertebral disc. Chaudhary S, Sharma R, Kothari SY, Thukral BB.

Pictorial CME

Compatodactyly - a rare condition for hand rehabilitation. Pramanik R.

PG Forum

i) Book News

ii) Article News

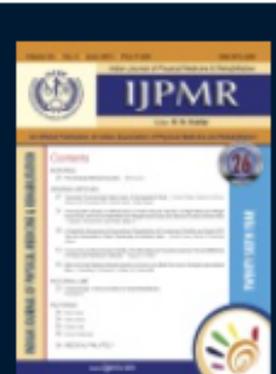
iii) Rehab Quiz

iv) Rehab Challenges

Medical Philately

IJPMR Editorial Board

IAPMR Executive Committee



Print Edition

Editor:

Prof RN Halder

ISSN

0973-2209

Disclaimer: The contents of this journal are not for the consumption of general population and are also not intended to help the public use this information to treat any medical condition or indulge in practice of rehabilitation of the persons with disability, themselves. The public in its own interest is advised to consult their doctor for advice on the management of their medical conditions.

Web administration and designing: Dr U Singh. First built: April 15, 2004. Last updated: October 20, 2015

IJPMR EDITORIAL BOARD 2015-2017

EDITOR : Dr. R. N. Haldar

- EMERITUS EDITORS : Dr. A.K. Agarwal, Dr. Suranjan Bhattacharji, Dr. U. Singh
ASSOCIATE EDITORS : Dr. Mrinal Joshi, Dr. Rajesh Pramanik
ASSISTANT EDITORS : Dr. Anupam Gupta, Dr. Anil Gaur, Dr. N. Romi Singh
MEMBERS : Dr. N. George Joseph, Dr. Asim Palit, Dr. S. Sunder,
Dr. Rajendra Sharma, Dr. Ajay Gupta, Dr. George Zacharia,
Dr. K. B. Wangjam, Dr. Avishek Srivastava, Dr. B. Ramachandran
EX-OFFICIO : Dr. S.L. Yadav, Dr. P. Thirunavukkarasu

ADVISORY BOARD (NATIONAL)

Dr. A.B. Tally	Dr. Abdul Gaffor	Dr. Ajit Kumar Varma	Dr. A.K. Joy Singh
Dr. A.K. Mukherjee	Dr. Ambar Ballav	Dr. B.D. Athani	Dr. B.G. Dharmanand
Dr. B.K. Choudhury	Dr. C. Ramesh	Dr. Feroz Khan	Dr. Ganesh Arun Joshi
Dr. George Tharion	Dr. K. Sunder S	Dr. M.K. Mathur	Dr. Nonica Laisram
Dr. Nirmal Surya	Dr. P.K. Mandal	Dr. R.K. Ghatak	Dr. R.K. Srivasthava
Dr. Sanjay Wadhwa	Dr. S. Hariharan	Dr. S.K. Jain	Dr. S.Y. Kothari
Dr. T.J. Renjanathan	Dr. T. Sreedhar	Dr. U.N. Nair	Dr. V. K. Sreekala

ADVISORY BOARD (INTERNATIONAL)

Dr. Joel A DeLisa (USA)	Dr. Walter Frontera (USA)
Dr. Andrew Haig (USA)	Dr. John L Melvin (USA)
Dr. Jianan Li (China)	Dr. John Olver (Australia)
Dr. Marta Imamura (Brazil)	Dr. Linamara Battistella (Brazil)
Dr. Germano Pestelli (Italy)	Dr. Alessandro Giuestini (Italy)
Dr. Gerold Stucki (Germany)	Dr. Gulseren Akyuz (Turkey)
Dr. Chang-il Park (Korea)	Dr. Tai Ryoan Han (Korea)
Dr. Apichana Kovindha (Thiland)	Dr. Areerat Supputtitada (Thiland)
Dr. Md. Taslimuddin (Bangladesh)	

INDIAN ASSOCIATION OF PHYSICAL MEDICINE & REHABILITATION EXECUTIVE COUNCIL 2015 - 2017

President	:	Dr. S.L. Yadav	
Vice President	:	Dr. M. M. Biswas	
Hony Secretary	:	Dr. P. Thirunavukkarasu	
Joint Secretary	:	Dr. A. K. Joy Singh	
Treasurer	:	Dr. Ajay Gupta	
Members	:	Dr. Anand Varma	Dr. Anil Gupta
		Dr. Jayanta Saha	Dr. I.N. Krishnaprasad
		Dr. Navita Purahit	Dr. Rajesh Pramanik
		Dr. C. Ramesh	Dr. Roy R. Chandran
Co-opted and Zonal Member	:	Dr. Dilip Kumar Khatua	
		Dr. V. Sri Kumar	
Editor IJPMR	:	Dr. R. N. Haldar	
Editor IAPMR Bulletin	:	Dr. S. Sunder	
Chairman Academic Committee	:	Dr. Feroz Khan	
Chairman Membership Committee	:	Dr. Rajendra Sharma	
Immediate Past President	:	Dr. Kunjabasi Wangjam	

.....
Frequency : Quarterly

ISSN0973-2209

Full text of the Journal and Guidelines to the contributors are available on website.

Subscription :

Annual subscription is ₹ 2000/- (India) and US \$ 200 (other countries). Kindly send your request for subscription to the editor along with DD/ Cheque at par in favour of "Indian Journal of PMR" payable at Kolkata. Overseas per hardcopy 50\$. Reprint per hard copy ₹ 200/-.

The journal is despatched in India by surface mail and abroad by sea mail.

Disclaimer :

Indian Association of Physical Medicine & Rehabilitation and Editors can not be held responsible for errors or any consequences arising from the use of information contained in this journal; the views and opinion expressed do not necessarily those of the IAPMR and Editorial Board, neither does the publication of advertisements constitute any endorsement by IAPMR and Editor.

Correspondence :

Editorial Office :

Prof (Dr) Rathindranath Haldar

Department of Physical Medicine & Rehabilitation,

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

244, AJC Bose Road, Kolkata - 700020.

E-mail:indianjournalofpmr@gmail.com Phone no : 00 91 9830152173

Visit us : www.ijpmr.com & www.iapmr.org/ijpmr

IJPMR EDITORIAL BOARD 2015-2017

EDITOR : Dr. R. N. Haldar

- EMERITUS EDITORS : Dr. A.K. Agarwal, Dr. Suranjan Bhattacharji, Dr. U. Singh
ASSOCIATE EDITORS : Dr. Mrinal Joshi, Dr. Rajesh Pramanik
ASSISTANT EDITORS : Dr. Anupam Gupta, Dr. Anil Gaur, Dr. N. Romi Singh
MEMBERS : Dr. N. George Joseph, Dr. Asim Palit, Dr. S. Sunder,
Dr. Rajendra Sharma, Dr. Ajay Gupta, Dr. George Zacharia,
Dr. K. B. Wangjam, Dr. Avishek Srivastava, Dr. B. Ramachandran
EX-OFFICIO : Dr. S.L. Yadav, Dr. P. Thirunavukkarasu

ADVISORY BOARD (NATIONAL)

Dr. A.B. Tally	Dr. Abdul Gaffor	Dr. Ajit Kumar Varma	Dr. A.K. Joy Singh
Dr. A.K. Mukherjee	Dr. Ambar Ballav	Dr. B.D. Athani	Dr. B.G. Dharmanand
Dr. B.K. Choudhury	Dr. C. Ramesh	Dr. Feroz Khan	Dr. Ganesh Arun Joshi
Dr. George Tharion	Dr. K. Sunder S	Dr. M.K. Mathur	Dr. Nonica Laisram
Dr. Nirmal Surya	Dr. P.K. Mandal	Dr. R.K. Ghatak	Dr. R.K. Srivasthava
Dr. Sanjay Wadhwa	Dr. S. Hariharan	Dr. S.K. Jain	Dr. S.Y. Kothari
Dr. T.J. Renjanathan	Dr. T. Sreedhar	Dr. U.N. Nair	Dr. V. K. Sreekala

ADVISORY BOARD (INTERNATIONAL)

Dr. Joel A DeLisa (USA)	Dr. Walter Frontera (USA)
Dr. Andrew Haig (USA)	Dr. John L Melvin (USA)
Dr. Jianan Li (China)	Dr. John Olver (Australia)
Dr. Marta Imamura (Brazil)	Dr. Linamara Battistella (Brazil)
Dr. Germano Pestelli (Italy)	Dr. Alessandro Giuestini (Italy)
Dr. Gerold Stucki (Germany)	Dr. Gulseren Akyuz (Turkey)
Dr. Chang-il Park (Korea)	Dr. Tai Ryoong Han (Korea)
Dr. Apichana Kovindha (Thiland)	Dr. Areerat Supputtitada (Thiland)
Dr. Md. Taslimuddin (Bangladesh)	

INDIAN ASSOCIATION OF PHYSICAL MEDICINE & REHABILITATION EXECUTIVE COUNCIL 2015 - 2017

President	:	Dr. S.L. Yadav	
Vice President	:	Dr. M. M. Biswas	
Hony Secretary	:	Dr. P. Thirunavukkarasu	
Joint Secretary	:	Dr. A. K. Joy Singh	
Treasurer	:	Dr. Ajay Gupta	
Members	:	Dr. Anand Varma	Dr. Anil Gupta
		Dr. Jayanta Saha	Dr. I.N. Krishnaprasad
		Dr. Navita Purahit	Dr. Rajesh Pramanik
		Dr. C. Ramesh	Dr. Roy R. Chandran
Co-opted and Zonal Member	:	Dr. Dilip Kumar Khatua	
		Dr. V. Sri Kumar	
Editor IJPMR	:	Dr. R. N. Haldar	
Editor IAPMR Bulletin	:	Dr. S. Sunder	
Chairman Academic Committee	:	Dr. Feroz Khan	
Chairman Membership Committee	:	Dr. Rajendra Sharma	
Immediate Past President	:	Dr. Kunjabasi Wangjam	

.....
Frequency : Quarterly

ISSN0973-2209

Full text of the Journal and Guidelines to the contributors are available on website.

Subscription :

Annual subscription is ₹ 2000/- (India) and US \$ 200 (other countries). Kindly send your request for subscription to the editor along with DD/ Cheque at par in favour of "Indian Journal of PMR" payable at Kolkata. Overseas per hardcopy 50\$. Reprint per hard copy ₹ 200/-.

The journal is despatched in India by surface mail and abroad by sea mail.

Disclaimer :

Indian Association of Physical Medicine & Rehabilitation and Editors can not be held responsible for errors or any consequences arising from the use of information contained in this journal; the views and opinion expressed do not necessarily those of the IAPMR and Editorial Board, neither does the publication of advertisements constitute any endorsement by IAPMR and Editor.

Correspondence :

Editorial Office :

Prof (Dr) Rathindranath Haldar

Department of Physical Medicine & Rehabilitation,

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

244, AJC Bose Road, Kolkata - 700020.

E-mail:indianjournalofpmr@gmail.com Phone no : 00 91 9830152173

Visit us : www.ijpmr.com & www.iapmr.org/ijpmr

PG Forum

BOOK NEWS

1. Glen Gillen. Stroke Rehabilitation: A Function-Based Approach. Edition: 4th. August 26, 2015. ISBN-13: 978-0323172813.
2. Brie Williams , Anna Chang . Current Diagnosis and Treatment: Geriatrics 2E (Current Geriatric Diagnosis and Treatment). Edition: 2nd Apr 15, 2014 ISBN-13: 978-0071792080
3. Timothy L. Kauffman , Ronald W. Scott. A Comprehensive Guide to Geriatric Rehabilitation: [previously entitled Geriatric Rehabilitation Manual], Edition: 3rd September 9,2015 ISBN-13: 978-0702045882
4. Shane (S.Q.) Xie Advanced Robotics for Medical Rehabilitation: Current State of the Art and Recent Advances (Springer Tracts in Advanced Robotics) Edition: 1st December 7, 2015. ISBN-13: 978-3319198958

ARTICLE NEWS

1. Assis, Livia PhD; Almeida, Thais; Milares, Luiz Paulo MS; dos Passos, Nayara; Araújo, Bruna; Bublitz, Caroline MS; Veronez, Suellen MS; Renno, Ana Claudia Muniz PhD. Musculoskeletal Atrophy in an Experimental Model of Knee Osteoarthritis: The Effects of Exercise Training and Low-Level Laser Therapy. *American Journal of Physical Medicine & Rehabilitation*; **94(8)**: p 609–616.
2. Le, David MS; Shafi, Shahid MD, MPH, FACS; Gwartz, Patricia PhD; Bennett, Monica PhD; Reeves, Rustin PhD; Callender, Librada BA, CCRC; Dunklin, Cynthia BS, CCRC; Cleveland, Samantha BS. Effect of Obesity on Motor Functional Outcome of Rehabilitating Traumatic Brain Injury Patients. *American Journal of Physical Medicine & Rehabilitation*; **94(8)**: p 627–632.
3. Akkaya, Nuray MD; Dogu, Beril MD; Ünlü, Zeliha MD; Çarlı, Alparslan Bayram MD; Akkaya, Semih MD; Tekin, Levent MD; Özçakar, Levent MD Ultrasonographic Evaluation of the Flexor Pollicis Longus Tendon in Frequent Mobile Phone Texters. *American Journal of Physical Medicine & Rehabilitation*; **94(6)**: p 444–448.
4. Rosu O. M., Ancuta C. McKenzie training in patients with early stages of ankylosing spondylitis: results of a 24-week controlled study. *European Journal of Physical and Rehabilitation Medicine (Europa Medicophysica)*; **51(3)**: 261-8..
5. Marie Claude Blais and Jean Marie Boisvert. Coping with Traumatic Brain Injury: How do Post-Acute TBI Couples compare with those from the General Population on Psychological and Marital Adjustment? *Int J Phys Med Rehabilitation*; **30(3)**: 270-3.

PG Forum

BOOK NEWS

1. Glen Gillen. Stroke Rehabilitation: A Function-Based Approach. Edition: 4th. August 26, 2015. ISBN-13: 978-0323172813.
2. Brie Williams , Anna Chang . Current Diagnosis and Treatment: Geriatrics 2E (Current Geriatric Diagnosis and Treatment). Edition: 2nd Apr 15, 2014 ISBN-13: 978-0071792080
3. Timothy L. Kauffman , Ronald W. Scott. A Comprehensive Guide to Geriatric Rehabilitation: [previously entitled Geriatric Rehabilitation Manual], Edition: 3rd September 9,2015 ISBN-13: 978-0702045882
4. Shane (S.Q.) Xie Advanced Robotics for Medical Rehabilitation: Current State of the Art and Recent Advances (Springer Tracts in Advanced Robotics) Edition: 1st December 7, 2015. ISBN-13: 978-3319198958

ARTICLE NEWS

1. Assis, Livia PhD; Almeida, Thais; Milares, Luiz Paulo MS; dos Passos, Nayara; Araújo, Bruna; Bublitz, Caroline MS; Veronez, Suellen MS; Renno, Ana Claudia Muniz PhD. Musculoskeletal Atrophy in an Experimental Model of Knee Osteoarthritis: The Effects of Exercise Training and Low-Level Laser Therapy. *American Journal of Physical Medicine & Rehabilitation*; **94(8)**: p 609–616.
2. Le, David MS; Shafi, Shahid MD, MPH, FACS; Gwartz, Patricia PhD; Bennett, Monica PhD; Reeves, Rustin PhD; Callender, Librada BA, CCRC; Dunklin, Cynthia BS, CCRC; Cleveland, Samantha BS. Effect of Obesity on Motor Functional Outcome of Rehabilitating Traumatic Brain Injury Patients. *American Journal of Physical Medicine & Rehabilitation*; **94(8)**: p 627–632.
3. Akkaya, Nuray MD; Dogu, Beril MD; Ünlü, Zeliha MD; Çarlı, Alparslan Bayram MD; Akkaya, Semih MD; Tekin, Levent MD; Özçakar, Levent MD. Ultrasonographic Evaluation of the Flexor Pollicis Longus Tendon in Frequent Mobile Phone Texters. *American Journal of Physical Medicine & Rehabilitation*; **94(6)**: p 444–448.
4. Rosu O. M., Ancuta C. McKenzie training in patients with early stages of ankylosing spondylitis: results of a 24-week controlled study. *European Journal of Physical and Rehabilitation Medicine (Europa Medicophysica)*; **51(3)**: 261-8..
5. Marie Claude Blais and Jean Marie Boisvert. Coping with Traumatic Brain Injury: How do Post-Acute TBI Couples compare with those from the General Population on Psychological and Marital Adjustment? *Int J Phys Med Rehabilitation*; **30(3)**: 270-3.

Editorial

Post Graduate Medical Education

From last couple of years there has been lot of discussions for improving professional education and identity. Most of us admit that there is a need for a fundamental redesign of the medical education and skill acquisition. Even the theme of next conference is “competency based education”, so I considered of providing food for thought beforehand.

Abraham Flexnar, a research fellow from Carnegie Foundation published a report on medical education in 1910 which has influenced medical education in the United States, Canada and rest of the world¹. After almost hundred years, we are experiencing pressure to change the training programs to a new paradigm, competency based medical education (CBME) which is defined as “an outcomes based approach to the design, implementation, assessment and evaluation of a medical education program using an organised framework of competencies. In CBME, the unit of progression is mastery of specific knowledge, skills, and attitudes and is learner centred.”²

To work towards CBME four steps are required (1) standardisation of learning outcomes and individualisation of learning process, (2) integration of formal knowledge and clinical experience, (3) developing habits of inquiry and innovation and (4) focus on professional identity formation, To fulfill the order we require innovative, radical & paradigm changes while keeping in mind our nation’s need and a time frame.

The first step will be having a consensus on standardisation of learning skills, even though Medical Council of India has laid down minimum standard guidelines for post-graduate teaching we still have large gaps in training across India. The residency training units should maintain minimum clinical standards and high level of professionalism otherwise a trainee cannot effectively learn competency in a poorly functioning clinical environment and mediocre academic leadership. Still we’ll have learning gaps which can be filled by more innovative, online collaborative learning environment, teaching the same content at multiple sites. This virtual environment will also help to develop interpersonal skills, networking and team based approach.

Physical Medicine and Rehabilitation trainee in particular, must accept to respect interdisciplinary environment, and this calls for complex, contextually rich conception of professionalism; where we move to relational autonomy which recognizes that human agents are interconnected and interdependent, meaning that autonomy is socially constructed and must be granted by others.⁴ Trainees should be encouraged to interact more and more with the other team members and to attend goal setting or discharge meetings of inpatients. In public hospitals outpatients are busy and trainees should use this opportunity to discuss their patients with faculty followed by short teaching and discussion.

There is substantial evidence in literature to demonstrate that most physicians cannot determine their own strengths and weaknesses without external data and feedback. Thus clinical competency of assessor is equally crucial component which has received no attention; a recent study found that, compared with residency clinics, practicing physicians provided only marginally better care to older patients in a number of areas.⁵ Faculties must be trained for the assessment process and should give unbiased opinions of the trainee performance, or the trainees may fall into traps of nonspecific assessment, escapism and shortcut approach.

To effectively evaluate post-graduate education many countries have adopted programmatic assessment in clinical work place based on tools such as mini Clinical Evaluation Exercise (mini-CEX), Direct Observation of Procedural Skills (DOPS), Multi-Source Feedback (MSF), Critical Appraisal of a Topic (CAT) and progress tests along with OSCE. This combination of tools along with regular progress meeting and on floor mentoring should be practiced for comprehensive competency assessment.⁶

Lastly, the unstated aim of teaching professionalism has been to ensure the development of practitioners who possess professional identity. First step to identity creation happens during residency where we get identification and enrichment of identity. Identity creation process includes career & role transitions, socialization and identity work. Identity is dynamic and relational and as an individual moves into new roles, these transitions facilitate changes in creation of “sub-identities”. Organizations and groups also are actively engaged in shaping member’s identity in society. The third more direct process “identity work” which focuses on individual’s active construction of identity in social context, this includes contribution of role models, stories and rhetoric. Some others emphasise the role of “working and doing” in creation of self. Feedback from peers and society will help establish and strengthen this identity.⁷

I look forward to see more discussions, presentations, articles and sessions to cumulatively address this issue for the betterment of postgraduate education.

References

1. Flexner A. Medical Education in the United States and Canada. A Report to the Carnegie Foundation for the Advancement of Teaching. Bulletin No.4. Boston, Mass: Updyke; 1910
2. Frank JR, Mungroo R, Ahmad Y, Wang M, De Rossi S, Horsley T. Towards a definition of competency based education in medicine: A systemic review of published definitions. *Med Teach*. 2007; **29**: 642-7.
3. Cooke M, Irby DM, O’Brien, Bridget C. Educating Physicians: A Call for Reform of Medical School and Residency. 2010 San Francisco, Calif Jossey-Bass.
4. MacDonald C. Nurse Autonomy as relational. *Nurs Ethics* 2002; **9**: 194-201.
5. Lynn LA, Hess BJ, Conforti LN, Lipner RS, Holmboe ES. The effect of residency clinic systems on the quality of care for older adults in internal and family medicine residency training program. *Acad Med* 2009; **84**: 1732-40.
6. Erik W Driessen, Jan Van Tartwijk, MarjanGovaerts, PimTeunissen, Cees P M Van Der Vleuten. The use of programmatic assessment in the clinical workplace: A Maastricht case report. *Medical Teaching* 2012; **34**: 226-31
7. Michael G Pratt, Kevin W Rockmann, Jeffery B Kaufmann. Constructing professional identity: the role of work and identity learning cycles in the customization of identity among medical residents. *Academy of Management Journal* 2006; **49**: 235-62.

– **Mrinal Joshi**

Associate Editor
Prof. & HOD, Dept. of PMR
SMS Medical College
Jaipur, Rajasthan

Original Article

Effect of Caudal Epidural Steroid Injection in Chronic Low Back Pain due to Prolapse Intervertebral Disc

Chaudhary S¹, Sharma R², Kothari SY³, Thukral BB⁴

Abstract

Background: Low back pain (LBP) due to disc herniation is a frequent cause of back pain. It is a debilitating condition having enormous medical and socio-economic effects. Epidural injection of steroids has been used to treat LBP for many decades. Despite widespread use and numerous publications there is significant controversy with regards to the medical necessity and indications for epidural injections, hence we planned this study.

Materials and methods: This was a prospective follow-up study. Forty-one patients of confirmed diagnosis of prolapse intervertebral disc (PIVD) were included. Caudal epidural steroid injection (CESI) of 80 mg methylprednisolone acetate diluted in 20 ml of 0.9% saline was given. Outcome was assessed by Numeric Pain Rating Scale (NRS), Oswestry Disability Index (ODI), Straight Leg Raise (SLR) and Modified Schober Test (MST) at baseline, one, three, six and twelve weeks follow-up.

Results: Thirty-seven patients completed the study. Significant improvement in patient's status was observed after CESI, as measured with MST, SLR, NRS and ODI at one and three weeks post injection and the improvement were maintained till 12th week. Eighty-three per cent of patients were satisfied at the end of the study and side-effects reported were mild.

Conclusion: CESI is a simple, safe and cost effective intervention procedure for the treatment of chronic LBP due to PIVD. It provides rapid pain relief and improvement of physical function starting within a week of injection.

Key words: Epidural injection, herniated disc, low back pain, prolapsed disc.

Introduction:

Low back pain (LBP) or sciatica as a clinical phenomenon dates back to Domenico Cotugno's article *De Ischiade Nervosa Commentarius* in 1764¹. The importance of LBP is due to its high lifetime prevalence (80%) in the community and effect on individual in terms

of pain and disability². Thirteen per cent of population suffer with persistent back pain of high intensity, with either moderate or severe disability^{2,3}. Amongst various structure causing LBP, disc herniation accounts for 30% of the cases⁴. Back pain due to disc herniation may present as local pain or as radicular pain⁵.

Traditional conservative medical treatments for patients with low back pain include trials of oral medications, exercise therapies, manual therapies, and lifestyle modifications. Epidural steroid injections first advocated in 1952 by Robecchi and Capra⁶, have also become a widely utilized conservative therapeutic modality in the treatment of patients with LBP. The rationale behind injecting glucocorticoid into the epidural space is that it will combat the inflammatory response associated with disc herniation and will thus reduce pain. Reports of the effectiveness of epidural corticosteroids have varied from 18% to 90%². Thus, epidural steroid injections are not only the most commonly used intervention, but also the most contentious and misunderstood modality of treatment. There are various studies stating the effectiveness of caudal epidural steroid injection (CESI), however very

Author's affiliations:

¹ DNB PMR, Assistant Professor*

² MD PMR, Director & Professor**

³ MS Ortho, DNB PMR, Special DGHS & Professor***

⁴ MD Radiology, Professor & Head***

*Dept of PMR, PGIMER & Dr RML Hospital, New Delhi

**All India Institute of Physical Medicine & Rehabilitation (AIPMR), Mumbai

*** Dept of PMR, VMMC & Safdarjang Hospital, New Delhi

Cite as:

Chaudhary S, Sharma R, Kothari SY, Thukral BB. Effect of caudal epidural steroid injection in chronic low back pain due to prolapse intervertebral disc. *IJPMR* June 2015; Vol 26(2): 49-52.

Correspondence:

Dr. Shipra Chaudhary

House no 7C, DDA Flat, Ber Sarai, New Delhi 16

Phone: 9810632919, E-mail: shipc76@gmail.com

Received on 14/06/2014, Accepted on 29/06/2015

few Indian studies document efficacy of CESI in chronic back pain due to PIVD.

The present study was planned to examine the effectiveness of CESI in patients with discogenic back pain due to disc herniation, which are non-responsive to other conservative modes of treatment.

Materials and Methods:

A prospective follow-up study of one year duration (May 2009 to April 2010) conducted in Department of Physical Medicine & Rehabilitation Safdarjang Hospital with the aim of assessing the efficacy of CESI in cases of prolapsed intervertebral disc (PIVD). Forty-one patients of PIVD satisfying the inclusion criteria were consecutively enrolled for the study.

Inclusion criteria: Age above 18 years of both genders, history of low back pain and lower extremity pain of at least six weeks duration not responding to conservative treatment. SLR <60 degree, diagnosis of PIVD confirmed by MRI.

Exclusion criteria: Unwilling to participate in the study, PIVD with neurological deficits, previous lumbar surgery, spinal stenosis, spinal structural abnormalities, any acute or chronic uncontrolled medical illness and psychiatric disorders which might interfere with assessment of the patient. Patients with history of possible adverse reaction to steroid were also excluded from the study.

All the patients were explained about the procedure. Informed written consent was taken from all patients. Examination of spine and neurological examination was done at baseline and subsequent follow-ups. X-ray of lumbosacral (LS) spine and magnetic resonance imaging (MRI) of LS spine, complete haemogram (haemoglobin, total leukocyte count, differential leucocyte count and erythrocyte sedimentation rate and blood sugar (fasting and postprandial) were done at baseline.

Intervention: The patient was made to lie in the left lateral position. A 20-gauge needle was passed through the sacral hiatus and needle placement was confirmed by "whoosh" test⁷. The epidural space was injected with 80 mg of methylprednisolone acetate diluted in 20 ml of 0.9% saline. Following the injection the patient remained on bedrest for a day in the hospital with regular monitoring of pulse and blood pressure.

Patients were evaluated at baseline, one, three, six and twelve weeks using Objective Parameters of Straight Leg Raise (SLR) and Modified Schober Test (MST) and subjective parameters of pain using Numeric Pain Rating Scale (NRS) and Disability using Oswestry Disability Index (ODI).

Straight Leg Raise: The SLR test causes gliding of lumbar nerve roots which get compressed by the herniated disc proximal to neural foramina leading to radiation of pain down the leg in nerve root distribution⁸. SLR less than 60 degree was taken as positive.

Modified Schobers Test: In MST distraction of skin marked over the lumbar spine is measured which corresponds to the flexion movement of the lumbar spine⁹. Normally there is more than 5cm of distraction.

Numeric Pain Rating Scale: It is an eleven-point numerical pain rating scale in which patients rate their pain ranging from zero (no pain) to ten (worst imaginable pain). A two-point change on the NRS in patients with LBP represents a clinically meaningful change¹⁰.

Oswestry Disability Index: The Oswestry Disability Index is the commonly recommended condition specific outcome measure for spinal disorders¹¹. It has ten sections namely pain intensity, personal care, lifting, walking, sitting, standing, sleep, social life, travelling and employment. Total scores can range from zero (highest level of function) to 50 (lowest level of function). For each section the total score ranged zero to five according to the deterioration of function. The total score is expressed in percentage.

Statistical analysis: Descriptive statistics including mean and standard deviation (SD) were found for each quantitative variable. For non-parametric data, mean changes at different follow-ups was analysed using Friedman test followed by Wilcoxin signed ranks test. The results were considered significant at five per cent level of significance ($p < 0.05$).

Results:

Forty-one (41) subjects were enrolled in the study but only 37 patients completed three months follow-up period. The age distribution of 37 patients (27 male and 10 females) ranged from 19 to 50 years; average being 33.11 ± 8.319 (Table 1). Duration of back pain ranged from three months to 36 months, average being 11.64 ± 13.74 (Table 2). Out of 37 subjects 18 patients (48.6%) had pain for less than six months duration. PIVD was present at both L4-L5 and L5-S1 levels in 18 (48.6%) followed by L4-L5 level in ten patients (27.02%) confirmed by MRI (Table 2).

Table 1: Demographic Profile

Gender	Age in years				Average
	10-20	21-30	31-40	41-50	
Male	3	8	11	5	27 (73%)
Female	0	4	4	2	10 (27%)

Table 2: Duration of Low Back Pain and Level of PIVD

Pain duration	Level of PIVD
<6 months = 48.6 %	L4-5 = 27.1%
6-12 months = 24.3%	L5-S1 = 24.3%
>12 months = 27.1%	L4-5 and L5-S1 = 48.16%

Mean NRS, SLR, MST and ODI score at baseline was 7.51 ± 1.12 , 40.53 ± 11.62 , 18.24 ± 0.94 and 50.43 ± 12.54 respectively (Table 3). There was improvement in all the assessment parameters post CESI (Table 4). A statistically significant improvement was observed at one week and three weeks post injection which was maintained till 12 weeks (Table 4). Though mild change was observed between third and sixth and sixth and twelfth weeks follow-up, but it was not significant. Maximal improvement was found after one week post injection in all the parameters.

Only three patients reported side-effects after receiving CESI. Two patients (5.4%) reported transient mild headache which improved the same day while one (2.7%) had transient increase in leg pain, improved within three days without any medication. Three subjects out of 37 patients who received CESI underwent surgery. Out of these, one patient did not show any improvement after surgery.

Discussion:

Pain due to a herniated nucleus pulposus is an important medical and socio-economic problem. Pain and reduced mobility severely compromise quality of life and are particularly disruptive to the working individual. The

aim of any therapy should be achievement of normal lifestyle as soon as possible.

The result of our study showed a significant improvement in patient's status after CESI which started within a week post injection and persisted till the end of the study. We observed significant improvement in mobility of spine one week post injection. Valat *et al*¹² and Apathy *et al*¹³ also observed significant improvement in lumbar flexion movement within one week post injection.

We observed significant reduction in pain score after CESI at one week and third week follow-up and no significant change in subsequent follow-ups, however the improvement in the pain score persisted till 12 weeks. Wilson-MacDonald *et al*¹⁴ also observed significant early reduction in pain in their study but found no long term effect. Similar results were obtained by Buchner *et al*¹⁵ with greatest relief in pain in the initial two weeks and no significant improvement at six weeks and six months follow-up.

A statistically significant improvement in Straight Leg Raise was observed in our study which persisted till 12 weeks. This is in accordance with the study done by Bush and Hillier¹⁶, who also observed statistically significant improvement in SLR at four weeks, they however observed improvement till 52 weeks follow-up. Buchner *et al*¹⁵ also observed significant improvement in SLR at two weeks and six weeks follow-up and no significant change at six months follow-up. In our study 83 % of the patients were SLR negative at the end of three months. Similarly Sayeh *et al*¹⁶ also observed negative SLR in 88% of patients six months post injection.

Table 3: Assessment at Baseline and Follow-ups

Parameters	Time				
	0 Weeks T0	1Weeks T1	3 Weeks T3	6 Weeks T6	12 Weeks T12
NRS	7.51 ± 01.12	3.59 ± 2.38	2.86 ± 2.47	3.22 ± 2.61	2.84 ± 2.41
SLR	40.53 ± 11.62	63.41 ± 13.30	67.45 ± 12.89	67.96 ± 13.42	69.35 ± 13.05
MST	18.24 ± 0.94	19.64 ± 1.28	20.14 ± 1.49	20.23 ± 1.45	20.28 ± 1.46
ODI	50.43 ± 12.54	36.32 ± 13.44	26.32 ± 13.39	25.95 ± 15.57	25.32 ± 14.92

Table 4: Change in NRS, SLR, MST and ODI between Various Follow-ups

Time interval (in weeks)	Mean change in NRS \pm SD	Mean change in SLR \pm SD	Mean change in MST \pm SD	Mean change in ODI \pm SD	P value
T0-T1	3.91 ± 2.37	22.87 ± 13.95	$1.39 \pm .97$	14.10 ± 11.21	S
T0-T12	4.67 ± 2.36	28.81 ± 16.75	2.04 ± 1.26	26.10 ± 17.04	S
T1-T3	0.72 ± 1.38	4.04 ± 6.92	$0.5 \pm .85$	10 ± 10.40	S
T3-T6	0.35 ± 1.47	0.51 ± 5.69	$0.09 \pm .28$	0.38 ± 18.18	NS
T6-T12	0.37 ± 1.31	1.38 ± 3.88	$0.05 \pm .19$	1.62 ± 5.88	NS

T0= Score at baseline, T1= Score at one week, T3= Score at 3 weeks, T6= Score at 6 weeks, T12= Score at 12 weeks, SD= Standard deviation, NS=Not significant, S=Significant

The improvement in the ODI in our study started at one week post injection and significant change was observed at three weeks follow-up. There was minimal change at six weeks and twelve weeks follow-up, however significant improvement in ODI was maintained till 12 weeks. Thus, improvement in ODI score within three weeks showed early improvement in physical function leading to early return to work and in other functional activities. Manchikanti *et al*³ also observed significant improvement in ODI score at three months and no further improvement at six months and one year follow-up. Sayeh *et al*¹⁷ also observed significant change in ODI at one month post injection with no significant change at one year follow-up.

In our study, 81% patients were satisfied with the treatment at three weeks and 83% at 12 weeks, whereas Bowman¹⁸ reported some improvement in 85% patients at one week and 43% had improvement lasting three months.

Three patients (8%) who received CESI underwent surgery after completion of study because of failure of relief and pain, which is less than that reported in the literature (10-15%)¹⁸. However our study was of short duration with a follow-up of three months and hence we cannot comment on whether CESI potentially avoids the need for a more invasive surgical procedure which is costly, involves a significant risk to the individual patient, and may not always be successful.

Our results were consistent with the previous studies, which have suggested that the benefits of CESI is for short term, regarding improvement in pain and functional status of the patient, however we could not comment on long term effect because of short duration of the study period. We also observed that CESI was well tolerated. Minor complications are reported in our study such as mild exacerbation of radicular pain during injection and transient headache but there was no major complication.

CESI is a simple, rapid and easily performed procedure that can offer significant and faster pain relief, reduction in disability and return to work. CESI may be considered as an alternative to operative procedure in patients not responding well to conservative treatment, avoiding high operative risk or when they refuse to be operated upon.

Conclusions:

It can be inferred from our study that CESI is a simple, safe and cost effective intervention procedure for the treatment of PIVD. It provides rapid pain relief and improvement of physical function starting within a week of injection and hence can be used in PIVD patients not responding to other conservative methods of treatment. Further studies

are required to assess the long term efficacy and safety of CESI.

Carry Home Message: CESI is effective in the management of not only acute PIVD but it can be used for management of chronic PIVD not responding to other conservative method of treatment

References:

1. Cotugno DFA. De Ischiade nervosa commentarius. Naples, Fratres Simonios, 1764.
2. Boswell MV, Trescot AM, Datta S, Schultz DM, Hansen HC, *et al*. Interventional techniques: evidence based practice guidelines in the management of chronic spinal pain. *Pain Physician* 2007; **10**: 7-111.
3. Manchikanti L, Singh V, Cash KA, *et al*. Preliminary results of a randomized, equivalence trial of fluoroscopic caudal epidural injections in managing chronic low back pain: Part 2- Disc herniation and Radiculitis. *Pain Physician* 2008; **11**: 801-15.
4. Zhang YG, Guo TM, Guo X, Wu SX. Clinical diagnosis for discogenic pain. *Int J Biol Sci* 2009; **5**: 647-58.
5. Karen P. Barr and Mark A. Low back pain. In: Randall L, editor. Braddom Physical Medicine and Rehabilitation. 3rd ed. St Louis: Elsevier, 2007; 883-927.
6. Robechhi A, Capra R. L'idrocortisone (composto F). Prime esperienze cliniche in campo reumatologico. *Minerva Med* 1952; **98**: 1259-63.
7. Eastwood D, William C, Buchan I. Caudal epidurals: The whoosh test. *Anaesthesia* 1998; **53**: 305-7.
8. Kobayashi S, Shizu N, Suzuki Y, Asai T, Yoshizawa H. Changes in nerve root motion and intradiscal blood flow during intraoperative straight leg raising test. *Spine* 2003; **28**: 1427-34.
9. Macrae IF, Wright V. Measurement of back movement. *Ann Rheum Dis* 1969; **28**: 584-9.
10. Childs JD, Piva SR, Fritz JM. Responsiveness of the numeric pain rating scale in patients with low back pain. *Spine* 2005; **30**: 1331-4.
11. Fairbank, Jeremy CT, Paul B. Oswestry Disability Index. *Spine* 2000; **25**: 2940-52.
12. Valat JP, Giraudeau B, Rozenberg S, Goupille P, Nourgeois, *et al*. Epidural steroid injections for sciatica: a randomized, double blind controlled clinical trial. *Ann Rheum Dis* 2003; **62**: 639-43.
13. Apathy A, Penczner G, Licker E, Eiben A, Balint G. Caudal epidural injection in the management of lumbosacral nerve pain syndromes. *Orv Hetal* 1999; **140**: 1055-8.
14. Wilson-MacDonald J, Burt J, Griffin D, Glynn C. Epidural steroid injection for nerve root compression: a randomized controlled trial. *J Bone Joint Surg Br* 2005; **87**: 352-5.
15. Buchner M, Zeifang F, Brocai DRC, Schiltewolf M. Epidural corticosteroid injection in the conservative management of sciatica. *Clin Orthop Relat Res* 2000; **375**: 149-56.
16. Sayeh FE, Kenanidis EI, Papisvisiliou KA, Potoupnis ME, Kirkos JM, *et al*. Efficacy of steroid and nonsteroidal caudal epidural injections for low back pain and sciatica. *Spine* 2009; **34**: 1441-7.
17. Bowman S J. Outcome assessment after epidural corticosteroid injection for low back pain and sciatica. *Spine* 1993; **18**: 1345-50.
18. Bush K, Cowan N, Katz DE, Gishen P. The natural history of sciatica associated with disc pathology: a prospective study with clinical and independent radiologic follow-up. *Spine* 1992; **17**: 1205-12.

A Comparative Study on Effectiveness of Intra-articular Injection of High Molecular Weight Hyaluronate, Steroid and High Molecular Weight Hyaluronate plus Steroid in Osteo-arthritis Knee

Basak A¹, Pramanik R², Das Pallab³, Ballav A⁴

Abstract

Background: Although primary osteo-arthritis is well known as a benign degenerative condition, the impact of this disease course is becoming terribly disabling day to day in our community possibly because of increasing life expectancy. After lots of search regarding the role of intra-articular hyaluronic acid plus steroid in osteo-arthritis knee it is noted that scarcity of literature regarding conclusive evidence for the above. There is a grey zone regarding the combined role of these two agents in patients with primary osteo-arthritis. This project is a humble sincere attempt to find out the role of high molecular weight hyaluronate plus steroid in osteo-arthritis knee and to compare the effectiveness of this with intra-articular steroid, and intra-articular HMW hyaluronic acid.

Methods and Design: This is a single blind randomised controlled parallel group study conducted in the department of physical medicine and rehabilitation, IPGME & R, SSKM Hospital, Kolkata for a period of 18 months taking 27 subjects in each group. All patients with primary osteo-arthritis knee with grade two or grade three were included in the study group. And those who did not want to get incorporated in the study, patients with secondary osteo-arthritis knee, grade one or grade four osteo-arthritis knee, with gross knee instability, patients with contra-indications of intra-articular injections or intra-articular injection of steroid or with history of allergy to a viscosupplementation solution and patients received intra-articular injection in knee within last one year were excluded from the study. WOMAC pain, stiffness and functional subscales, VAS pain, ROM of knee joint, 50 feet walk time, Patients global assessment scale, Physicians global assessment scale were the parameters studied. After taking clearance from the institutional ethical committee, patients were selected based on the inclusion and exclusion criteria, and baseline (visit-1) assessment was done on the parameters. The selected patients have been divided into three groups randomly. Written informed consent was taken from all patients before interventions. One group received intra-articular injection of methylprednisolone, second group received intra-articular injection of high molecular weight hyaluronate, and third group received intra-articular injection of high molecular weight hyaluronate plus methylprednisolone in the knee joint. The injections administered under strict aseptic condition. After administering injections, the patients assessed at the interval of 6 weeks (visit-2) and 12 weeks (visit-3) using the parameters mentioned above. The results have been analysed according to the standard statistical methods to fulfill the aims and objectives of the study.

Discussion: Majority of patients were female and more than 50 years of age with K-L radiological grade of 3. At the baseline visit, the WOMAC pain was comparable in all the three groups.

It has been seen that, there was statistically significant improvement in all the parameters at the 2nd visit (6 weeks) from the baseline in all groups, and at the 3rd visit (12 weeks) though there was improvement on all the parameters from the 2nd visit in all groups, it was not statistically significant. Steroid, high molecular weight hyaluronate and steroid plus HMW hyaluronate all are effective in osteo-arthritis knee in terms of reduction of pain, reduction of stiffness of knee joint, increase of range of motion of knee joint, reduction of 50 feet walking time, reduction of patients and physicians global assessment score. No treatment regime is statistically significantly better than the other group after 6 and 12 weeks of postinjection. Adverse effects of any treatment regime is negligible.

Author's affiliations:

- ¹ MBBS, MD(PMR) Assistant Professor, PMR*
- ² MBBS, MD(PMR), MRCP(UK), Associate Professor, PMR**
- ³ MBBS, MD(PMR), Associate Professor, PMR*
- ⁴ MBBS, DTMNH, MD(PMR), Ex Professor and HOD, PMR**
Dept. of Physical Medicine and Rehabilitation,
* Burdwan Medical College, West Bengal, India
**Institute of Post graduate Medical Education and Research,
Kolkata, India

Cite as:

Basak A, Pramanik R, Das Pallab, Ballav A. A comparative study on effectiveness of intra-articular injection of high molecular weight hyaluronate, steroid and high molecular weight hyaluronate plus steroid in osteoarthritis knee. IJPMR June 2015; Vol 26(2): 31-7.

Correspondence:

Dr Amalsh Basak, 590 Anandapally, Sunny Bliss Apartments, Block04, Flat no 4, Garia, Kolkata 700084. Email: dr_amaleshbasak@yahoo.co.in.

Received on 15/07/2014, Revised on: 26/03/2015
Accepted on 24/04/2015

Key words: Comparative study, intra-articular injections, high molecular weight hyaluronate plus steroid, osteo-arthritis knee.

Introduction:

Although primary osteo-arthritis is well known as a benign degenerative¹ condition, the impact of this disease course is becoming terribly disabling day to day in our community possibly because of increasing life expectancy. Even with the magical advent of the newer therapeutic treatment options, medical fraternity is still struggling to limit the disability of the so called benign disease. Until recent past intra-articular steroid was a good option to minimise patients' discomfort along with lots of experimental and inconclusive disease modifying drugs of osteo-arthritis. Recently intra-articular hyaluronic acid emerged as a newer weapon in the armamentarium of the physiatrists. After lots of search regarding the role of intra-articular hyaluronic acid plus steroid in osteo-arthritis knee it is noted that scarcity of literature regarding conclusive evidence for the above. There is a grey zone regarding the combined role of these two agents in patients with primary osteo-arthritis. This project is a humble sincere attempt to find out the role of high molecular weight hyaluronate plus steroid in osteo-arthritis knee and to compare the effectiveness of this with intra-articular steroid, and intra-articular HMW hyaluronic acid.

Aims and Objectives:

To compare the effectiveness of:

- 1) Intra-articular injection of high molecular weight hyaluronate,
- 2) intra-articular injection of steroid, and
- 3) intra-articular injection of high molecular injection of high molecular weight hyaluronate plus steroid in primary osteo-arthritis knee in relation to symptoms as well as quality of life.

Materials and Methods:

Institutional ethical committee clearance has been taken for the study. Individual informed consent has been taken from patients to include in this study group. The study was conducted in the department of physical medicine and rehabilitation, IPGME & R, SSKM Hospital, Kolkata which extended from December 2010 to May 2012, and 27 subjects with primary osteo-arthritis knee who attended the OPD and osteo-arthritis clinic of the department of physical medicine and rehabilitation, SSKM Hospital, Kolkata, taken in each group. For the purpose of sample size calculation the pain component of the Western Ontario and McMaster University (WOMAC) index was considered as the primary outcome measure. It is estimated that 21 subjects would be required per group in order to detect a difference of 2 (two) in the WOMAC

pain score with 80% power and 5% probability of type 1 error. This calculation assumes a standard deviation (SD) of 4 for this parameter and root mean square standardised effect of 0.5 assuming 20% drop out rate. This translates to a recruitment target of 27 subjects per group or 81 subjects overall. It was a single blind randomised controlled parallel group study. All patients with primary osteo-arthritis knee of grade two or grade three were included in this study, and grade one or grade four were excluded from the study. Those who did not want to get incorporated in the study, patients with secondary osteo-arthritis knee, or with gross knee instability, patients having contra-indications of intra-articular injection i.e. overlying soft tissue infection, bacteraemia, anatomic inaccessibility, an non-cooperative patient, etc, or patients with contra-indications of intra-articular injection of steroid i.e. infection in and around the joint, bacteraemia or sepsis, significant skin breakdown at the proposed injection site, presence of a joint prosthesis, uncontrolled diabetes etc, or with contra-indications of intra-articular high molecular weight hyaluronate i.e. allergy to a viscosupplementation solution excluded from the study. Patients who received intra-articular injection in knee within last one year also not included in the study.

Parameters studied:

- 1) The Western Ontario and McMaster Universities (WOMAC) index of osteo-arthritis pain subscale (out of 20), stiffness subscale (out of 8), and functional subscale (out of 68). The WOMAC 4-point Likert scale was used for this purpose.
- 2) Pain in visual analogue scale (VAS) score (out of 10).
- 3) Range of motion of knee joint (in degrees).
- 4) 50 feet walk time (in seconds).
- 5) Patients global assessment. For this, patients were asked to rate their overall condition considering pain, stiffness, swelling, activities of daily living and overall status, which was measured as out of ten (10) scale.
- 6) Physicians global assessment. For this, the physician rated the overall condition of the patient considering pain, patients' general condition, disease activity, physical examination, lab and clinical parameters which were measured as out of ten (10) scale.

Study technique: First of all ethical committee clearance was taken. In this study patients suffering from primary osteo-arthritis knee have been selected for intervention according to inclusion and exclusion criteria. The selected

patients have been counselled about the disease and therapeutic modalities. They were examined and assessed at baseline (visit-1) first. Study parameters measured at the visit-1.

WOMAC 5 point Likert scale was used for measurement of pain, stiffness and functional parameters. A 10 cm horizontal visual analogue scale was also used for pain measurement. Range of motion was measured using goniometer. Fifty feet walking time was measured using a stopwatch and asking the patient to walk for a distance of 50 feet in bare feet with maximum speed which is comfortable. Patients and physicians' global assessment scales were used to see the overall condition of the patient. The selected patients have been divided into three groups randomly. One group received intra-articular injection of methylprednisolone, second group received intra-articular injection of high molecular weight hyaluroic acid, and third group received intra-articular injection of high molecular weight hyaluronate plus methylprednisolone in the knee joint. The injections administered under strict aseptic condition (Figs 1&2).

After administering injections, the patients assessed at the interval of 6 weeks (visit-2) and 12 weeks (visit-3) using the parameters mentioned above. The results have been analysed according to the standard statistical methods to fulfill the aims and objectives of the study.

Intervention: All patients were educated regarding joint protection and lifestyle modification and all patients were advised exercises for osteo-arthritis knee. All patients were instructed to perform range of motion of knee exercises and to perform 3 to 5 sets of 8 to 12 repetitions per set per knee of quadriceps setting exercises, as well as 3 to 5 sets of 8 to 12 repetitions per set of wall slides². Only paracetamol 1 g was advised as analgesic on SOS basis with a maximum tablets of two a day. For intra-articular injection, first of all written informed consent was taken from each and every patient. Forty (40) mg of methylprednisolone was given in symptomatic knee under aseptic condition (for steroid group of patients). The HMW hyaluronate group was given 6ml of HMW hyaluronate as single dose in symptomatic knee under aseptic condition. For 3rd group (combined group), first 40mg of methylprednisolone was injected under aseptic condition followed by injection of 6ml of HMW hyaluronate under aseptic condition in the same sitting in symptomatic knee. Before injecting any drug, aspiration was attempted under aseptic condition and fluid was aspirated as much as possible. All injections were administered blindly (i.e., without using ultrasonography)

by a single person following standard techniques as mentioned on text books of Physical Medicine and Rehabilitation by Joel. A. Delisa.



Fig 1- *Aspiration of Synovial Fluid from the Knee Joint*



Fig 2- *Administration of Steroid into the Knee Joint*

Results:

Data have been summarised by usual description statistics such as mean and standard deviation (SD) for numerical variables that are normally distributed, and median and interquartile range for those that are not. Numerical variables have been compared between groups by one way ANOVA if normally distributed and Kruskal-Wallis ANOVA if otherwise. Appropriate posthoc test used to detect difference between to individual groups. Changes from baseline to study end have been assessed to repeated measure ANOVA for parametric variables and Friedman's ANOVA for non-parametric variables. Categorical variables compared between groups by

Chi-square test or Fisher’s exact test as appropriate. All analysis are two-tailed and $p < 0.05$ has been considered statistically significant.

Demographics:

In this study, out of total population of 66, 45 patients i.e., 79% were 50 years or more years of age with mean age of 59.35 years (Table 1 & Fig 3).

Table 1: Descriptive Statistics for Age

Age	No of cases	Mini-mum	Maxi-mum	Mean	Std deviation
Years	66	40	81	59.35	10.202

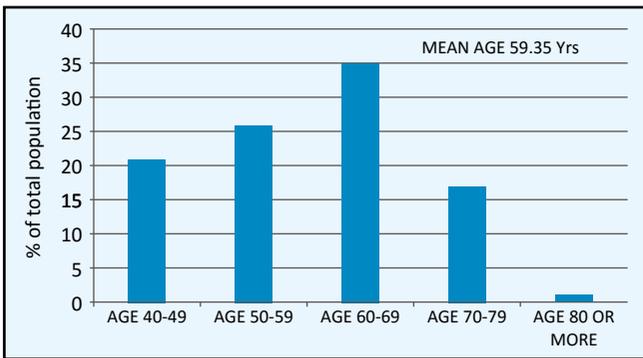


Fig 3- Age Distribution

Table 2 & Fig 4 show 60.6% of the total population were female and 39.4% were male, which is consistent with the fact that osteo-arthritis is more common in female population as revealed by other literatures also.

Table 2: Descriptive Statistics (Frequencies) for Sex

Sex	Frequency	Percent	Valid percent	Cumulative percent
Male	26	39.4	39.4	39.4
Female	40	60.6	60.6	100
Total	66	100	100	

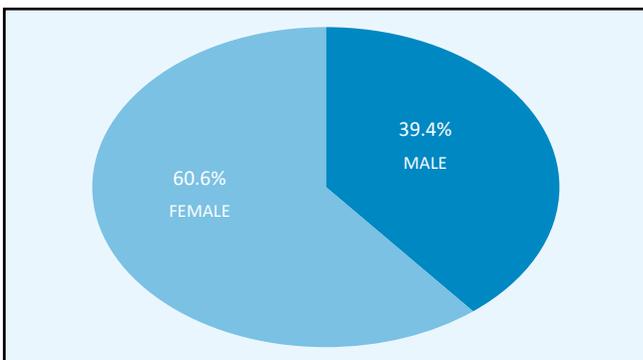


Fig 4- Sex Distribution

In this study 9.1% patients were overweight and 90.9% patients were within normal BMI range with mean BMI of 22.27 (Table 3 & Fig 5).

Table 3: Descriptive Statistics for BMI

	N	Minimum	Maximum	Mean	Std. deviation
BMI	66	20	27	22.27	1.525

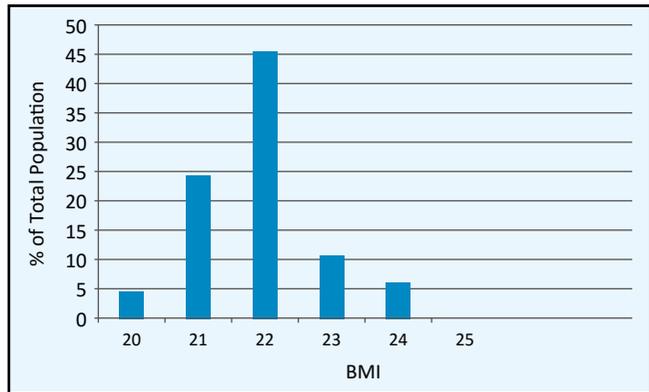


Fig 5- BMI Distribution in Population

In this study 11% patients had K-L radiological grade 2 osteoarthritis and 89% patients had K-L radiological grade 3 osteoarthritis (Table 4 & Fig 6).

Table 4: K-L Radiological Grading

K-L grade	Frequency	Percent	Valid percent	Cumulative percent
2	7	11	11	11
3	59	89	89	100
	66	100	100	

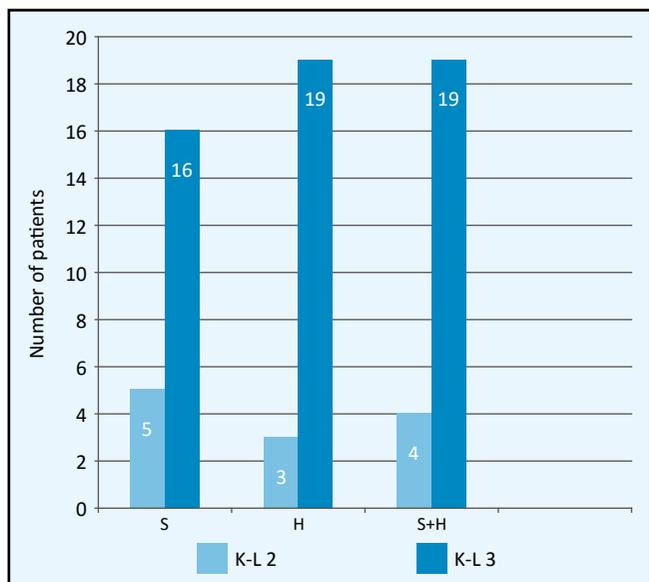


Fig 6- K-L Grade in All Three Study Groups (K-L = Kellgren Lawrence grade)

WOMAC Pain: (Tables 5 to 8)

WOMAC pain at visit 1 for all groups:

P value: 0.4339; Number of groups: 3

Table 5: WOMAC Pain at Visit 1, (S=Steroid Group, H=Hmw Hyaluronate Group, S+H=Steroid+Hmw Hyaluronate Group), NS=Not Significant

Tukey's multiple comparison test	Mean difference	q	Significant <0.05	Summary	95% CI of difference
S VS H	-1.330	1.801	NO	NS	-3.838 to 1.178
S VS S+H	-0.4058	0.5430	NO	NS	-2.944 to 2.133
H VS S+H	0.9242	1.224	NO	NS	-1.642 to 3.490

So, at baseline visit, WOMAC pain was comparable in all the three study groups (p value= 0.4339).

Table 6: Summary of WOMAC Pain, Stiffness and Functional Score in the Three Study Groups; (S=Steroid Group, H=HMW Hyaluronate Group, S+H=Steroid+HMW Hyaluronate Group)

Pain	S	H	S+H	Between groups p value
Baseline	8.261	9.591	8.667	0.4339
6 Weeks	5.957	7.182	5.762	0.4760
12 Weeks	4.739	5.682	4.571	0.6707
Stiffness				
Baseline	1.478	1.773	1.810	0.8668
6 Weeks	0.8261	1.045	0.9524	0.8870
12 Weeks	0.5217	0.7727	0.7619	0.7748
Functional score				
Baseline	34.48	36.86	36.86	0.6280
6 Weeks	23.39	26.95	24.71	0.5690
12 Weeks	19.91	26.41	20.67	0.2076

Table 7: Summary of VAS Pain Score, Range of Motion of Knee Joint and 50 Feet Walk Time in 3 Study Groups; (S=Steroid Group, H=HMW Hyaluronate Group, S+H=Steroid+HMW Hyaluronate Group)

VAS pain	S	H	S+H	Between groups p value
Baseline	8.043	7.091	7.238	0.2116
6 Weeks	6.348	5.948	5.486	0.3226
12 Weeks	5.609	5.025	4.234	0.4234
ROM knee				
Baseline	122.2	127.9	125.0	0.6273
6 Weeks	125.2	129.5	126.4	0.7062
12 Weeks	128.3	131.4	127.9	0.7297
50 feet walk time				
Baseline	24.70	22.32	28.05	0.2646
6 Weeks	22.35	18.36	21.43	0.3628
12 Weeks	21.39	17.64	17.43	0.2895

Table 8: Summary of Patients Global Assessment Score in 3 Study Groups; (S=Steroid Group, H=HMW Hyaluronate Group, S+H=Steroid+HMW Hyaluronate Group)

	S	H	S+H	Between groups p value
Baseline	6.478	6.545	6.476	0.9760
6 Weeks	5.261	4.773	4.476	0.3613
12 Weeks	4.087	4.273	4.143	0.9475

Table 9: Summary of Physicians Global Assessment Score in 3 Study Groups; (S= Steroid Group, H=HMW Hyaluronate Group, S+H= Steroid+HMW Hyaluronate Group)

	S	H	S+H	Between groups p Value
Baseline	5.783	6.182	6.238	0.3477
6 Weeks	4.348	4.409	4.333	0.9908
12 Weeks	4.043	4.227	3.810	0.8099

Drop out (Fig 7): Table 9 shows physicians' global assessment. In this study in steroid group 4 patients out of 27 failed to follow-up. In HMW hyaluronate group, and in steroid plus HMW hyaluronate group 5 and 6 patients out of 27 patients in each group failed to follow-up respectively. So, the total drop out rate was 18.51%.

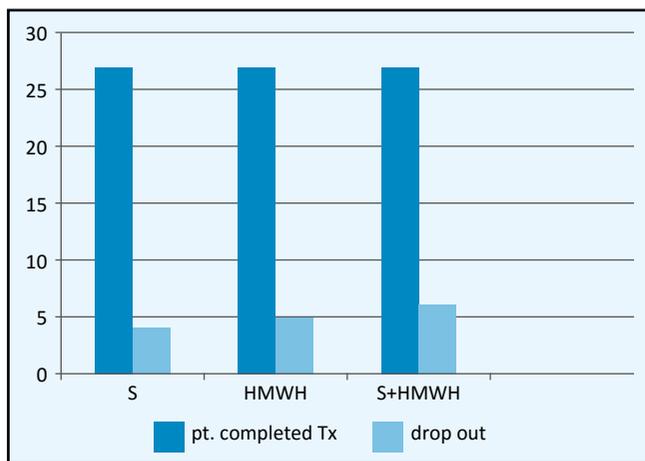


Fig 7- Out in All Groups, S= Steroid Group, Hmw H= HMW Hyaluronate Group, S+HMWH H= Steroid Plus Hmw Hyaluronate Group

Adverse effects: Only two patients complained of local burning sensation during administration of 6ml of HMW Hyaluronate in knee joint. The burning sensation was transient and relieved after few minutes of administration of injection. No other adverse effects occurred in any group of patients.

Discussion:

The effectiveness of intra-articular injection of steroid² and high molecular weight (HMW) hyaluronate in osteo-arthritis knee has been claimed for a long³. There are some studies comparing the effectiveness of the two in knee osteo-arthritis⁴. One study found, which showed the comparison of effectiveness between the two in shoulder osteo-arthritis. But, till date, no literature support could be achieved which showed comparison of effectiveness between intra-articular steroid, intra-articular HMW hyaluronate and intra-articular steroid plus HMW hyaluronate in osteo-arthritis knee.

This study showed that age is an important factor for the occurrence of osteo-arthritis as majority of the patients were old with mean age of 59.35 years. Majority of patients were female with 60.6% of total study population which suggests that osteo-arthritis is more prevalent in female population as supported by many literatures. Though obesity is an important factor for the occurrence of osteo-arthritis knee, the mean BMI (basal metabolic index) of this study population was 22.27. Majority of the patients had Kellgren-Lawrence grade 3 of osteo-arthritis with 89% of the total study population and rest of the population had grade 2 of osteo-arthritis. Grade 1 and grade 4 patients were not included in the study, as most of the grade 1 patients do not have significant pain and other discomforts, so detection of improvement could not be understood and comparison with other groups would not be appropriate. And in grade 4 patients it is very difficult to administer injection intra-articularly as the joint space is greatly impaired with presence of subchondral sclerosis in K-L grade 4 osteo-arthritis knee.

For WOMAC pain score, it has been seen that there was significant improvement of WOMAC pain score in all groups of patients. The improvement was significant at 6 weeks and at 12 weeks from the baseline visit in all groups, but the improvement at 12 weeks from 2nd visit (6 weeks) was not statistically significant in all groups. The difference of improvement of WOMAC pain in between groups was not statistically significant. The same pattern of improvement was there for all studied parameters i.e. WOMAC stiffness, WOMAC functional score, VAS pain score, 50 feet walk time, ROM of knee, patients global assessment score and physicians global assessment score within all groups with time and in between groups. So, the findings of the study suggest that no statistically significant difference was there between the three study groups. It is important to mention that very few patients in each group enjoyed pain reduction to zero on VAS scale, that is also for few weeks. In most of the cases pain intensity reduced, but never came to zero. So, none of the treatment option was able to reduce the pain completely. Onset of improvement of various parameters could not be determined, as while asking the

patients at 6 weeks about the onset of improvement of various parameters, most of the patients could not remember the exact time of onset. The duration of the improvement also could not be determined as the final follow up was at 12 weeks. So, better designed and better planned studies could be done to find out those in future. During routine OPD follow-up, two patients of HMW hyaluronate group reported about recurrence of symptoms after 8 months of postinjection. Total 15 patients failed to follow-up with total drop out rate of 18.51%. Only two patients complained of local burning sensation during administration of 6ml of HMW hyaluronate in knee joint and that was for few minutes. No other adverse reaction occurred in any group of patients, which suggests that all the treatment options are safe if not otherwise contra-indicated.

Limitations:

There were several limitations of the study. The limitations are :

- 1) No control group was taken.
- 2) Sample size was small in each group.
- 3) It was a short term study as the final follow-up was at 12 weeks, so it was not possible to know the treatment effects after 12 weeks postinjection.
- 4) Initial frequent follow-up and statistical analysis were not done. So this study has a limitation to conclude about the immediate postinjection effect.

Conclusions:

- 1) Osteo-arthritis is more prevalent in female population and in older age group.

- 2) Steroid, high molecular weight hyaluronate and steroid plus HMW hyaluronate all are effective in osteo-athritis knee in terms of reduction of pain, reduction of stiffness of knee joint, increase of range of motion of knee joint, reduction of 50 feet walking time, reduction of patients and physicians' global assessment score.
- 3) No treatment regime is statistically significantly better than the other group after 6 and 12 weeks of post-injection.
- 4) Adverse effects of any treatment regime is negligible.

Disclosure Statement:

This study was not funded by any governmental or non-governmental organisation or any pharmaceutical company, and no financial or other benefit was related to this study and no commitment or agreement was there to provide such benefit from a commercial entity.

References:

1. Di Cesare PE, Abramson SB, Samuels J. Part 15 – cartilage, bone, and heritable connective tissue disorders, Firestein: Kelley's Textbook of Rheumatology, 8th ed. 2008, chapter 89.
2. Arroll B, Goodyear-Smith F. Intra-articular corticosteroid injections are better than placebo for improving symptoms of knee osteo-arthritis: Corticosteroid injections for osteoarthritis of the knee: meta-analysis. *BMJ* 2004; **328**: 869.
4. Jones AC, Patrick M, Doherty S, *et al*. Intra-articular hyaluronic acid compared to intra-articular triamcinolone hexacetonide in inflammatory knee osteoarthritis. *Osteoarthritis Cartilage* 1995; **3**: 269-73.
5. Merolla G, Sperling JW, Paladini P, Porcellini G. Efficacy of Hylan G-F 20 versus 6-methylprednisolone acetate in painful shoulder osteoarthritis: a retrospective controlled trial. 2011 Dec; **95**: 215-24. Epub 2011 May 13.

Original Article

A Feasibility Assessment of International Classification of Functioning, Disability and Health (ICF) Tool for Locomotion in Rural Community of Northern India

Dinesh Kumar¹, Bansal P² Bhardwaj Ashok Kumar³

Abstract

Background: ICF is a valid tool to assess the degree and extent of disability, functioning, and health among patients. Its use in population to assess the disability is often limited.

Aim: To assess the feasibility of ICF tool in community settings among patients with any signs and symptoms of locomotion.

Design: Community based survey was carried out to assess the disability.

Setting: The studied individuals were assessed during house to house survey in a rural area of Himachal Pradesh, India. Any individual with any signs and symptoms of disability associated to locomotion was interviewed by the trained medical social worker at their home.

Population: Total 82 individuals were interviewed to study the degree and extent of disability related to locomotion.

Methods: An ICF tool version 2.1a as recommended by World Health Organisation was used for assessment.

Results: A total 82 people whom 58.5% were assessed using ICF tool and 40.0% of males and 50.0% of females observed with no problem of impairment for locomotion. Among those who reported, moderate level of impairment related to joints was observed among 32.4% females and 31.3% males. Mild impairment for muscle power was present among 31.3% males and 29.4% of females. Assessment of extent of impairment observed that the lower limb was most commonly (about 40.0%) involved in both males and females. Both males and females were mostly observed with restricted performance for daily activities like using transportation, lifting/carrying of objects, walking and moving around using assisted equipment. About 47.9% and 31.3% of males responded that the design of building and technology for public use, as mild and moderate barrier respectively. Design of building for public use was observed as severe barrier among 38.2% of females.

Conclusions: Disability related to locomotor system involving lower extremities is most common form of disability. Mild to moderate level of impairment was observed among individuals with locomotor disability to carry out day to day activities.

Rehabilitation impact: ICF tool can be used to study the degree and extent of disability. A standard pattern of analysis and reporting the results would help to assess the effect of rehabilitative interventions in community settings.

Key words: ICF, feasibility, locomotion, community.

Author's affiliations:

¹ MD, Assistant professor

² MD, Associate professor

³ MD, Professor & HOD

Department of Community Medicine, Dr. Rajendra Prasad Government Medical College, Kangra, Himachal Pradesh, India.

Cite as:

Dinesh Kumar, Bansal P, Bhardwaj Ashok Kumar. A Feasibility Assessment of International Classification of Functioning, Disability and Health (ICF) Tool for Locomotion in Rural Community of Northern India. *IJPMR* June 2015; Vol 26(2): 38-42.

Correspondence:

Dr. Dinesh Kumar, Assistant Professor, Department of Community Medicine, Dr. Rajendra Prasad Government Medical College, Kangra, Himachal Pradesh, India. Email: dinesh9809@gmail.com

Received on 05/04/2013, Revised on 16/07/2014

Accepted on 29/06/2015

Introduction:

International Classification of Functioning, Disability and Health (ICF) is a valuable tool for assessing individual health status comprehensively. It constitutes complete spectrum of health and its functioning in various environmental conditions. It was approved in 54th assembly of World Health Organisation (WHO) and accepted as a valid reference standard for classification and documentation of functioning state of an individual and populations¹. The ICF Core Sets have been developed as a reference standard for reporting of functioning. These sets provide a list of ICF categories relevant to specific health conditions². It is a tool that categorises the factors influencing the health and helps to tailor the

social and clinical rehabilitative interventions to improve the individual functioning. Its value for patient care has been anticipated and studied in clinical and rehabilitative medicine³⁻⁵. Its feasibility assessment in community settings is limited. So, possible challenges in translating the ICF to map the disability and functioning status of individuals in community setting needs to be studied and documented. Therefore, the present study was planned to assess the feasibility while administering the ICF study tool among individuals self reported with problems related to locomotion in community settings of northern India.

Materials and Methods:

A community based survey was carried out in selected villages of Shahpur block of district Kangra of Himachal Pradesh State from October to December 2012. As per census 2011, the state has population of 68,56,509. The Shahpur block has population of 2,11,147 and almost 95.0% of population reside in rural area. A house to house survey was carried out by a medical social worker in town population of about 2000. A member of household was interviewed only if observed or reported with any signs and symptoms related to limitation of function or change in body structure related to locomotion. Then the International Classification of Functioning, Disability and Health (Version 2.1a)⁶ questionnaire was used to collect the information about locomotor functioning and disability of an individual.

The study tool consists of three main components. First, body functions and structures, which refer to physiologic functions and anatomical parts, respectively. Any loss or deviations from normal body structures is referred as impairments. Second component is activity, which refers to execution of task by the individual. Third component is participation referring involvement in life situations. An additional component studies the environmental status of a disabled individual. These components of body functions and structures, activities and participation, and environmental factors are classified based on ICF categories. The categories are denoted by the alpha numeric codes to classify functioning and disability. In each category of ICF, there are two levels of codes, and first level code shares attributes of next level of codes; for example: “b7 neuromuscular and movement related functions” which is first level and then “b710 mobility of joint” as a second level. The following part of activities were assessed as a core set;

Part 1a: Impairments of body functions

Impairments are problems in body function as a significant deviation or loss.

s730: Upper extremity (arm, hand), s740: Pelvis, s750: Lower extremity (leg, foot), s760 Trunk

First qualifier: extent of impairments

0=No impairment means the person has no problem, 1=Mild impairment means a problem that is present less than 25% of the time, with an intensity a person can tolerate and which happens rarely over the last 30 days, 2=Moderate impairment means that a problem that is present less than 50% of the time, with an intensity, which is interfering in the person’s day to day life and which happens occasionally over the last 30 days, 3=Severe impairment means that a problem that is present more than 50% of the time, with an intensity, which is partially disrupting the persons day to day life and which happens frequently over the last 30 days, 4=Complete impairment means that a problem that is present more than 95% of the time, with an intensity, which is totally disrupting the persons day to day life and which happens every day over the last 30 days, 8=Not specified means there is insufficient information to specify the severity of the impairment, 9=Not applicable means it is inappropriate to apply a particular code (e.g. b650 menstruation functions for woman in pre-menarche or post-menopause age).

Part 1 b: Impairments of body structures

- Body structures are anatomical parts of the body such as organs, limbs and their components.
- Impairments are problems in structure as a significant deviation or loss.

b710: Mobility of joint, b730: Muscle power, b765: Involuntary movements

First qualifier: extent of impairment (codes are the same as Part 1a)

Second qualifier: nature of the change

0=No change in structure, 1=Total absence, 2=Partial absence, 3=Additional part, 4=Aberrant dimensions, 5=Discontinuity, 6=Deviating position, 7=Qualitative changes in structure, including accumulation of fluid, 8=Not specified, 9=Not applicable

Part 2: Activity limitations and participation restriction

Respondent’s actual performance of a task or action in the person’s actual situation or surroundings, and elicits information about the effects of environmental barriers or facilitators. It is important to emphasise that you are only interested in the extent of difficulty the respondent has in doing things, assuming that they want to do them. Not doing something is irrelevant if the person chooses not to do it.

- In your present surroundings, how much of a problem do you actually have in walking long distances (such as a kilometre or more)?
- Is this problem walking made worse, or better, by your actual surroundings?
- Is your capacity to walk long distances without assistance more or less than what you actually do in your present surroundings?

Respondent focuses on his or her capacity to do a task or action, and in particular to focus on limitations in capacity that are inherent. These limitations should be direct manifestations of the respondent's health state, without the assistance (modified home, accessories or person etc). The level of capacity should be judged relative to that normally expected of the person, or the person's capacity before they acquired their health condition.

- In your present state of health, how much difficulty do you have walking long distances (such as a kilometre or more) without assistance?
- How does this compare with someone, just like yourself only without your health condition? (Or: "...than you had before you developed your health problem or had the accident?")

First qualifier: performance

Extent of participation restriction

Second qualifier: capacity (without assistance)

Extent of activity limitation

(For both the codes are the same as Part1a)

The enlisted codes were studied:

d430: Lifting and carrying objects, d440: Fine hand use (picking up, grasping), d450: Walking, d465: Moving around using equipment (wheelchair, skates, etc), d470: Using transportation (car, bus, train, plane, etc), d510: Washing oneself (bathing, drying, washing hands, etc), d520: Caring for body parts (brushing teeth, shaving, etc), d530: Toileting, d540: Dressing, d550: Eating, d560: Drinking, d570: Looking after one's health

Part 3: Environmental factors

Environmental factors make up the physical, social and attitudinal environment in which people live and conduct their lives.

Barrier: 0=No, 1=Mild, 2=Moderate, 3=Severe, 4=Complete

Facilitator: 0=No, 11=Mild, 12=Moderate, 13=Severe, 14=Complete

The enlisted codes were studied:

e110: For personal consumption (food, medicines), e115: For personal use in daily living, e120: For personal indoor and outdoor mobility and transportation, e125: Products for communication, e150: Design, construction and building products and technology of buildings for public use, e155: Design, construction and building products and technology of buildings for private use

For assessment of categories, the questions were asked in local language and assessment was done to ascertain the presence or absence of ICF codes relevant to locomotion. Once ascertained presence or absence of codes, and if present, the grade of response was filled immediately by the medical social worker. While assessing the response of the person, comprehensive assessment of environmental factors and interview of the family member was also done simultaneously. Prior ethical approval was obtained from Institutional Ethics Committee (IEC) and informed consent was also sought before administering the questionnaire. Descriptive analysis was done to report the survey findings.

Results:

Total 82 (58.5% males) people were assessed using ICF tool and it was observed that males reported more with impairment of body function related to locomotion. About 40.0% of males and 50.0% of females observed with no problem of impairment for locomotion. Moderate level of impairment related to joints was observed among 32.4% females and 31.3 % males. When assessed for muscle power, mild impairment was present among 31.3% males and 29.4% of females. Assessment of extent of impairment observed that the lower limb was most commonly (about 40.0%) involved in both males and females. Upper limb was involved in about 20.0% of males and 10.0% of females. In males, mild to severe level of impairment of lower extremities were observed among 10.0% to 12.0% of studied individuals. Whereas, moderate level of lower limb impairment was observed more among females (26.5%) as compared to males (12.5%). When assessed for nature of change, as compared to males, more females were observed with aberrant dimensions (20.6% *versus* 8.3%) and partial absence (11.8% *versus* 9.0%) of lower extremities. As compare to females, more (12.5%) of males reported with severe level of impairment for upper extremities and none of studied males and females were observed with change of structure for upper extremities, pelvis and trunk.

All individuals were assessed for limitation and

participation restriction in day to day activity. Both males and females were mostly observed with restricted performance for daily activities like using transportation, lifting/carrying of objects, walking and moving around using assisted equipment. Restriction in lifting/carrying of objects was of moderate level among 37.5% of males and 17.6% of females. When asked for walking, moderate level of performance was observed more in females (32.4%) than of males (14.6%). Complete impairment was observed for transportation use among 25.0% of males and 17.6% of females. Fine hand use was impaired completely among 18.8% of males and 14.7% of females. More than three-fourths of individuals did not observe with any limitation of performance for activities related to self care. Severe impairment of toileting was observed among 10.4% of males as compared to 2.9% of females.

When assessed for capacity to carry the works, male observed with more capacity limitation as compared to females. Among males, complete impairment of capacity was observed for using transportation (39.6%), fine hand use (33.3%) and walking (25.0%). Whereas, among females complete impairment was up to 23.6% for fine hand use and 20.6% for transportation use. Among males, moderate and severe impairment was observed as 22.9% and 25.0% for moving around while using equipment, 22.9% and 22.5% for lifting/carrying the objects, 14.6% and 18.8% for walking, and 16.7% and 12.5% for using transportation respectively. Mild to severe impairment in capacity was observed for lifting/carrying objects and transportation use among females.

Limitation in performance and capacity was observed less for activities related to self care. Among males, performance was severely impaired for toileting (10.4%), mild to moderate limitation was observed for dressing (12.5% and 16.7%), eating (16.7% and 8.3%), drinking (16.7% and 6.3%), toileting (10.4% and 6.3%) and washing oneself (12.5% and 2.3%). Capacity limitation was also observed more for dressing, eating, drinking and washing one self. Among females the performance and capacity impairment for self care activities were observed to be less as compared to males. In females, the impairment of performance and capacity was observed more for dressing and toileting.

Among males, assessment for environmental factors observed that product and technology use was observed more as a barrier than as facilitator. About 47.9% and 31.3% of males responded that the design of building and technology for public use, as mild and moderate barrier respectively. For private use of building, 48.3%

and 31.3% of males said as mild and moderate barrier respectively. Mild and moderate extent of barrier was observed respectively as, 29.2% and 37.5% for personal indoor and outdoor mobility, 31.3% and 20.8% for personal use in daily living, 35.4% and 12.5% for personal consumption of food and medicines. Similar pattern was observed among females, most of them responded products and technology in daily use as a barrier than the facilitator. Design of building for public use was observed as severe barrier among 38.2% of females. Mild and moderate extent of barrier was observed for personal indoor and outdoor mobility (44.1% and 38.2%), design of building for private use (35.5% and 26.5%), for products of communication (23.5% and 26.5%), personal use in daily living (35.3% and 11.8%) and personal use for food and medicines (14.7% and 17.6%).

Discussion:

In India, prevalence of disability has been reported as 2.0% in rural settings. State specific variation in disability is from 3.0% in Jammu and Kashmir to 1.6% in Maharashtra. Burden assessment of disability depends upon sensitivity and specificity of the measuring instrument. Study from rural setting observed prevalence of disability upto 6.0%⁷. In addition to assess the disability burden in population, the extent and factors influencing the functioning and disability also need to be studied in order to plan the rehabilitative measures.

The WHO has developed a consensus based valid ICF tool to measure functioning, disability and health. It has been considered as universally accepted model and taxonomy in human functioning³. So far, its use in extraction of relevant patient specific information for patient oriented management has been studied. However, its use in reporting the extent and type of limitations of functioning and disability in populations has not being studied. As locomotor system related disability is observed as most common form of disability⁸. In present survey, a feasibility assessment of using ICF tool was made among individuals reported with any signs and symptoms associated with locomotion. A trained medical social worker interviewed the individuals at their homes and recorded their responses. Once comprehend the rationale and interview technique it become easy to interpret and record the individual responses.

The locomotor assessment showed that the limitation of functions was more for movement (b710) and muscle power (b730). Limitation was observed to be more among males as compared to females. For both genders, the extent of impairment was observed mostly in lower

extremities (s750). Among studied females, partial absence and aberrant dimensions of lower extremities were reported as most common nature of change. The performance was observed to be restricted for moving around using equipment (d470), transportation use (d470), and walking (d450). Performance was also observed to be restricted for fine hand use (d440), lifting and carrying objects (d430). In addition to performance, the reduction in capacity to carry the above mentioned tasks associated to lower and upper extremities was found to be restricted. Both the limited performance and capacity to carry daily activities were found to be more among males than of females. Limited performance and capacity for activities related to self care was not observed among majority of studied individuals. Studied for environmental factors found that, most of males reported current design of buildings for public (e150) and private (e155) use as a barrier than the facilitator. As compared to females, more males reported the use of product and technology for personal consumption (e110) and personal use in daily living (e115) as a facilitator.

Disability related to locomotor system involving lower extremities is most common form of disability. Mild to moderate level of impairment was observed among individuals with locomotor disability to carry out day to day activities. Studied population considered insignificant outdoor environmental modifications (buildings for public and private use) which were serving as a barrier to impart the daily activities. Effective use of product and technology for daily activities serve as a facilitator and help to reduce the extent of disability.

This study provides an information that how ICF study tool can be use to assess the degree and extent of disability in group of individuals. Assessment of disability using ICF tool in community settings provides an opportunity to assess the individual health comprehensively. However, it becomes very important for an interviewer to well worse with the objective and methodology of assessment. The way of asking the questions and ascertaining the code to

qualify for extent of disability requires training. Being a valid tool for assessing the health and disability, a standard method of reporting the results-especially for group level data- is also vital. It will serve as a foundation to initiate or reorient the rehabilitative policies for disabled persons. Effective evaluation of the rehabilitative policies can also be studied in community settings using the ICF tool. Formulation of standard method of analysis and reporting would certainly help to communicate the findings to the policy makers and programme managers to formulate the healthy public policy.

Conclusions:

It is feasible to administer the ICF tool to assess the degree and disability in community settings. Being a valid tool, a standard method of analysis and reporting of findings from community based assessment helps to assess the effect of the rehabilitative measures.

References:

1. Cieza A, Stucki G. The International Classification of Functioning Disability and Health: its development process and content validity. *Eur J Phys Rehabil Med* 2008; **44**: 303-13.
2. Stucki G, Kostanjsek N, Ustün B, Cieza A. ICF-based classification and measurement of functioning. *Eur J Phys Rehabil Med* 2008; **44**: 315-28.
3. Stucki G, Ewert T, Cieza A. Value and application of the ICF in rehabilitation medicine. *Disabil Rehabil* 2002; **24**: 932-8.
4. Rauch A, Cieza A, Stucki G. How to apply the International Classification of Functioning, Disability and Health (ICF) for rehabilitation management in clinical practice. *Eur J Phys Rehabil Med* 2008; **44**: 329-42.
5. Boonen A, Maksymowych WP. Measurement: function and mobility (focussing on the ICF framework). *Best Pract Res Clin Rheumatol* 2010; **24**: 605-24.
6. Ganesh KS, Das A, Shashi JS. Epidemiology of disability in a rural community of Karnataka. *Indian J Public Health* 2008; **52**: 125-9.
7. World Health Organization. International Classification of Functioning, Disability and Health: ICF. Geneva: WHO, 2001.
8. National sample Survey Organization. A report in disabled persons. Department of Statistics. New Delhi: Government of India 2002.

Concurrent and Discriminative Validity of the Mini Balance Evaluation Systems Test (miniBESTest) in People with Parkinson's Disease

Margaret KY Mak

Abstract

Purpose. To examine the concurrent and discriminative validity of the miniBESTest in individuals with Parkinson's disease (PD).

Method: Thirty-four individuals with PD participated in study 1. Thirty-one healthy subjects and 127 individuals with PD completed study 2. All participants were assessed at the University Balance and motion analysis laboratory. Balance performance was assessed using the miniBESTest and Berg's balance scale (BBS). Self-perceived balance confidence level of subjects was measured by the activities-specific balance confidence (ABC) scale.

Results: In study 1, results of Pearson's correlation showed that the scores of the miniBESTest correlated well with BBS ($r=0.765$; $p<0.001$) and moderately well with ABC scores ($r=0.587$; $p<0.001$). For study 2, results of one-way analysis of variance demonstrated significant differences in miniBESTest scores among healthy subjects, PD non-fallers (PD-NF) and PD fallers (PD-F). Healthy subjects obtained the highest mini-BESTest score of $88.2 \pm 8.9\%$, followed by PD-NF ($73.6 \pm 14.7\%$) and PDF ($57.1 \pm 17.0\%$) (all $p<0.001$). Significant differences were also observed among healthy subjects, PD-NF and PD-F for each miniBESTest domain score (all $p<0.05$).

Conclusion: The miniBESTest is a valid method to document balance performance in individuals with PD. Both total and domain miniBESTest scores could differentiate between healthy subjects, PD-NF and PD-F.

Key words: Accidental falls, measure, balance, stability, Parkinson's disease.

Introduction:

Falls are a serious problem in people with Parkinson's disease (PD). In a 20-year prospective follow-up study¹, it was reported that 87% of individuals with PD had one or more falls and 35% sustained a fracture as a result of falling. Falls lead to devastating consequences such as restriction of mobility, physical deterioration and early institutionalisation². Evaluation of balance and mobility is important to determine the risk of falling

for individuals with PD and the efficacy of treatment in this patient population. Berg's balance scale (BBS), a multi-factorial measure of functional balance ability, is commonly used to assess balance performance³, and has been found to be reliable and valid for use in individuals with PD⁴. It tests a person's balance ability during sitting, standing, transfer, and stepping activities, and is relatively safe and easy to administer. However, the emphasis of BBS is on functional performance and disregards important aspects of dynamic balance control such as the ability to respond to external perturbation, the ability to maintain balance following different sensory inputs, and stability during walking activities.

A new clinical tool called the balance evaluation systems test (BESTest) has been reported⁵. It is a comprehensive assessment tool that aims to identify impaired balance systems that underlie poor functional balance ability and to focus on specific training strategies. It comprises 36 items that are classified into six domains, i.e., biomechanical constraints, stability limits/verticality, sensory organization, anticipatory postural adjustments, postural responses, and dynamic balance during gait. This

Author's affiliations:

¹ Associate Professor

Department of Rehabilitation Sciences, The Hong Kong Polytechnic University, Hong Kong

Cite as:

Margaret KY Mak. Concurrent and discriminative validity of the mini balance evaluation systems test (miniBESTest) in people with Parkinson's disease. *IJPMR* June 2015; Vol 26(2): 43-8.

Correspondence:

Margaret Mak, Associate Professor
Department of Rehabilitation Sciences, The Hong Kong Polytechnic University, Hung Hom, Hong Kong
Tel: 852 2766 6708, Fax: 852 2330 8656
Email: rsmmak@inet.polyu.edu.hk

Received on 19/11/2013, Accepted on 29/06/2015

comprehensive test was found to be reliable and valid in assessing balance performance in 22 subjects with or without balance disorders⁵. However, it takes about 40 min to administer, which reduces its application in clinical use. In response to this limitation, Franchignoni *et al*⁶ simplified the BESTest to a miniBESTest which can be completed within 15 minutes. Twenty-four items which were found to represent a uni-dimensional construct of dynamic balance were selected from the BESTest by factor analysis. Rasch analysis was used to delete a further 10 items which showed a misfit or high local dependency. The remaining 14 items comprise four domains, sensory organisation, anticipatory postural adjustments, postural responses, and dynamic balance during gait. The miniBESTest was validated in a convenience sample of patients with balance disorders resulting from various neurological conditions including hemiparesis, PD, neuromuscular diseases, ataxia, multiple sclerosis and traumatic brain injury⁶. For the miniBESTest to be used in the evaluation of individuals with PD, it was essential to examine its validity in this patient group. In addition, it was crucial to examine whether it could distinguish between healthy subjects, PD fallers (PD-F) and PD non-fallers (PD-NF).

The present study consisted of two inter-related studies. Study 1 aimed to examine the concurrent validity of the miniBESTest by hypothesising that it would correlate with BBS, a well established balance performance test, and the subjective activity-specific balance confidence scale (ABC). Study 2 aimed to explore the discriminative validity of the miniBESTest by hypothesising that the scores of miniBESTest could distinguish between healthy subjects, PD-NF, and PD-F.

Materials and Methods:

Subjects:

Studies 1 and 2 were cross-sectional comparative studies on two groups of individuals with PD and healthy older adults. Individuals with PD were recruited from the Hong Kong PD Association, a patient self-help group, and healthy subjects were recruited from local health centres for the aged. All participants joined the studies on a volunteer basis. Individuals with PD had to be aged 40 years or above, to be diagnosed with idiopathic PD by neurologists⁷, to be on levodopa treatment, to be able to stand independently and walk with or without an assistive device for a distance of 6m and for a duration of 1 minute, and to have cognitive function adequate for participation in the study, with a mini mental status examination score of 23 or above⁸. Individuals with

neurologic conditions other than PD, cardiovascular, orthopaedic or vestibular impairment that would limit their balance or the ability to initiate gait, visual and hearing problems, or the presence of severe on/off L-dopa motor fluctuations or dyskinesia were excluded from this study. The inclusion and exclusion criteria of healthy subjects were similar to those of the patient group except that they did not have PD. Ethical approval was obtained from the University Ethics Committee. All participants gave informed consent according to the declaration of Helsinki prior to data collection.

Procedures:

All tests were carried out at the Balance and Motion Analysis Laboratory of the Hong Kong Polytechnic University. All individuals with PD were tested once during the on-phase of anti-parkinsonian medication, i.e., within 1-2 hours after taking their medications. The assessment was performed by a physiotherapist who was blinded to the research questions. Demographic data, duration of PD since diagnosis, time since last anti-PD medication prior to the examination, and history of falls were collected. Fallers were defined as subjects having had two or more falls in the previous 12 months⁹. The Hoehn and Yahr (HY) scale was used to quantify the severity level of PD¹⁰, and ranged from stage 0 to 5, where the higher value indicates more severe PD. The Unified Parkinson disease rating scale-motor examination (UPDRS-III) scores were used to measure the level of impairment and disability in individuals with PD¹¹. The UPDRS-III comprises 14 items with 27 distinct functions that document speech, facial expression, tremor, rigidity, agility, posture, bradykinesia, and postural and functional activities. Each item is scored from 0 to 4, where a higher score implies greater impairment of motor function. The total UPDRS-III score ranges from 0 to 108.

The BBS comprises 14 items that cover maintenance of static posture and balance ability during standing. Each item is scored on a four-level ordinal scale from 0 (worst performance) to 4 (best performance), with a total score of 0-56. The test-retest reliability of BBS was reported to be excellent (ICC=0.97)¹². The miniBESTest comprises 14 items that cover four domains of balance and mobility tasks: anticipatory postural adjustment, response to perturbation, sensory orientation, and dynamic stability in gait with or without a concurrent task. Each item is scored from on a three-level ordinal scale from 0 (worst performance) to 2 (best performance). Total miniBESTest scores and scores under each domain are presented as a percentage of the total score range from

0 to 100⁶. The miniBESTest was found to have good test-retest reliability (ICC=0.86)⁶. Both the BBS and the miniBESTest can be completed within 15 minutes. The validated Chinese version of the ABC scale was used to provide an estimate of fear of falling¹³, and was shown to have excellent test-retest (ICC=0.99) and good inter-test reliability (ICC=0.85)¹³. Subjects were asked to rate their self-perceived level of balance confidence from 0 (no confidence at all) to 100 (full confidence) for completing 16 activities of daily living. The mean score of the 16 activities was calculated, ranging from 0 to 100; a low ABC score reflected greater fear of falling.

Statistical analysis:

All data were analysed using SPSS version 17 (SPSS Inc., Chicago, USA). The normality of all continuous data was checked using the Kolomogorov-Smirnov test. For study 1, parametric Pearson’s r or non-parametric Spearman’s rho was used to evaluate the correlation between the miniBESTest and BBS, and between the miniBESTest and ABC, depending on the normality of the data. For study 2, if data were normally distributed, differences between healthy subjects, PD-NF and PD-F for demographics, miniBESTest scores and miniBESTest domain scores were analysed by one-way analysis of variance (ANOVA) with post-hoc Tukey tests. Gender of the subjects (nominal data) was tested using the Chi-square test. Ordinal data and data that did not meet the criterion of normality were analysed using Kruskal-Wallis and Mann-Whitney U tests with bonferroni correction for post-hoc tests. The level of significance was 0.05.

Results:

Study 1: Thirty-four individuals (20 men and 14 women) with PD completed the study. The mean age of the participants was 63.1±9.3 years, and their mean body weight and height were 58.7±9.4 kg and 160.6±8.1 cm,

respectively. The individuals had PD for 7.6±5.3 years, had HY stages of 2.1±0.7, and UPDRS-III of 20.4±8.3, indicating mild to moderate levels of disease severity and motor impairment. They had a mean BBS score of 51.9±5.2, miniBESTest score of 70.6±17.5%, and ABC score of 76.6±20.4. Results of Pearson’s correlation showed that the miniBESTest scores correlate well with BBS (r=0.765; p<0.001) and moderately well with ABC (r=0.587; p<0.001)¹⁴.

Study 2: After the completion of study 1, we invited all participants to join study 2, and 20 of them agreed to join the study. Thirty-one healthy subjects and 127 individuals with PD completed study 2. Table 1 shows no significant difference in subject characteristics among healthy subjects, PD-NF and PD-F. It also shows that PD-F had a significantly longer duration of PD (p=0.01), a significantly higher HY score (p<0.001) and a higher UPDRS-III score (p=0.001) compared with PD-NF, indicating that PD-F had more severe PD and greater motor impairment than PD-NF. Results of one-way ANOVA demonstrated significant differences among healthy subjects, PD-NF and PD-F for miniBESTest scores (Table 2). Healthy subjects obtained the highest mini-BESTest score of 88.2 ± 8.9%, followed by PD-NF (73.6±14.7%) and PD-F (57.1±17.0%) (all p<0.001). Results also showed significant differences among the three subject groups for all miniBESTest domains (all p<0.05; Table 2).

Discussion:

The study generated two new findings. First, the miniBESTest is a valid measure of balance performance in individuals with PD as its scores correlated well with those of BBS and ABC. Second, the miniBESTest has good discriminative validity as both its total and domain scores were able to distinguish between healthy subjects, PD-NF and PD-F.

Table 1: Subject Characteristics

Demographics	C (n=31)	PD-NF (n=94)	PD-F (n=33)	P-value		
				C versus PD-NF	C versus PD-F	PD-NF versus PD-F
Age (years)	62.6±9.3	62.1±9.9	65.2±7.4		0.258	
Weight (kg)	58.7±10.9	59.0±9.9	59.1±10.9		0.983	
Height (cm)	157.1±8.5	160.9±7.9	160.4±7.3		0.063	
Gender (Female)	17	38	16	0.161	0.611	0.420
MMSE score (0-30)	28.3±2.1	28.0±2.6	27.5±2.8		0.432	
PD duration (years)	—	6.4±4.9	9.6±6.2	—	—	0.010*
HY score (0-5)	—	2.3±0.6	2.7±0.6	—	—	<0.001*
UPDRS-III score (0-108)	—	25.2±11.0	32.7±9.9	—	—	0.001*

* P <0.05; C: Control subjects; PD-NF: Parkinsonian non-fallers; PD-F: Parkinsonian fallers; MMSE: Mini-mental state examination; HY: Hoehn and Yahr staging; UPDRS: Unified Parkinson’s disease rating scale

Table 2: Comparisons of the Total and Domain Scores of MiniBESTest Among Healthy Subjects, PD Non-fallers and PD Fallers

Variables	C (n=31)	PD-NF (n=94)	PD-F (n=33)	P-value		
				C versus PD-NF	C versus PD-F	PD-NF versus PD-F
Mini-BEST score (0-28)	24.7±2.5	20.6±4.1	16.0±4.8	<0.001*	<0.001*	<0.001*
Mini-BEST score (0-100%)	88.2±8.9	73.6±14.7	57.1±17.0	<0.001*	<0.001*	<0.001*
Anticipatory transitions (0-100%)	93.0±10.3	78.5±17.7	62.6±22.4	<0.001*	<0.001*	<0.001*
Postural responses (0-100%)	81.7±22.1	57.4±33.5	27.3±26.3	<0.001*	<0.001*	<0.001*
Sensory orientation (0-100%)	95.7±9.6	84.0±19.7	69.2±23.2	0.010*	<0.001*	<0.001*
Dynamic gait (0-100%)	84.8±13.1	74.1±13.5	64.5±18.9	0.002*	<0.001*	0.004*

* P <0.05; C: Control subjects; PD-NF: Parkinsonian non-fallers; PD-F: Parkinsonian fallers; Mini-BEST: Mini Balance Evaluation System Test

Concurrent validity: BBS is the gold standard tool for clinical balance assessment for people with balance disorders. Its use in individuals with PD has also been validated⁴. Leddy *et al*¹⁵ reported that the BESTest score had high correlation with BBS score ($r=0.873$). We found that there was good correlation between simplified miniBESTest and BBS scores ($r=0.765$)¹⁴. The satisfactory concurrent validity with BBS suggests that the miniBESTest is a valid test of balance performance in individuals with PD. Apart from three items (sit-to-stand, single-leg stance, and standing with feet together) that are similar in both the miniBESTest and BBS, BBS focuses on measuring balance performance during standing while the miniBESTest assesses balance during both standing and walking activities. The miniBESTest comprises five items that challenge subjects' balance during walking at changing speeds, walking with the head turned, walking with pivot turns, stepping over obstacles, and walking while performing a concurrent task. Since most fall-related activities occur during walking in individuals with PD¹⁶⁻¹⁸, the miniBESTest could be more specific for assessing their balance performance. In addition, the miniBESTest assesses compensatory stepping responses whereas BBS does not include any test on postural responses. A poor and inflexible postural response to external perturbations such as slow and small amplitude of step responses has been reported to relate to balance deficits in individuals with PD¹⁹⁻²¹. Among the available clinical tests, the retropulsion test was found to be the most valid for postural instability in individuals with PD²², and is included in the UPDRS to assess postural instability. The inclusion of this domain shows that the miniBESTest is specific to address balance performance in individuals with PD. In the present study, the mean BBS score of the participants was 51.9 (out of 56) and the mean miniBESTest score was 70.6% (out of 100%), which indicates that BBS could potentially show a ceiling effect

in the evaluation of balance performance in individuals with PD^{23,24}.

In this study, a moderate correlation was found between miniBESTest and ABC scores in individuals with PD, which was consistent with a positive correlation between BESTest and ABC scores in a group of patients with various neurological disorders⁵. Our findings confirmed that poor balance performance in the miniBESTest was associated with a reduced level of self-perceived confidence or greater fear of falling. The latter was found to be associated with falls and was a significant predictor of future falls in people with PD^{25,26}. This further supports the validity of the miniBESTest to measure balance deficits in individuals with PD who had mild to moderate disability.

Discriminative validity: Horak *et al*⁵ reported that healthy subjects had significantly higher BESTest scores than individuals with PD. We confirmed these results and also found that PD-NF had significantly higher scores than PD-F. The sensitivity of the miniBESTest to discriminate between these three groups of subjects supports the second hypothesis that the miniBESTest has good discriminative validity. In the present study, fallers were defined as individuals who had at least two falls in the previous 12 months because recurrent falls are more likely to have a disabling impact on an individual's life²⁷. The lower miniBESTest score attained by both PD-NF and PD-F in comparison with healthy subjects implied that they had poorer dynamic balance ability and explained their higher risk of falling.

When the four domains of the miniBESTest were examined, we further found that individuals with PD had poorer performance than control subjects in every domain, and that significant differences existed between PD-NF and PD-F. Among the four domains, PD-F had exceptionally low scores in 'postural response'. The

commonly perceived causes of falls in individuals with PD were tripping and slipping¹⁸. However, individuals with PD demonstrated longer latencies, shorter steps and slower step velocity for postural correction in both lateral²⁸ and anterior-posterior directions²⁹. Individuals with PD also had difficulty in selecting appropriate postural response strategies to regain balance and in altering their response with a change in the direction of the perturbation³⁰. A poor postural response would increase the risk of falling. Anticipatory postural adjustments are made by postural muscles that are activated in a feed-forward manner prior to an expected perturbation³¹. People with PD have been shown to exhibit anticipatory postural adjustment with prolonged duration and reduced amplitude^{32,33}. A low score in the domain ‘anticipatory postural adjustments’ could increase the risk of falling during transfer and sit-to-stand^{16,18}.

PD-F had poorer scores than PD-NF in the domain ‘sensory orientation’ especially under conditions of standing on foam and an inclined stance. Individuals with PD were found to have impaired proprioceptive integration and rely more heavily on visual feedback when their equilibrium was challenged^{29,34}. Under blindfold conditions, individuals with PD and especially PD-F might have difficulty to use proprioceptive sensation to maintain their balance. Dynamic gait stability challenges subjects with regard to walking at different speeds, with pivot turns and while performing concurrent motor tasks (i.e., head turning, stepping over obstacles) and concurrent cognitive tasks of counting backwards. Walking and turning are the most common activities that cause falls¹⁶⁻¹⁸. People with PD were found to be unable to modulate their gait speed and walk at a slow pace³⁵. Turning was difficult irrespective whether the angle was small or large^{17,36-38}. Dual-task walking was more difficult than walking alone³⁹⁻⁴¹ and PD-F had worse dual-task walking performance than PD-NF⁴². The low score obtained by both PD-NF and PD-F shows that this domain is specific for assessing individuals with PD. Our findings support that the domain scores of the miniBESTest are sensitive to discriminate between healthy subjects, PD-NF and PD-F.

This study has several limitations. First, we examined ambulatory, community-dwelling people with PD, as their relatively higher level of mobility would presumably expose them to a greater number of situations where they would be at risk of falling. The findings of the present study could apply to PD subjects who have no comorbidity but could not be generalized to individuals with PD at all ambulatory stages or those who live in

institutions. Second, this is a cross-sectional study and a causal relationship between falls and miniBESTest scores could not be established. Future studies should examine the use of the miniBESTest to assess balance performance in a larger sample of patients at all stages of the disease, and with different levels of mobility. Further prospective study is needed to examine the ability of the miniBESTest to predict future falls and to determine a cut-off score for the prediction of falls in people with PD.

To conclude, the study established the concurrent and discriminative validity of miniBESTest in individuals with PD. The miniBESTest should be a useful measurement tool to quantify the balance deficits in PD populations.

Clinical messages:

- MiniBESTest is found to be a valid measure of balance performance in individuals with Parkinson’s disease.
- Both total and domain miniBEST score discriminate between healthy subjects, Parkinsonian non-fallers and Parkinsonian fallers

Acknowledgements:

The author would like to thank KT Kam, KL Li, MY Tsui and NC Wong for their assistance in data collection and data entry and all subjects for their participation.

References:

1. Hely MA, Reid WGJ, Adena MA, Halliday GM, Morris JGL. The Sydney Multicenter Study of Parkinson’s Disease: The inevitability of dementia at 20 years. *Mov Disord* 2008; **23**: 837-44.
2. Hely MA, Morris JG, Traficante R, Reid WG, O’Sullivan DJ, Williamson PM. The Sydney multi-centre study of Parkinson’s disease: progression and mortality at 10 years. *J Neurol Neurosurg Psychiatry* 1999; **67**: 300-7.
3. Berg KO, Wood-Dauphinee SL, Williams JI, Maki B. Measuring balance in the elderly: validation of an instrument. *Can J Public Health* 1992; **83**: 7-11.
4. Qutubuddin AA, Pegg PO, Cifu DX, Brown R, Mcnamee S, Carne W. Validating the Berg Balance Scale for patients with Parkinson’s disease: a key to rehabilitation evaluation. *Arch Phys Med Rehabil* 2005; **86**: 789-92.
5. Horak FB, Wrisley DM, Frank J. The Balance Evaluation Systems Test (BESTest) to differentiate balance deficits. *Phys Ther* 2009; **89**: 484-98.
6. Franchignoni F, Horak F, Godi M, Nardone A, Giordano A. Using psychometric techniques to improve the Balance Evaluation Systems Test: The Mini-BESTest. *J Rehabil Med* 2010; **42**: 323-31.
7. Hughes AJ, Daniel SE, Kilford L, Lees AJ. Accuracy of clinical diagnosis of idiopathic Parkinson’s disease: a clinico-pathological study of 100 cases. *J Neurol Neurosurg Psychiatry* 1992; **55**: 181-4.

8. Folstein MF, Folstein SE, McHugh PR. "Mini-Mental State": a practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res* 1975; **12**: 189-98.
9. Dibble LE, Lange M. Predicting falls in individuals with Parkinson disease: a reconsideration of clinical balance measures. *J Neurol Phys Ther* 2006; **30**: 60-7.
10. Hoehn MM, Yahr MD. Parkinsonism: onset, progression and mortality. *Neurology* 1967; **17**: 427-42.
11. Fahn S, Elton RL, Members of the UPDRS Developmental Committee. Unified Parkinson's disease rating scale. In: Fahn S, Marsden CD, Calne DB, Goldstein M, editors. Recent Developments in Parkinson's Disease. Vol 2. Florham Park: Macmillan Health Care Information, 1987: 153-63.
12. Conradsson M, Lundin-Olsson L, Lindelof N, Littbrand H, Malmqvist L, Gustafson Y, et al. Berg Balance Scale: intrarater test-retest reliability among older people dependent in activities of daily living and living in residential care facilities. *Phys Ther* 2007; **87**: 1155-63.
13. Mak MK, Lau AL, Law FS, Cheung CC, Wong IS. Validation of the Chinese translated Activities-specific Balance Confidence Scale. *Arch Phys Med Rehabil* 2007; **88**: 496-503.
14. Portney LG, Watkins MP. Foundations of Clinical Research: Applications to Practice. 2nd ed. Upper Saddle River: Prentice Hall Health, 2000.
15. Leddy AL, Crouner BE, Earhart GM. Functional gait assessment and Balance Evaluation System Test: reliability, validity, sensitivity and specificity for identifying individuals with Parkinson Disease who fall. *Phys Ther* 2011; **91**: 102-13.
16. Bloem BR, Grimbergen YA, Cramer M, Willemsen M, Zwiderman AH. Prospective assessment of falls in Parkinson's disease. *J Neurol* 2001; **248**: 950-8.
17. Ashburn A, Stack E, Ballinger C, Fazakarley L, Fitton C. The circumstances of falls among people with Parkinson's disease and the use of Falls Diaries to facilitate reporting. *Disabil Rehabil* 2008; **30**: 1205-12.
18. Mak MKY, Pang MYC. Parkinsonian single fallers versus recurrent fallers: different fall characteristics and clinical features. *J Neurol* 2010; **257**: 1543-51.
19. Horak FB, Nutt JG, Nashner LM. Postural inflexibility in Parkinsonian subjects. *J Neurol Sci* 1992; **111**: 46-58.
20. Bloem BR, Hausdorff JM, Visser JE, Giladi N. Falls and freezing of gait in Parkinson's disease: a review of two interconnected, episodic phenomena. *Mov Disord* 2004; **19**: 871-84.
21. Benatru I, Vaugoyeau M, Azulay JP. Postural disorders in Parkinson's disease. *Neurophysiol Clin* 2008; **38**: 459-65.
22. Visser M, Marinus J, Bloem BR, Kijes H, Van Den Berg BM, Van Hilten JJ. Clinical tests for the evaluation of postural instability on patients with Parkinson's Disease. *Arch Phys Med Rehabil* 2003; **84**: 1669-74.
23. Steffen T, Seney M. Test-retest reliability and minimal detectable change on balance and ambulation tests, the 36-item short-form health survey and the unified Parkinson Disease rating scale in people with parkinsonism. *Phys Ther* 2008; **88**: 733-46.
24. Tanji H, Gruber-Baldini AL, Anderson KE, Pretzer-Aboff I, Reich SG, Fishman PS, et al. A comparative study of physical performance measures in Parkinson's disease. *Mov Disord* 2008; **23**: 1897-905.
25. Mak MKY, Pang MYC. Balance confidence and functional mobility are independently associated with falls in people with Parkinson's disease. *J Neurol* 2009; **256**: 742-9.
26. Mak MKY, Pang MYC. Fear of falling is independently associated with recurrent falls in patients with Parkinson's disease: a 1-year prospective study. *J Neurol* 2009; **256**: 1689-95.
27. Delbaere K, Close JCT, Brodaty H, Sachdev P, Lord SR. Determinants of disparities between perceived and physiological risk of falling among elderly people: cohort study. *BMJ* 2010; **341**: 4165.
28. King LA, Horak FB. Lateral stepping for postural correction in Parkinson's disease. *Arch Phys Med Rehabil* 2008; **89**: 492-9.
29. Jacobs JV, Horak FB. Abnormal proprioceptive-motor integration contributes to hypometric postural responses of subjects with Parkinson's disease. *Neuroscience* 2006; **141**: 999-1009.
30. Jacobs JV, Horak FB. External postural perturbations induce multiple anticipatory postural adjustments when participants cannot pre-select their stepping foot. *Exp Brain Res* 2007; **179**: 29-42.
31. Aruin AS, Forrest WR, Latash ML. Anticipatory postural adjustments in conditions of postural instability. *Electroencephalogr Clin Neurophysiol* 1998; **109**: 350-9.
32. Burleigh-Jacobs A, Horak FB, Nutt JG, Obeso JA. Step initiation in Parkinson's disease: influence of levodopa and external sensory triggers. *Mov Disord* 1997; **12**: 206-15.
33. Jacobs JV, Horak FB, Lou JS, Kraakevik JA. The supplementary motor area contributes to the timing of the anticipatory postural adjustment during step initiation in participants with and without Parkinson's disease. *Neuroscience* 2009; **164**: 877-85.
34. Vaugoyeau M, Viel S, Assaiante C, Amblard B, Azulay JP. Impaired vertical postural control and proprioceptive integration deficits in Parkinson's disease. *Neuroscience* 2007; **146**: 852-63.
35. Morris ME, Ianssek R, Matyas TA, Summers JJ. Stride length regulation in Parkinson's disease: normalization strategies and underlying mechanisms. *Brain* 1996; **119**: 551-68.
36. Huxham F, Baker R, Morris ME, Ianssek R. Footstep adjustments used to turn during walking in Parkinson's disease. *Mov Disord* 2008; **23**: 817-23.
37. Mak MKY, Patla A, Hui-Chan CWY. Sudden turn during walking is impaired in people with Parkinson's disease. *Exp Brain Res* 2008; **190**: 43-51.
38. Stack E, Ashburn A. Dysfunction turning in Parkinson's disease. *Disabil Rehabil* 2008; **30**: 1222-9.
39. O'Shea S, Morris ME, Ianssek R. Dual task interference during gait in people with Parkinson disease: effects of motor versus cognitive secondary tasks. *Phys Ther* 2002; **82**: 888-97.
40. Rochester L, Hetherington V, Jones D, Nieuwboer A, Willems AM, Kwakkel G, et al. Attending to the task: interference effects of functional tasks on walking in Parkinson's disease and the roles of cognition, depression, fatigue, and balance. *Arch Phys Med Rehabil* 2004; **85**: 1578-5.
41. Yogeve G, Giladi N, Peretz C, Springer S, Simon ES, Hausdorff JM. Dual tasking, gait rhythmicity and Parkinson's disease: which aspects of gait are attention demanding? *Eur J Neurosci* 2005; **22**: 1248-56.
42. Plotnik M, Dagan Y, Gurevich T, Giladi N, Hausdorff JM. Effects of cognitive function on gait and dual tasking abilities in patients with Parkinson's disease suffering from motor response fluctuations. *Exp Brain Res* 2011; **208**: 169-79.

Pictorial CME

Camptodactyly – A Rare Condition for Hand Rehabilitation

Pramanik R

A 16 months old male child presented to PMR OPD for correction and rehabilitative management of hand deformity (Fig 1) noticed by his parents since birth, the parents became concerned about the deformity from very early days and consulted various neonatologist, paediatrician and orthopaedicians, at last he has been referred to plastic surgeon for surgical correction which was not practically feasible option. Then the child was referred to the department of PMR for deformity correction.

When we examined the baby we saw there is ulnar deviation of index and middle fingers of both hands without any other obvious skeletal deformity. But

interestingly we noticed a similar type of deformity in the mother's hand (Fig 2). On further systemic examination we did not find any organ abnormality including cardiac problem. Hence we diagnosed the case as camptodactyly.

Although we did an x-ray of both hands to rule out any bending of phalanx to rule out clinodactyly (Fig 3). Not only that the above examination and investigations also ruled out any possibility of Kirner syndrome because there is no bending of the distal phalanx.

We counselled the parents regarding the clinical condition and put him on resting hand splint for correction of the deformity and advised to continue the follow-up for further management.



Fig 1– Hand Deformity



Fig 2– Mother's Deformed Hand



Fig 3– X-ray Showing Bending of Phalanx

Author's affiliations:

MD, MRCP (UK), Associate Professor, PMR, IPGME&R, Kolkata

Cite as:

Pramanik R. Camptodactyly—a rare condition for hand rehabilitation. IJPMR June 2015; Vol 26(2): 53.

PG Forum

REHAB QUIZ

1. **Which of the following micro processor knee uses artificial intelligence function?**
 - a. Nabtesco hybrid knee
 - b. Ossur rheo knee
 - c. Ottobock C-Leg
 - d. All of the above
2. **For myoelectric prosthesis the minimum amount EMG Voltage required is?**
 - a. 15 micro volt
 - b. 25
 - c. 10
 - d. 25
3. **Scaphoid pad is used for?**
 - a. Scaphoid fracture
 - b. FECC injury
 - c. Medial long.Arch support
 - d. None of these
4. **What is protrusio acetabuli?**
 - a. Peripheral displacement of the acetabulum resulting in impingement
 - b. Intrapelvic displacement of the medial wall of the acetabulum
 - c. Posterolateral subluxation of the femoral head
 - d. Concentric osteophyte formation of the acetabulum
5. **You have a patient with a right AKA and a prosthesis. When assessing his gait, you note a lateral trunk lean towards the prosthetic side. What do you suspect?**
 - a. Prosthesis too short
 - b. Hip adduction contracture
 - c. Prosthesis in adduction alignment
 - d. Prosthesis too long
6. **PCL-deficient knee puts more force on the:**
 - a. ACL
 - b. Posterior compartment
 - c. Lateral compartment
 - d. Patellofemoral compartment
7. **A discharge appears “tornadic” on the screen with a rate of 200Hz. The sound is best described as continuous and high frequency. What is the most likely diagnosis?**
 - a. Cramp potentials
 - b. Isaac’s syndrome
 - c. Myasthenia gravis
 - d. Myotonia congenitalis
8. **A 39-year-old, overweight police officer presents to clinic with a 4-week complaint of severe lateral left thigh burning. Manual muscle testing is normal. No rash is appreciated. A lumbar MRI and pelvis CT are normal. What do you expect to find on EMG?**
 - a. Large MUAPs
 - b. Decreased CMAP latency at over the vastus lateralis
 - c. The EMG will be normal
 - d. Positive sharp waves and fibs in L2 innervated muscles
9. **What percentage of patients does not fully recover from adhesive capsulitis?**
 - a. 10%
 - b. 25%
 - c. 15%
 - d. 20%
10. **In which of the following conditions is a Milwaukee CTLSO contra-indicated?**
 - a. Skeletal immaturity
 - b. Idiopathic scoliosis
 - c. Thoracolumbar curves
 - d. Curves greater than 60 degrees

ANSWERS

Answer keys to March 2015

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

PG Forum

REHAB CHALLENGES

A 26 years old male patient presented to PMR OPD with spastic quadriplegia and immobility since last 2 years due to a compressive myelopathy after a road traffic accident. He was treated by neurosurgeons for initial few months and became haemodynamically stable within few days though there is no significant neurological recovery over the months. Thereafter patient was poorly managed mainly at home with little bit of unsupervised physiotherapy.

When we examined the patient in our indoor we found around grade 3 spasticity in ankle planti-flexors and hamstrings bilaterally, that was managed by stretching, medication and chemical neurolysis followed by tone inhibiting orthosis and gait training. He achieved reasonable indoor independent mobility with the above indoor management.

But patient was struggling to manage his ADL due to poor ROM of both elbows though hand function improved little bit with conservative management (Fig 1). X-ray (Fig 2) of both elbow joint picked up significant heterotrophic ossification bilaterally limiting his elbow movement. Further investigation like CT scan of elbow (Fig 3) also confirmed heterotrophic ossification with very close proximity to elbow joint.

Now the patient is very much keen to go back to his normal job which requires good amount of upper limb function. Please opine regarding further rehabilitative management of this young gentleman.



Fig 1



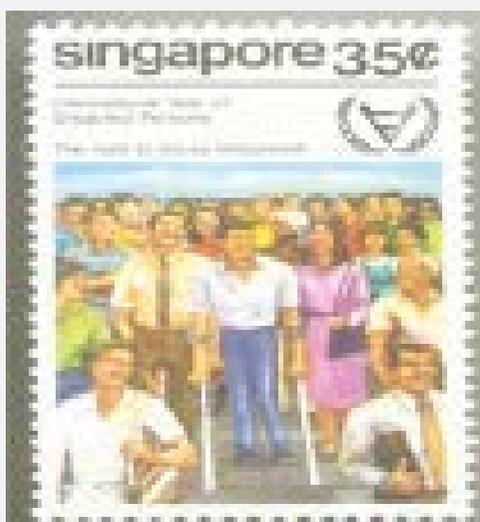
Fig 2



Fig 3

Medical Philately

1981 International Year of Disabled People social integration



Country	Singapore
Date	1981
Disability	Crutches
Meta	philately, stamps, digital disability, theme, imagery of disability on postage stamps, outside centre, crutches, integration, friends, social integration
Number	SG408
Theme	Integration International Year of Disabled People

PG Forum

REHAB CHALLENGES

A 26 years old male patient presented to PMR OPD with spastic quadriplegia and immobility since last 2 years due to a compressive myelopathy after a road traffic accident. He was treated by neurosurgeons for initial few months and became haemodynamically stable within few days though there is no significant neurological recovery over the months. Thereafter patient was poorly managed mainly at home with little bit of unsupervised physiotherapy.

When we examined the patient in our indoor we found around grade 3 spasticity in ankle planti-flexors and hamstrings bilaterally, that was managed by stretching, medication and chemical neurolysis followed by tone inhibiting orthosis and gait training. He achieved reasonable indoor independent mobility with the above indoor management.

But patient was struggling to manage his ADL due to poor ROM of both elbows though hand function improved little bit with conservative management (Fig 1). X-ray (Fig 2) of both elbow joint picked up significant heterotrophic ossification bilaterally limiting his elbow movement. Further investigation like CT scan of elbow (Fig 3) also confirmed heterotrophic ossification with very close proximity to elbow joint.

Now the patient is very much keen to go back to his normal job which requires good amount of upper limb function. Please opine regarding further rehabilitative management of this young gentleman.



Fig 1



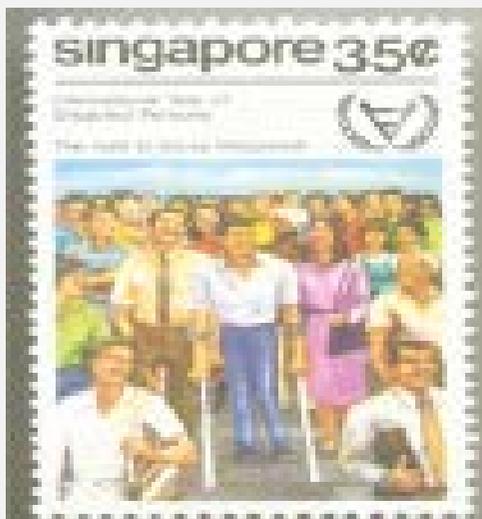
Fig 2



Fig 3

Medical Philately

1981 International Year of Disabled People social integration



Country	Singapore
Date	1981
Disability	Crutches
Meta	philately, stamps, digital disability, theme, imagery of disability on postage stamps, outside centre, crutches, integration, friends, social integration
Number	SG408
Theme	Integration International Year of Disabled People

Traumatic Thoracolumbar Spine Injury –A Demographic Study

Kumar Dileep¹, Gupta Anil Kumar², Sharma VP³,
Srivastava RN⁴, Ahmed Javed⁵, Singh Sanjai⁶

Abstract

Study design and subjects: Cross-sectional descriptive analysis of data of patients with thoracolumbar SCI admitted for rehabilitation at a tertiary care centre from January 2011 to September 2014.

Objectives: To identify the demographic pattern of TLSCI admitted to this centre.

Setting: Department of PM&R, King George's Medical University, Lucknow.

Methods: One hundred and thirty-three consecutive patients of traumatic TLSCI admitted for rehabilitation were included in the study. Detailed demographic, clinical, neurological evaluation as per ASIA scale and radiological assessment done and analyzed.

Results: Mean age of our sample was 29.62±5 years. There were 21.05% females and 78.95% males. A significant percentage (36.84%) was farmers/labourers, followed by students 26.31%. Majority (67.67%) had fall from height followed by road traffic accidents (21%). Only 3.76% received ambulance for transport and majority (87.22%) of the cases transported by hired four wheelers. Only 18.78% cases came to tertiary center within 2 hours and majority (70%) came after 8 hours of injury. Ratio of complete and incomplete injuries being 1.7:1. Most common vertebral involvement in 58.64% cases were of T12 and L1.

Conclusions: Majority of Indian population live in rural areas which have minimal accessibility to even primary care. This disparity should be removed by even distribution of specialty hospital and trauma care centres in rural areas with better transportation with trained staff for trauma care. A national SCI registry system is needed and SCI case should be reported from all hospitals so that rehabilitation programme planning can be done accordingly.

Key words: Thoracolumbar spinal cord injury (TLSCI), American Spinal Injury Association (ASIA), paraplegia, demography.

Introduction:

The most devastating event which can occur in an individual's life is spinal cord injury (SCI). Not only the sensory-motor system is affected, there is multisystem

involvement and long term disability to the individual. Complete restoration of functions is not yet amenable despite the ongoing research in the treatment of SCI, which is a big obstacle in independent living of the victim.

Traumatic injury to thoracolumbar spine is second most common site after cervical spine injury, compromising the cord functions i.e. motor, sensory, autonomic reflex resulting in paraplegia. Conus medullaris, cauda equina injury are also included in this group. Due to the non-existence of spinal cord registries in India, no reliable data set is available, on the basis of which the demographics, economic and disability burden of the same can be ascertained. An epidemiological data helps us to make plans for better allocation of resources directed towards preventing SCI and rehabilitating the resulting disabled individuals.

Developing countries like India are at high risk of this kind of injury due to progressive socialisation and industrialisation with unawareness about safety

Author's affiliations:

¹ MS (Ortho), Assistant Professor

² MD (PMR), DNB (PMR), Assistant Professor

³ MS (Ortho), DNB (PMR), Professor

⁴ MS (Ortho), Professor

⁵ MBBS, Junior Resident

⁶ MBBS, Junior Resident

Dept of PMR, RALC Campus, Nazibullah Road, King George's Medical University, Lucknow, UP

Cite as:

Kumar Dileep, Gupta Anil Kumar, Sharma VP, Srivastava RN, Ahmed Javed, Singh Sanjai. Traumatic thoracolumbar spine injury—a demographic study. IJPMR June 2015; Vol 26(2): 27-30.

Correspondence:

Dr. Anil Kumar Gupta, MD (PMR), DNB (PMR), Assistant Professor, Dept of PMR, RALC Campus, Nazibullah Road, King George's Medical University, Lucknow

E-mail- dranilaiims@yahoo.co.in, Mobile-9559399513

Received on 15/11/2014, Accepted on 14/04/2015

programme. This is a hospital based study from a single tertiary care rehabilitation centre in Northern India.

Materials and Methods:

One hundred and thirty-three consecutive patients of traumatic thoracolumbar SCI admitted for rehabilitation to the department of PM&R, King George's Medical University, Lucknow, from January 2011 to mid September 2014 were included in the study. Detailed clinical, neurological evaluation as per American Spinal injury Association Classification (ASIA) and radiological assessment done including identification of mechanism of injury, mode of ambulation and delay in transport. This is a cross-sectional descriptive study, data analysis was done in October 2014 and results were compiled and analysed.

Results:

Mean age of the sample was 29.62 ± 5 years, a significant number 55 (41.35%) were from the age group of 16 to 25 years (Table 1). There were 21.05% females and 78.95% males, with a male to female ratio of 3.75:1. A significant number 49 (36.84%) were farmers and labourers, followed by students 35 (26.31%) (Table 2). Average monthly income of the sample was Rs. 7000 approximately (Table 2). Nineteen i.e. 14.29% were illiterate and majority 63 (47.37%) were educated in between 6th to 10th standard. Taking into account educational status, income and job profile of each individual, we attempted to find out the socio-economic strata of the sample through Kuppuswamy score. Majority of the sample belonged to the lower socio-economic group, thus after SCI drastic deterioration in economy of the family occurs. Majority 90 (67.67%) had fall from height followed by road traffic accidents in 28 (21%) as the cause of injury. About 6% cases had fall of weight on back and 3 cases were developed after gunshot (Table 3). Only 5 (3.76%) received ambulance for transport and

Table 1: Age and Sexwise Distribution of Cases

Age group (years)	Male	Female	No of cases	Percentage (%)
6-15	3	2	5	3.76
16-25	43	12	55	41.35
26-35	22	9	31	23.31
36-45	25	4	29	21.80
46-55	8	0	8	6.02
55-65	4	1	5	3.76
Total	105 (78.95%)	28 (21.05%)	133	100

majority 116 (87.22%) of the cases transported by hired four wheelers. Only 25 (18.78%) cases came to tertiary care centre within 2 hours and majority 93 (70%) came after 8 hours of injury (Table 3). Most of the injured presented with neurologically complete picture i.e., 84 (63.16%). Ratio of complete and incomplete injuries was 1.7:1 at the time of presentation at the tertiary care centre. Most common vertebral involvement in 78 (58.64%) cases was of T12 and L1 (Table 4).

Discussion:

In contrast to developed countries where RTA are the main cause of SCI¹⁻⁵, fall from height is the main culprit of SCI in India (Singh *et al*⁶). Fall from roof and wall is the leading cause due to lack of fencing on roof, no guarding of staircases and sleeping on unprotected roof. In rural areas fall from tree is another important cause of this catastrophic event. In this study, RTA is the second most common cause with an increasing trend after fall from height. Uncontrolled motorisation, socio-economic growth and increased traffic load with industrialisation have made injuries as major public health problem in India.

Table 2: Distribution of Cases according to Education, Occupation, and Family Income

	Characteristics	No of cases	Percentage (%)
Education	Illiterate	19	14.29
	Up to 5th standard	16	12.03
	6th to 10th standard	63	47.37
	11-12th standard	17	12.78
	>12th standard	18	13.53
Occupation	Labourer	22	16.54
	Farmer	27	20.30
	Student	35	26.31
	Housewife	12	9.02
	Government job	5	3.76
	Lineman	5	3.76
	Business	6	4.51
	Private job	5	3.76
	Driver	4	3.01
	Others	12	9.03
Family income / month	<Rs.5,000	69	51.88
	5,001-10,000	46	34.59
	10,001-20,000	12	9.02
	20,001-50,000	6	4.51
	>50,000	0	0

Table 3: Mechanism of Trauma, Mode of Transport, and Delay in Ambulation

Characteristics		No of cases	Percentage (%)	
Mechanism of trauma	I. Road traffic accident	28	21.05	
	II. Fall from height	o Fall from tree	25	18.80
		o Fall from roof/wall	53	39.85
		o Fall from stairs	3	2.25
		o Fall on ground	4	3.01
		o Fall from height after electric sock	5	3.76
	III. Fall of heavy weight	8	6.02	
	IV. Assault	o Fire arm injury	3	2.25
o Beaten with stick		1	0.76	
V. Miscellaneous (Machinery, Train accident)	3	2.25		
Mode of ambulation	Ambulance	5	3.76	
	Tricycle	3	2.25	
	Two-wheeler	4	3.01	
	Three-wheeler	5	3.76	
	Four-wheeler	116	87.22	
Delay in transport	<2 hours	25	18.80	
	2-8 hours	15	11.28	
	9-12 hours	34	25.56	
	13-24 hours	39	29.32	
	> 24 hours	20	15.04	

Agrawal *et al*⁷ reported a sex ratio of 3.6:1 and Li *et al*⁸ documented a sex ratio of 3.1:1 which is similar to our study, in contrast of some studies which show large male and female ratio. Most common age group in our study was 16-25 years. The age distribution of patients is comparable with studies⁹⁻¹² from other parts of the world.

The “108” ambulance facilities have definitely improved the transportation but because of lack of awareness, trained paramedical staff, SCI evacuation equipment in the form of spinal board, collar, straps etc, this has failed to do any good to the injured and secondary injury to the cord is much common. Only 5 cases (3.76%) were transported by ambulance to specialised centre in our study which is very low and needs to be improved. None of the injured in this study received the primary management as per SCI protocols, also seen in studies of Solagberu *et al*¹³ and Nguyen *et al*¹⁴.

Neurologically complete injuries (ASIA A) were the most common in this study, as against the higher percentage of incomplete injuries in the developed world^{15,16}. Only 18.8% cases reached the tertiary centre in <2 hours while majority (69.9%) cases reached with a delay of >8 hours.

Table 4: Distribution of Cases according to Vertebral Level

	Characteristics	No of cases	Percentage (%)
Vertebral level	T2	1	0.76
	T3	2	1.50
	T4	4	3.01
	T5	3	2.25
	T6	5	3.76
	T7	3	2.25
	T8	8	6.02
	T9	6	4.51
	T10	4	3.01
	T11	11	8.27
	T12	34	25.56
	L1	44	33.08
	L2	4	3.01
L3	4	3.01	
Neurological level	A	84	63.16
	B	21	15.80
	C	17	12.78
	D	10	7.51
	E	1	0.75

In order to prevent fall from height, people should be made aware of the precautions that should be taken while building their houses, safety guards should be provided for workers, unprotected tree climbing should be discouraged. Injury prevention strategies should focus towards the need for better transport facilities, provision of safer roads, greater allocation of public transport and stringent traffic rules, as wearing of safety belts, alcohol awareness in India.

Conclusions:

Greater than 68.84% of Indian population live in rural areas¹⁷ instead comprehensive emergency and acute trauma care and tertiary care centres are available in urban areas and there is no or minimal availability of even primary care in rural areas. This disparity should be removed by even distribution of government specialty hospital and trauma care centres in rural areas. Better ambulance facilities with trained staff for trauma care including primary management of SCI should be instituted. There should be SCI management team in hospitals managing trauma to be led by rehabilitation medicine specialist and public should be educated about safety measures. Gururaj *et al*¹⁸ in 2011 reported the increasing trend of road crashes and deaths with a national average of 110/million, though the real incidence is not yet known due to lack of national registry system. Sekhon and Fehlings¹⁹ reported the incidence of SCI 15-40/million/year in developed countries.

In this study we have tried to find out the demographic trend of thoracolumbar SCI of cases presenting at our Rehab centre which is definitely not the true representation of demography, but it can give some clue about the problem. A national SCI registry system is needed and SCI case should be reported from all government as well as private hospitals so that rehabilitation programme planning can be done accordingly.

References:

1. Griffin MR, Optiz JL, Kurland LT, *et al*. Traumatic spinal cord injury in Olmstead County, Minnesota, 1935-1981. *Am J Epidemiol* 1985; **121**: 884-95.
2. Kraus JF, Franti CE, Riggins RS, *et al*. Incidence of traumatic spinal cord lesions. *J Chronic Dis* 1975; **28**: 471-92.
3. Pickett W, Simpson K, Walker J, Brison RJ. Traumatic spinal cord injury in Ontario, Canada. *J Trauma* 2002.
4. Price C, Makintubee S, Herndon W, Istre GR. Epidemiology of traumatic spinal cord injury and acute hospitalization and rehabilitation charges for spinal cord injuries in Oklahoma, 1988-1990. *Am J Epidemiol* 1994; **139**: 37-47.
5. Acton PA, Farley T, Freni LW, *et al*. Traumatic spinal cord injury in Arkansas, 1980 to 1989. *Arch Phys Med Rehabil* 1993; **74**: 1035-40.
6. Singh PK, Shrivastava S, Dulani R. Pre hospital care of spinal cord injury in a rural Indian setting. *Rural and Remote Health* **11**: 1760; 17th May 2011.
7. Agrawal P, Upadhyay P, Raja K. A demographic profile of traumatic and non-traumatic spinal injury cases: a hospital based study from India. *Spinal Cord* 2007; **45**: 597-602.
8. Li J, Liu G, Zheng Y. The epidemiological survey of acute traumatic spinal cord injury (ATSCI) of 2002 in Beijing municipality. *Spinal Cord* 2011; **49**: 777-82.
9. Kishan S, Vives MJ, Reiter MF. Timing of surgery following spinal cord injury. *J Spinal Cord Med* 2005; **28**: 11-9.
10. Solagberu BA. Spinal cord injuries in Ilorin, Nigeria. *West Afr J Med* 2002; **21**: 230-2.
11. Surkin J, Gilbert J, Harkey HL 3rd, Sniezek J, Currier M. Spinal cord injury in Mississippi; findings and evaluation, 1992-1994. *Spine* 2000; **25**: 716-21.
12. Yu Y, Matsuyama Y, Nakashima S, Yanase M, Kiuchi K, Ishiguro N. Effects of methylprednisolone sodium succinate (MPSS) and a potent inducible nitric oxide synthetase (iNOS) inhibitor on traumatic spinal cord injury. *Neuroreport* 2004; **15**: 207-12
13. Solagberu BA, Ofoegbu CK, Abdur-Rahman LO, Adekanye AO, Udoffa US, Taiwo J. Pre-hospital care in Nigeria: a country without emergency medical services. *Nigerian J Clin Pract* 2009; **12**: 29-33.
14. Nguyen TL, Nguyen TH, Morita S, Sakamoto J. Injury and pre-hospital trauma care in Hanoi, Vietnam. *Injury* 2008. **39**: 1026-33.
15. Chacko V, Joseph B, Mohanty SP, Jacob T. Management of spinal cord injury in a general hospital in rural India. *Paraplegia* 1986; **24**: 330-5.
16. Maharaj JC. Epidemiology of spinal cord injury in Fiji: 1985-94. *Spinal Cord* 1996; **34**: 549-59.
17. Govt. of India. Rural Urban population of India census 2011, censusindia.gov.in/2011-prov.../data.../india/Rural_Urban_2011.pdf
18. Gururaj G. Injury & Violence in India: Facts and Figures, National Institute of Mental Health and Neurosciences, Publication no 82. Bangalore: 2011.
19. Sekhon LHS, Fehlings MG. Epidemiology, demographics, and pathophysiology of acute spinal cord injury. *Spine* 2001; **26**: 2-12.