Indian Journal of
Physical Medicine and Rehabilitation

IJPMR 2012 Sep; Volume 23 (Number 3)

Contents

Print Edition

Editor:
Prof RN Haldar

ISSN
0973-2209

Web administration and designing: Dr U Singh. *First built:* April 15, 2004. *Last updated:* January 6, 2013

Case Report

Arnold Chiari Malformation with Holocord Syringomyelia Presenting as Unilateral Foot Drop: A Case Report

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

Abstract

Foot drop is a common problem encountered in the clinical practice of a medical rehabilitation specialist. The aetiology of foot drop is usually lower motor neuron, either by the affection of peripheral nerve or the lower lumbar roots. However other rare differential diagnosis of foot drop should be borne in mind while evaluating such a patient. A detailed neurological evaluation along with supportive investigations like electrodiagnosis and magnetic resonance imaging often helps in differentiating such a cause. Here we report a case of holocord syringomyelia, secondary to Arnold Chiari malformation type 1, presented as unilateral foot drop.

Key words : ***Foot drop, syringomyelia, Arnold Chiari malformation.***

Introduction:

Foot drop is defined as a weakness on foot dorsi-flexion, usually caused by lower motor neuron (LMN) disease. Common causes are L4-L5 radiculopathy, caused by either an intervertebral disc prolapse or foraminal stenosis, and peroneal neuropathy. Other causes include any axonal or demyelinating damage along the whole peripheral nervous system: lower spinal cord, cauda equina, lumbar plexus, and peripheral mixed nerve. Central nervous system pathology can also cause foot drop [1]. Central causes tend to occur where nerve fibres are highly condensed along the UMN tracts: motor cortex, corona radiata, internal capsule, cerebral peduncle, medulla, and spinal cord pyramidal tract. We present a young patient with insidious onset of unilateral foot drop caused by an extensive spinal pathology.

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Cite as:
Krishnaprasad IN, Soumya V, Abdulgafoor S. Arnold Chiari Malformation with Holocord Syringomyelia Presenting As Unilateral Foot Drop: A Case Report. IJPMR September 2012; Vol **23 (3):** 123-6.

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Received on 24/07/2012, Accepted on 01/10/2012

Case Report:

A five-year-old female child, apparently normally developed for age, presented with some difficulty in walking for the past eight months. The complaints started as difficulty in getting the right foot to the toe box of shoes and sandals, for which she needs assistance of her mother. The difficulty later progressed into walking difficulty with occasional pain in the leg and tripping on right foot while walking. She didn't have similar complaints in the left foot and also didn't have any motor or sensory symptoms in both upper limbs. She had recurrent episodes of posterior neck and head pain, which caused only mild functional impairment. For the past six months symptoms were constant. She didn't complain of any bladder symptoms, visual complaints, swallowing or speech difficulty. There was no history of trauma to the right leg before the onset of symptoms. There was nothing relevant in her past history except for a few episodes of febrile seizures which subsided spontaneously two years back. There was also no relevant family history of similar neurological illnesses. The child was fully immunised up to her age.

On examination, height and weight were adequate for age, no pallor or generalised lymphadenopathy, no skin lesions, and vitals were within normal limits. Right thoracolumbar scoliosis (Fig 1) was present, which persisted on Adams forward bending test. No limb length discrepancy noted. On right lower limb the motor power was grade 4 proximally, and grade 3 minus on ankle dorsiflexors. However plantar flexors showed grade 4

power. Left lower limb and both upper limbs showed grade 5 power. Deep tendon reflexes were normally elicitable from all four limbs, except right ankle jerk which was sluggish. Plantar reflex was not elicitable on right side. Mild wasting of hypothenar muscles and mild clubbing were noticed on both hands (Fig 2). Grip was moderate and appropriate for her age. There were no sensory findings in all four limbs or trunk. Cranial nerves and cerebellar function tests were within normal limits.

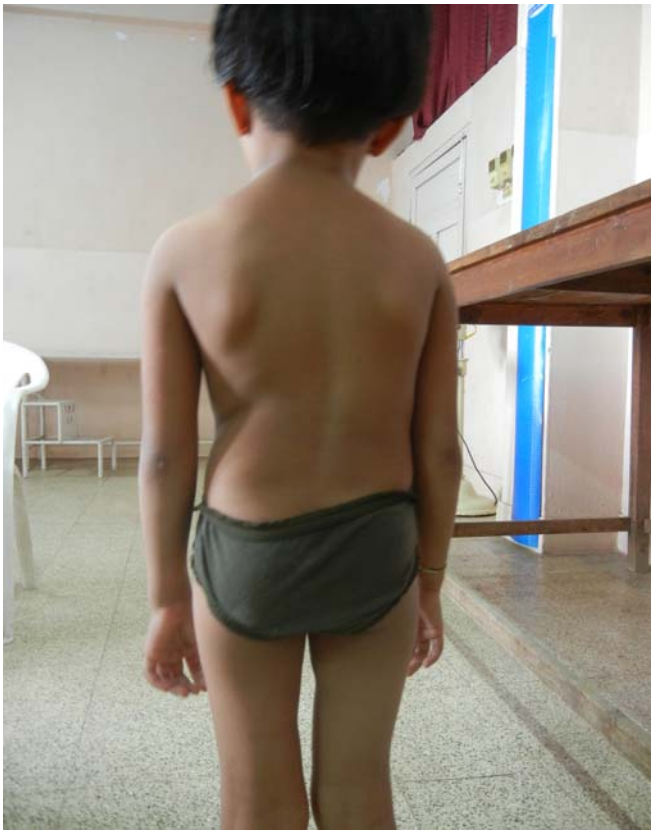

Fig 1- *Thoracolumbar Scoliosis*

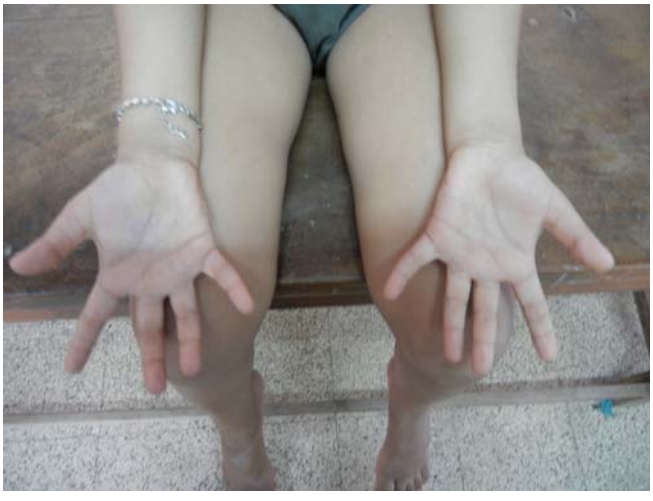

Fig 2- *Wasting of Hypothenar Muscle*

Nerve conduction study was performed in all four limbs. CMAP and SNAP were recorded from median, ulnar, radial, peroneal, tibial and sural nerves. Bilateral median CMAP and SNAP were found to be within normal limits. Low amplitude CMAPs were recorded from both ulnar nerves suggestive of an axonal loss pattern, whereas corresponding SNAPs were within normal limits. Both tibial CMAPs were within normal limits. Low amplitude axonal loss pattern was recorded from both peroneal nerve CMAPs, with normal SNAPs. Sural SNAP also recorded normally. F waves were either absent or latency prolonged from all motor nerves suggested. The whole NCS picture pointed towards an anterior horn cell involvement, and further work up with MRI was planned

X-ray of spine (Fig 3) showed thoracolumbar scoliosis towards right with apex at T12 and absent rotation. Cobb's angle measured was 30 degrees. No other abnormalities were detected.

MRI of the spine (Fig 4) with post contrast enhancement showed extensive syringohydromyelia involving the

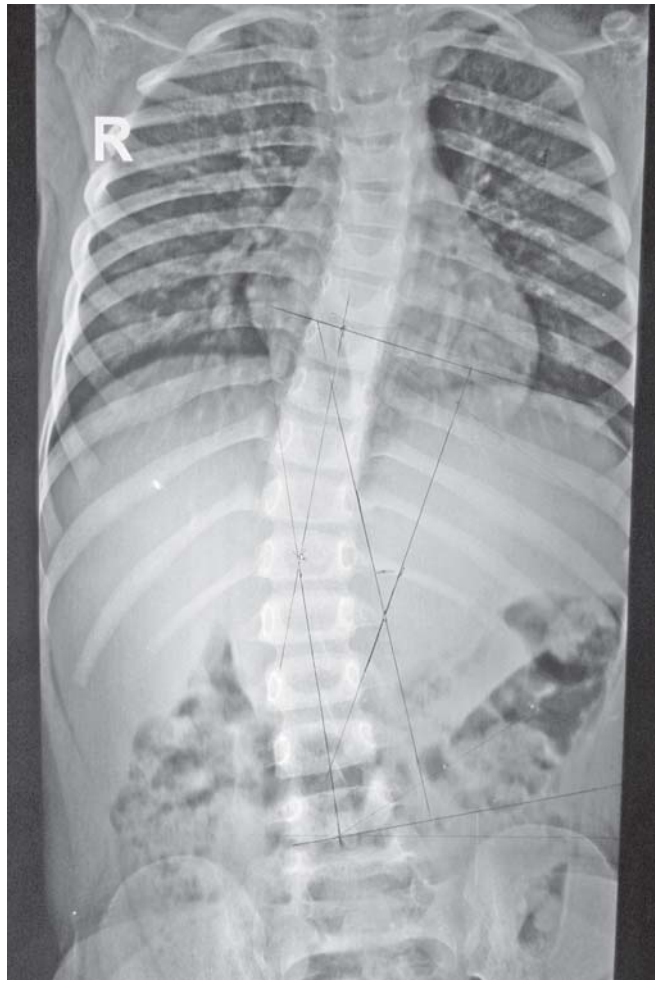

Fig 3- *Straight X-ray Showing Scoliosis*

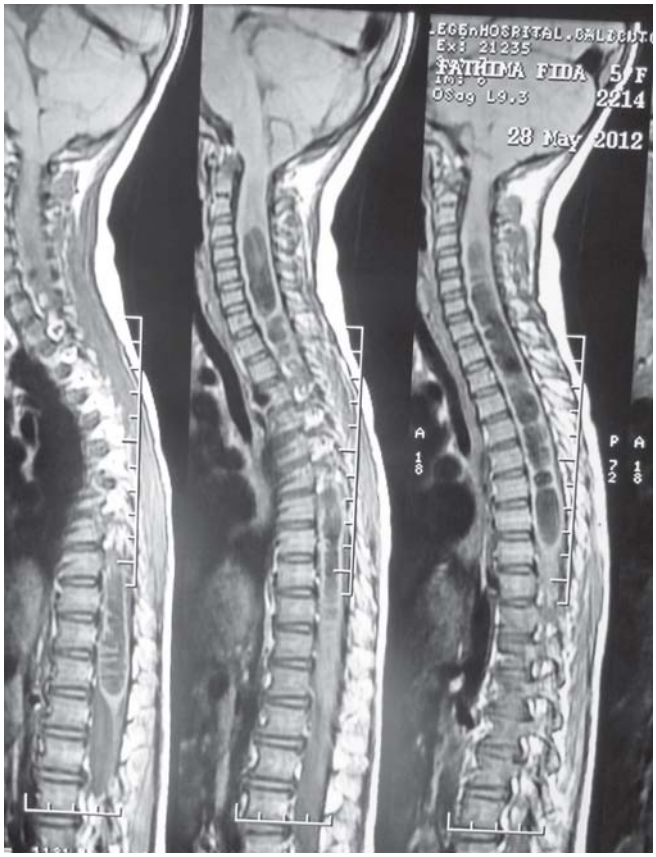

Fig 4- *MRI Showing Involvement of Spinal Cord*

entire cord from C2 to T10 with no abnormal contrast enhancement. Herniation of cerebellar tonsils noted 4 mm below foramen magnum. The findings were consistant with Arnold Chiari malformation type 1.

Discussion:

Syrinxes associated with congenital foramen magnum encroachment (Chiari malformations) may result from either central canal dilation (i.e,communicating syringomyelia or hydromyelia) or from an eccentric syrinx cavity in the gray matter of the cord (non-communicating syringomyelia). Because the two types of syrinxes are often indistinguishable by imaging studies, particularly later in the disease, they may be referred to as syringohydromyelia or hydrosyringomyelia.

Chiari I malformation is a congenital downward displacement of the cerebellar tonsils through the foramen magnum, into the cervical subarachnoid space. Chiari II malformation is downward displacement of the cerebellar vermis, pons, and medulla into the foramen magnum and elongation of the fourth ventricle. Chiari I malformation typically presents clinically in young adults, whereas Chiari II malformation presents in infants and is usually associated with myelomeningocoele and hydrocephalus. Chiari I malformation is the most common cause of syringomyelia. Although it usually presents clinically in young adult years, it may manifest first in an infant or older adult. The duration from onset of symptoms to diagnosis is typically 3 to 7 years.

The earliest symptom is often headache or neck or arm pain aggravated by straining or coughs; neck pain may be accompanied by torticollis. Neurologic findings depend on the structures involved. The syrinx is often noted at the C4–6 bony levels but may extend rostrally or caudally the full length of the cord (holocord syringomyelia). Dissociated sensory loss in a cape like distribution over the neck and arms is characteristic, because crossing spinothalamic tract fibres carrying pain and temperature sensation are most affected, whereas posterior column sensory fibres are spared. Hand and arm weakness develop as lower motor neurons of the cervical cord are affected. Long-tract myelopathic symptoms develop in the lower limbs with further expansion of the cervical syrinx.

Worsening scoliosis is common, particularly in childhood-onset syringomyelia of Chiari I malformation. Other associated craniocervical abnormalities like Klippel–Feil anomaly (congenital fusion of cervical vertebrae) and atlanto-occipital assimilation may coexist. Syrinx extension into the brainstem can lead to lower cranial nerve, cerebellar and respiratory problems. Rostral or caudal extension of the syrinx may result from rapid changes in intraspinal pressure, such as those caused by coughing, straining, or sneezing.

Chiari II malformation often presents in infancy as stridor, weak cry, nystagmus, and apnoea or in childhood as gait abnormality, spasms, worsening incoordination, and nystagmus. Later, it may lead to loss of head control, arm weakness, spasms, and tetraparesis.

Differential diagnosis for syringomyelia of Chiari I malformation includes multiple sclerosis; spinal muscular atrophy, amyotrophic lateral sclerosis; spinocerebellar ataxias, cervical disc and post-traumatic syringomyelia from trauma, arteriovenous malformation, arachnoiditis or meningitis, neurofibromatosis, and from spinal cord or brainstem tumours.

MRI confirms the diagnosis, but asymptomatic tonsillar herniation is common. Because cerebellar tonsils retract upward with age, MRI interpretation depends on age-appropriate controls. Tonsillar herniations greater than

6 mm are significant up to age 10 (In our patient it was 4 mm), greater than 5 mm for ages 10 to 30, and greater than 4 mm for ages over 30. However, 30 per cent of persons with cerebellar herniations of 5 to 10 mm are asymptomatic.

Treatment of Chiari I malformation involves posterior fossa decompression with a suboccipital craniectomy, with or without dural patch grafting, and cervical laminectomy with fenestration or shunting of the syrinx cavity. In patients with mild symptoms, 70 to 80 per cent report improvement. Some authors[2] suggest that direct surgery of the syrinx should be undertaken only after craniocervical decompression has failed.

A "top-down" approach has been suggested for surgical treatment of Chiari II malformation: shunt for hydrocephalus, then posterior fossa decompression for Chiari malformation, then syringopleural shunt for syringomyelia if needed.

After posterior decompression, with or without syrinx shunting, 50 per cent or more patients improve; in those with syrinxes, about one-third improves, one-third stabilises, and one-third deteriorates further after surgery. Postoperative neurologic decline can result from recurrent syringomyelia, occipital C1–C2 instability, pseudomeningocele, tethering of the spinal cord, meningitis, and extradural abscess.

Conclusion:

Bilateral progressive foot drop as a manifestation of holocord syringomyelia has been reported in the literature[3-5]. In all those reports, however there were other manifestations of typical syringomyelia which helped in differentiating the condition. In our patient, despite extensive spinal involvement the manifestations are limited to scattered motor findings and scoliosis. Other prominent feature of syringomyelia, the dissociated sensory loss, was conspicuously absent and inexplicable. Since nerve conduction studies showed evidence of moderate axonal loss in the CMAPs from peroneal and ulnar nerves bilaterally with abnormality in F waves, a pathology involving the anterior horn cells was suspected. Those findings along with the presence of scoliosis, prompted us to do a spinal work up with MRI which helped us to establish the diagnosis. This case stresses the importance of conducting a comprehensive clinical examination, ably supported by appropriate investigations, in any patient presenting with a seemingly peripheral lesion.

We took a neurosurgery opinion for the child for any surgical intervention. But since the clinical features were static at present and child was not significantly disabled, it was decided to manage conservatively at present, and consider decompression only if clinical worsening observed on follow-up. The child was given an ankle foot orthosis to aid ambulation and a molded spinal jacket to prevent spinal curve progression, and is currently under active follow-up.

References:

1. Westhout FD, Pare´ LS, Linskey ME. Central causes of foot drop: rare and underappreciated differential diagnoses. *J Spinal Cord Med* 2007; **30**: 62-6.
2. Little JW. Syringomyelia. Lin VW, Cardenas DD In: editor Spinal Cord Medicine: Principles and Practice. New York; 2003: 504-5.
3. Muhn N, Baker SK, Hollenberg RD, Meaney BF, Tarnopolsky MA. Syringomyelia presenting as rapidly progressive foot drop. *J Clin Neuromuscular Disord* 2002; **3:** 133-4.
4. J Kumar, A Kumar, S Gupta. Chiari I malformation with holocord syrinx. *J Neurol Neurosurg Psychiatry* 2007; **78**: 146.
5. Saifudheen K, Jose J, Gafoor VA. Holocord syringomyelia presenting as rapidly progressive foot drop. *J Neurosci Rural Pract* 2011; **2:** 195-6.

Original Article

Audit of Safety of Intramuscular Botulinum Toxin Injections among Patients Receiving Warfarin Anticoagulation Therapy

Yogendra Jagatsinh[1], Jim George[2]

Abstract

Background: Botulinum toxin (BTX) intramuscular injections are an effective treatment for spasticity in acquired brain injury. Despite use since the 1980s, issues concerning technique, dose and long-term side-effects remain unresolved. For example, the safety of BTX in warfarinised patients is unclear. There are two studies reporting the risk of intramuscular injections in patients receiving anticoagulant therapy with regard to possible local haematoma formation. There is no advice on this subject in the manufacturers' summary of product characteristics for the original brand of warfarin, Dysport, BOTOX, Xeomin or in the British National Formulary.
Aim: To assess the safety of BTX injections in patients receiving oral anticoagulation.
Design: Prospective audit of safe practice.
Setting: Outpatient setting in a rehabilitation centre.
Population: Adult population affected with spasticity with acquired brain injury and receiving concurrent warfarin anticoagulant therapy.
Methods: Fourteen patients who were receiving anticoagulant therapy were given regular BTX (number of injection cycles or total mean no of injections each). Patients gave written informed consent before the injections. Injection technique did not differ from that used for un-anticoagulated patients. Patients were assessed by the injector for obvious haemorrhage in the first 15 minutes after the injection resulting in swelling, bruising, tenderness or haematoma. Patients were asked to watch for appearance of local reactions like swelling, bruising or haematoma and pain in the first week.
Results: There were no clinically detectable local complications after intramuscular injections and no major or minor bleeding episodes after BTX injections.
Conclusion: In our group, BTX injections were administered intramuscularly to patients who were receiving anticoagulant therapy without significant risk of local bleeding. However, injections must be used with caution in patients with an INR above the therapeutic range.
Clinical rehabilitation impact: BTX can be safely given in patients on anticoagulation therapy with safety checks in place.

Key words: **Botulinum toxin, spasticity, warfarin, anticoagulation, acquired brain injury, intramuscular injection.**

Introduction:

Traditional teaching warns against giving intramuscular injections to patients who are anticoagulated because of an increase in the risk of developing muscle haematomas. If an intramuscular injection is essential for such a patient, it is recommended that it be administered in the upper extremity to permit easy access for manual compression, inspection for bleeding and/or the use of a pressure bandage[1]. Intramuscular injection into the desired muscle is the only route recommended for BTX injection and hence the need of multiple injections into deep seated muscles increases the risk in these patients. A recent caution from a pharmacy[2] prompted us to produce safety guidelines to inject BTX in our patients.

Warfarin is a narrow therapeutic range (index) drug, and additional caution should be taken when warfarin sodium is administered to certain patients. Reported risk factors for bleeding include high intensity of anticoagulation (INR >4.0), age ≥65, highly variable

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Cite as:
Yogendra Jagatsinh, Jim George. Audit of Safety of Intramuscular Botulinum Toxin Injections among Patients Receiving Warfarin Anticoagulation Therapy. IJPMR Sep 2012; Vol **23 (3):** 101-4.

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Received on 01/03/2012, Revised on 24/05/2012, Accepted on 22/06/2012.

INRs, history of gastro-intestinal bleeding, hypertension, cerebrovascular disease, serious heart disease, anaemia, malignancy, trauma, renal insufficiency, concomitant drugs and long duration of warfarin therapy. Bleeding is more likely to occur during the starting period and with a higher dose of warfarin (resulting in a higher INR). Intramuscular (IM) injections of concomitant medications should be confined to the upper extremity which permits easy access for manual compression, inspections for bleeding and use of pressure bandages[3].

The number of people receiving an oral anticoagulation therapy has increased over the past years as a result of greater number of its indications in patients with long term neurological conditions. More people in this group are therefore likely to need botulinum injections.

The aim is to assess the safety of BTX injections in patients receiving oral anticoagulation.

Material and Methods:

Prospective audit of adult patients was carried out after implementing the protocol of using checklist in our spasticity outpatient clinic. The selected group of patients were receiving long-term warfarin therapies, who were followed up in their anticoagulation clinic and who were candidates for regular BTX injections, due to their spasticity, from February 2007 to February 2008 were considered for this audit. To be eligible (Table 1), patients were to be on warfarin and receiving BTX injection for spasticity. They were required to have an INR in the therapeutic range (2 to 3.5) within the last week of injection and must not have had any change in their warfarin dose for a minimum of two weeks before the study. The reason to choose this range of INR is because most of the patients are maintained in this therapeutic range. Patients were excluded (Table 2) if they had INR (>3.5) more than the therapeutic range, required frequent warfarin dose adjustments, or were not able to consent to injection. Informed consent as a usual standard protocol was taken before each injection episode. As it was audit of the checklist and these patients were consented prior to each injection, there is no need to separate ethical approval from the hospital. This treatment is well proven and is used in the hospital for many years. Age, indication for anticoagulation, baseline INR within last week and site of injections were recorded. Study patients were given regular therapeutic BTX injections into the various indicated group of muscles in the upper and lower limbs by a 27 gauge needle. No extra measures, except a cotton wool pressure on the skin, were taken to avoid complications. Patients were observed for 15 minutes in the outpatient clinic for obvious haemorrhage, local swelling, bruising, tenderness or even haematoma (Table 3). Patients continued to receive the same dosages of medications after the injections and were asked to report any adverse effect within the first week and report it and also asked specifically at the next visit. The study was not to evaluate spasticity and effect of toxin so we did not include any outcome measures for this particular group of patient. Although the patients did have goals and outcome measures for their clinical evaluation which was separate to this study.

Table 1: *Inclusion Criteria*

1. Patients on warfarin and receiving BTX injection for spasticity.
2. INR should be in the therapeutic range (2 to 3.5) within the week of injection.
3. The dosage of warfarin should be stable in the last two weeks of injection.

Table 2: *Exclusion Criteria*

1. INR > 3.5
2. Required frequent warfarin dose adjustments.
3. Patients unable to consent to injection treatment.

Table 3: *Checklist for Patients on Warfarin in Spasticity Clinic*

1. Clear documentation of patient taking Warafarin.
2. Check the latest INR (within last week) before giving Botulinum toxin
3. INR should be in the therapeutic range (<3.5)
4. Avoid BTX injections if INR >3.5
5. Use of thinnest possible (27G) needle for injection.
6. Pressure with cotton wool after injection
7. Observe the patient for 15 minutes for bleeding, swelling, local haematoma.
8. Ask patient look for swelling, local haematoma within 1 week and report it.

Results:

Fourteen patients (mean age, 62 years; age range, 40 to 82 years) were suitable for the audit. All patients were enrolled from June 2007 to February 2008. Only one patient was excluded because he had high INR at the time and didn't receive BTX injections as per the checklist. On an average each patient received about 8 injections, with total injection sites of 103 in these 14 patients, all patients had complete follow-up for 3 months until when they were seen for next set of repeat injections.

The patients were screened for local haematoma, pain, swelling and tenderness. No patient had significant pain, tenderness or swelling at the injection site (Table 4). There were no reported local or systemic adverse effects in all these patients on follow up. here were no major or minor bleeding episodes after the injection or during follow-up.

As previously stated this study was not for evaluation for spasticity or evaluation of effect of BTX.

Discussion:

In this study of fourteen patients receiving stable long-term anticoagulation with warfarin, intramuscular BTX did not have any significant adverse effects or systemic effects.

Because patients taking oral anticoagulant can develop large haematomas after intramuscular injections, the policy we made at our institution is to administer BTX by twenty-seven gauge needles, which minimises tissue damage due to intramuscular injection and it is fair to presume that it should not infer a substantial risk of haemorrhage. We are unaware of data indicating the safety of BTX injection in this group of patients. We therefore undertook this study to evaluate the issue more fully.

A review of the literature revealed few direct references to this issue. Wintrobe's Clinical Hematology (1992) makes a general statement about the wisdom of avoiding interventions such as intramuscular injections in the anticoagulated state[4]. Marder (1979) makes similar general statements[5]. The data sheets for the common brands of BTX (Dysport®, BOTOX®) give no specific precautionary advice in patients taking warfarin.

Two small studies have investigated IM influenza vaccine administration in elderly patients taking warfarin. In first of these 41 patients taking warfarin received 0.5 ml vaccine as a single IM injection in the deltoid region, followed by application of firm pressure for five minutes[6]. All patients were followed up for 14 days and there were no cases of localised bleeding or any change in arm girth after injections. In a second study, 13 patients received 0.5 ml vaccine IM and these were compared with 13 patients receiving the same

Table 4: *Patient Demographics, INR at the Time of Injection and the Muscles Injection Sites*

Patient	Age	Sex	INR	Injection sites	No. of injections	Local complications
1.	40	M	2.5	GM, TP	3	None
2.	74	F	2.8	GM, SL, TP,FDL, EHL	7	None
3.	66	F	2.6	PM, BC, BR, FDS	6	None
4.	49	M	1.2	GM, SL, FHL, FHB, TP, BC, BR	10	None
5.	63	F	2.4	BC, BR, FDS, FCR, FDP	7	None
6.	82	M	3.1	PM, LD, BC, BR, ADD	8	None
7.	61	M	2.9	BC, BR, FDS, FCR, FCU, GM, SL, TP	11	None
8.	82	M	3.1	PM, BC, BR, ADD, HS, EHL	10	None
9.	62	M	2.5	GM	2	None
10.	49	F	2.9	BC, BR, FCR, FDS, FDP, FPL, FPB, GM, TP	12	None
11.	62	M	2.5	BC, BR, FCR, FDP, FDS, FPL	7	None
12.	49	F	3.5	BC, BR, FDS, FCR, FDP	7	None
13.	78	M	2.6	BC, FDS, FDP	5	None
14.	51	F	2.8	ADD, BilTP, BilGM	8	None

vaccine subcutaneously[7]. Three patients in each group had discomfort or pain at the injection site, but no local bleeding was recorded. It has been advised that when intramuscular injections are necessary in warfarinised patients, the injections be administered into an upper extremity as a precaution to permit easy access for manual compression, inspection of bleeding, and/or application of pressure bandages if necessary[1]. However with BTX we have to give multiple deep injections into individual muscles where access for manual compression or inspection is difficult.

Recently, a single blinded, randomised, controlled trial with 229 patients by Casajuana *et al*[8] also observed no major side effects or major haemorrhage during the intramuscular injections. In this study 129 patients were randomised to receive intramuscular influenza vaccines compared to 100 patients received subcutaneous vaccination in the control group. The appearance of local adverse reactions was more frequent in the subcutaneous administration group.

Theoretically intramuscular injections may cause some local bleeding within muscle due to the needle rupturing small blood vessels, it appears to us from our current practice that the rationale for the contra-indication of intramuscular injections in the anticoagulated state is far from clear. It seems to be one of presumed common sense. With increasing numbers of this group of patients being warfarinised for conditions such as DVT, ischaemic stroke and pulmonary embolism, and the wider use of BTX injections in the long term management of spasticity, we need to have safety guidelines and checks.

Conclusion:

It is unclear if there is a 'safe' INR level but our experience seems to suggest that it may be safe up to an INR level of 3.5. Our practice to administer BTX by 27 gauge needles also appears to be a safe approach but requires more studies to evaluate. It remains unclear the risk of gauge of needle to use, but our practice of using 27 guage has been avoiding bleeding complicatons.

Given the number of patients with spasticity on anticoagulants, more large scale studies on this issue are required to establish safe practice parameters.

References:

1. McEvoy GK *et al*, editors. American Hospital Formulary service-Drug information. USA (Bethesda): *American Society of Health-System Pharmacists*, 2005; 1416.
2. Willis S. Can intramuscular injections be given to patients taking warfarin? Quality Assurance. Southampton University Hospitals Trust.
3. Summary of Product Characteristics-Marevan. Goldshield Pharmaceuticals. June 2003.
4. Lee C R *et al*. Thrombosis and anti-thrombotic therapy. *In Wintrobe's Clinical Hematology* 9th ed; Vol 2: 1533.
5. Marder V J. The use of thrombolytic agents; choice of patient, drug administration, lab monitoring. *Ann Intern Med* 1979; **90:** 802.
6. Raj G, Kumar R, McKinney WP. Safety of intramuscular influenza immunization among patients receiving long-term warfarin anticoagulation therapy. *Arch Intern Med* 1995; **155:** 1529-31.
7. Delafuente JC *et al*. Influenza vaccination and warfarin anticoagulation: a comparison of subcutaneous and intramuscular routes of administration in elderly men. *Pharmacotherapy* 1998; **18:** 631-6.
8. Cajuana J *et al*. Safety of intramuscular influenza vaccine in patients receiving oral anticoagulation therapy: single blinded multi-centre randomized controlled trial. *BMC Blood Disorders* 2008; **8:** 1-7.

Case Report

Back Pack Palsy as an Unusual Cause of Shoulder Pain and Weakness–A Case Report

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Abstract

Heavy back packs carried for prolonged durations can cause different musculoskeletal and neurological problems especially in the untrained and physically vulnerable individuals. They can cause postural disorders, gait abnormalities, muscular strains, pains and injuries to the brachial plexus and nerves resulting in significant morbidity and at times permanent disability. We report a case of brachial plexus injury in a young soldier wearing back pack for prolonged period. He developed weakness and pain in right shoulder which was not relieved with rest and analgesics. On examination he had weakness in deltoid, biceps and scapular muscles along with numbness in axillary nerve area. Brachial plexus injury (upper trunk) was suspected and confirmed by electrodiagnostic evaluation. His baseline investigations were normal. He was advised rest and avoidance to lift heavy weight. He was managed with electrical muscle stimulation for weak muscles, strengthening exercises and analgesics. He responded well to the treatment and had minimal residual weakness at the end of the six weeks' treatment

Back pack palsy should be suspected in people carrying back packs and presenting with pain, weakness and numbness in the upper limbs. It can be prevented by education in the use of back packs, its weight limits, physical fitness and frequent breaks with changing positions.

Key words : **Back pack, brachial plexus.**

Introduction:

Back pack is commonly worn by soldiers, skiers, adventurers, scouts and even children. Over weight back packs worn for prolonged times and poor quality along with compromised physical health can cause significant disability at times[1]. Weakness, pain and numbness are the most frequent symptoms and it is commonly labelled backpack palsy. The exact incidence of back pack palsy is not known but has been reported to be around 53.7 per 100,000 in a study carried out among recruits in Finland[2].

We report a case of back pack palsy in a young soldier after a night long operation in a mountainous terrain.

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Cite as:

Mansoor S.N, Rathore F. A, Fahim Muhammad. Back Pack Palsy as an unusual cause of Shoulder pain and Weakness: A case report. IJPMR September 2012; Vol **23 (3):** 120-2.

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Received on 12/03/2012, Revised 13/07/2012, Accepted on 11/09/2012.

Case Report:

Twenty-eight years old previously healthy old soldier presented with weakness and pain in the right shoulder region. He had participated in an operation the night before during which, he had to carry his 30 kg back pack along with heavy weapon on his shoulder for ten hours. He was managed symptomatically but didn't improve. Over the next two weeks the weakness worsened and he was unable to participate in the daily military routine. He was referred to our department with a provisional diagnosis of adhesive capsulitis. He had no previous history of trauma or infection. He had stable vital signs. There was slight wasting of deltoid, supraspinatous and Infraspinatous on the right side. He was unable to abduct his shoulder (Fig 1), and there was numbness in axillary nerve distribution. On motor examination he had weakness in biceps 4/5, supraspinatous, infraspinatous, subscapularis and teres minor 3/5 each. The biceps and brachioradialis reflexes were depressed on the right. A provisional diagnosis of

brachial plexus injury secondary to lifting heavy weight on shoulders was made. Baseline investigations including blood complete picture, erythrocyte sedimentation rate, C reactive protien, alanine transaminase, urine routine examination, renal and liver function tests were normal. X-ray right shoulder and cervical spine revealed no abnormality (Fig 2). Electro-diagnostic evaluation was done. The right axillary nerve was not recordable; there were reduced compound motor action potential (CMAP) of musculocutaneous nerve, (1.4mV on the right side as compared to 7.5 mV on the left side). Electromyography (EMG) revealed neuropathic pattern in right deltoid, biceps and extensor digitorum communis with large polyphasic motor unit action potentials and a discrete (reduced) recruitment and interference pattern, there were no fibrillation potentials or positive sharp waves. This was suggestive of upper trunk involvement the right brachial plexus. He was managed with electrical muscle stimulation for deltoid muscle having a muscle power of 0/5 and strengthening exercises for scapular muscles and biceps. He was advised not to lift heavy weights. NSAIDs were prescribed for pain relief, carbamazapine for the neuropathic pains along with vit B12. The pain and numbness gradually improved, and over a period of 6 weeks he made significant recovery in his muscle strength (Fig 3).

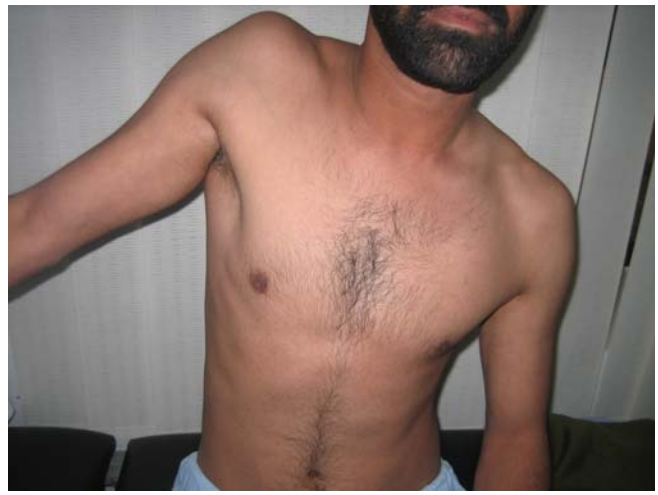

Fig 1- *Weakness in Abduction at Presentation*

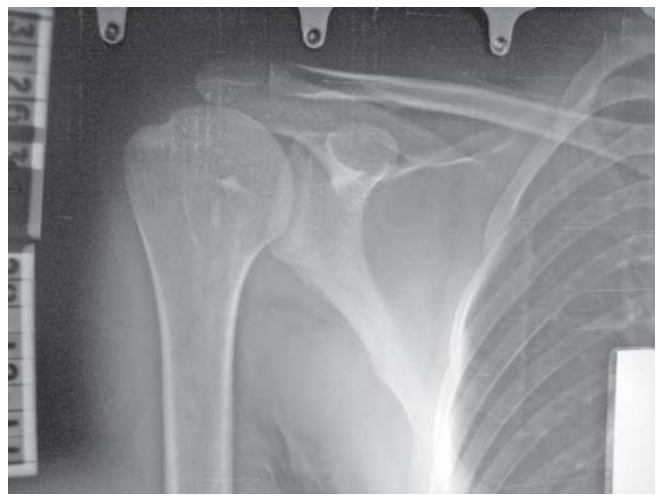

Fig 2- *Radiograph of the Right Shoulder Joint Did Not Reveal Any Abnormality*

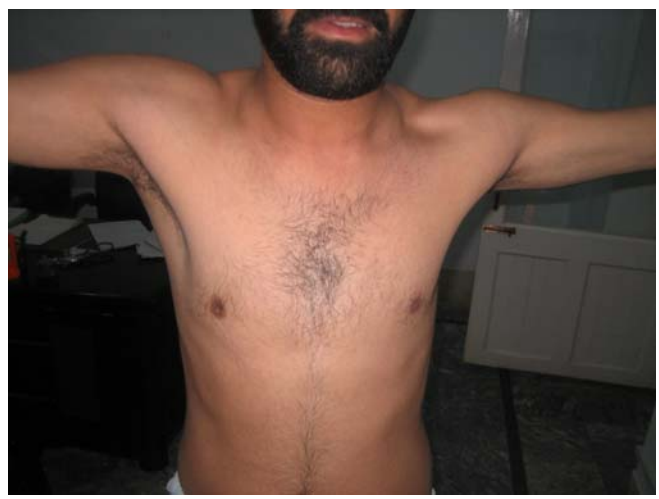

Fig 3- *Recovery after Six Weeks*

Discussion:

Back pack, is a bag carried on the back, and the weight is transmitted to the shoulders through the straps around the axilla. It also transmits some of the weight to the back and hips and hence is ideal to carry weights for long distances comfortably. Incorrect strapping, over weight backpacks, poor fitness and posture, congenital anomalies, uneven hilly terrain and prolonged wearing time put the individual at greater risk of injury[3].

It has been reported all around the globe especially in young recruits and soldiers who have to carry heavy back packs in hilly terrains for long time. The permissible weight to prevent backpack palsy varies from individual to individual depending on age, weight, physical build and fitness level. It is roughly between 25% to 35% of body weight. In our case, cause of palsy was heavy weight, 30kg, around 40% of his body weight and prolonged duration (10 hours) of carrying heavy backpack in a mountainous terrain.

Back pack palsy denotes a variety of neurological disorders originating due to wearing heavy back packs

for prolonged period of time. It usually present as weakness in elbow flexors, extensors and scapular muscles after carrying heavy weights. Numbness if present is more marked in the axillary region followed by lateral arm and forearm. Significant atrophy can develop over a period of time in severe cases. It can result in injury to the individual named nerves like suprascapular nerve, axillary nerve, median nerve, long thoracic nerve or musculocutaneous nerve[4]. It can also involve the posterior cord and upper trunk of brachial plexus, rarely lateral cord or complete plexus can be damaged. The damage is usually unilateral but occasionally bilateral. The severity of the injury varies from pain, weakness and numbness in the involved region to complete paralysis. The causative factors include the weight of the back pack, duration of wearing, quality of the back pack, type of terrain, physical fitness of the individual and congenital anomalies of the neuromuscular systems in susceptible individuals. Back pack palsy can be diagnosed using electrodiagnostic evaluations apart from clinical examination. Nerve conduction studies and electromyography can confirm diagnosis as well as the exact site and severity of the injury that will help in prediction of prognosis. In our study, CRP, ALT, RFTs and LFTs were done as baseline routine investigations and to rule out other associated causes of weakness. CRP was done to rule out polymyalgia rheumatica or other acute inflammatory causes. Electrodiagnostic studies were done in our case to confirm our clinical diagnosis.

The prognosis is good with almost complete recovery in 80% of the patients[3], two-thirds within two to five months of injury, however recovery keeps coming up to two years in certain individuals. A small number have incomplete recovery and residual significant disability. The standard treatment protocol depends upon the severity of injury, usually conservative management including physical modalities, therapeutic exercises, weight lifting restrictions and symptomatic medications lead to complete recovery.

In a follow-up study carried out over a mean period of 4.5 years after the injury. Nylund *et al*[5] found that there was complete recovery in 79% of the cases in a mean time of 3.2 months, more severe injury was observed in cases whom lifted heavy weights (>30 kg average).

Back packs without waist support increases the risk of nerve compression while pack frames have been reported to decrease the occurrence of compression neuropathy. Bessen *et al*[6] reported a reduction in occurrence in compression neuropathy among basic trainees using pack frames compared to those whom did not use it.

Similar case of backpack palsy was also reported from India[7] with involvement of complete brachial plexus and subsequent complete recovery in 10 weeks in a military recruit.

Conclusion:

Despite good prognosis for recovery, brachial plexus injuries due to backpacks should be kept in mind while training and treating people involved in carrying heavy back packs to prevent a disabling injury. It should include standardisation of back pack weights, duration of wearing, hilly terrain adjustments and physical fitness and most importantly end user education.

References:

1. Knapik JJ, Reynolds KL, Harman E. Soldier load carriage: historical, physiological, biomechanical and medical aspects. *Mil Med* 2004; **169:** 45-56.
2. Makela JP, Ramstad R, Mattila V, Philajamaki H. Brachial plexus lesions after backpack carriage in young adults. *Clin Orthop Relat Res* 2006; **452:** 205-9.
3. De Luigi, Arhtur J, Pasquina P,Dahl E. Rucksack induced plexopathy mimicking a lateral antebrachial cutaneous neuropathy. *Am J Phy Med Rehabil* 2008; **87:** 773-5.
4. Seçer M, Altýntoprak F, Dalgýç. A Brachial Plexus Injury Related To Carrying A Rucksack: *Two Cases Report J.Neurol. Sci.* 2009, **26:** 505-8.
5. Nylund T, Mattila VM, Salmi T, Pihlajamäki HK, Mäkelä JP. Recovery of brachial plexus lesions resulting from heavy backpack use: A follow-up case series. *BMC Musculoskeletal Disorders* 2011, **12:** 62
6. Bessen R, Belcher V, Franklin R. Rucksack paralysis with and without rucksack frames. *Mil Med.* 1987; **152:** 372-5.
7. Maurya S, Singh M , Bhandari PS, Bhatti TS. Backpack brachial plexus palsy. Case report. *Indian Journal of Neurotrauma (IJNT).* 2009; **6:** 153-4.

Obituary

Prof (Dr) Pranab Kumar Bagchi left this mortal world for heavenly abode on 2nd September 2012.

Prof.Bagchi hailed from Jalpaiguri district of North Bengal and obtained his MBBS degree from Sir Nil Ratan Sirkar Medical College, Calcutta in the year 1964.

He had his post graduation i.e. MD (PMR) in the year 1984 and was posted as Basic Teacher in Physical Medicine & Rehabilitation at N.R.S.Medical College and Hospital. He had served as Asst.Prof, Reader and Associate Prof at Burdwan Medical College, Calcutta Medical College. Later he was posted as Professor of PMR at the apex institution i.e. IPGMER & SSKM Hospital, Kolkata.

He was president of IAPMR West Bengal Chapter and organizing chairperson of IAPMRCON2002 at Kolkata.

As a teacher, friend and father Dr Bagchi is probably second to none. He was also known as modern “Ajatsatru”. His ever smiling face always gave consolation, confidence and encouragement to most of his fellow friends and juniors. He was honest, brave and straight forward and he never retreated to reveal the truth. He has left behind his wife and daughter who are now practicing gynecologists. In short Prof Bagchi was a wide hearted man.

May his soul rest in peace.

- Prof B K Chowdhury

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3. Physical Medicine and Rehabilitation Board Review by Sara Cuccurullo. Demos Medical; November 18, 2009:2nd edition.
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2. Caliandro P, Celletti C, Padua L, Minciotti I, Russo G, Granata G, La Torre G, Granieri E, Camerota F. Focal muscle vibration in the treatment of upper limb spasticity: a pilot randomized controlled trial in patients with chronic stroke. *Archives of Physical Medicine and Rehabilitation* September 2012; **93(9):** 1656-1661.
3. Kang, Yujeong; Jang, Dae-Hyun; Jeon, Jae Yong; Lee, Sook Joung; Jeong, Soon Yong; Shin, Dong Ik; Kim, Hwa Jeong. Pressure Monitoring of Multilayer Inelastic Bandaging and the Effect of Padding in Breast Cancer–Related Lymphedema Patients. *American Journal of Physical Medicine & Rehabilitation* September 2012; **91(9):** 768-773.
4. Freyssin C, Verkindt C, Prieur F, Benaich P, Maunier S, Blanc P. Cardiac rehabilitation in chronic heart failure: effect of an 8-week, high-intensity interval training versus continuous training. *Archives of Physical Medicine and Rehabilitation* August 2012; **93(8):** 1359-1364.
5. Dogu, Beril; Yucel, Serap Dalgic; Sag, SinemYamac; Bankaoglu, Mujdat; Kuran, Banu. Blind or Ultrasound-Guided Corticosteroid Injections and Short-Term Response in Subacromial Impingement Syndrome: A Randomized, Double-Blind, Prospective Study. *American Journal of Physical Medicine & Rehabilitation* August 2012; **91(8):** 658-665.

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Chondroblastoma Presented as ACL Injury in a Young Boy

R Pramanik[1], P Das[2]

A 16-year-boy has been referred to PMR department for rehabilitation. He suffering from left knee pain and swelling for last two months preceded by a fall. After initial assessment and diagnoses of ACL injury his knee were immobilised with POP cast for more than four weeks. Then he was referred for rehabilitation for stiff painful knee. The initial diagnoses at PMR department was ACL injury with a normal looking x-ray of knee joint (Fig 1) and MRI scan was advised.

After the admission initial rehabilitative management for ACL injury like joint protection, exercise regimen and analgesia were started. Surprisingly MRI of knee joint (Fig 2 & 3) picked up a well marginated lobulated SOL of 22×23 mm in size at the upper end of tibial epiphysis. The lesion was hypodense in T2 images and hyperdense in GRE in respect to bone. The SOL showed significant contrast enhancement with surrounding bony oedema of upper end of tibia. The MRI features were consistent and confirmatory of diagnoses of chondroblastoma with bit of weakness around the attachment of anterior cruciate ligament. For academic interest a repeat x-ray picture (Fig 4) was taken which showed a suspicious area of radiolucency at the upper end of tibia. At that stage his chest x-ray (Fig 5) was normal.

The patient was then referred to department of orthopaedics for excision biopsy and bone grafting. After the operation patient is doing well with a comprehensive rehabilitation management.

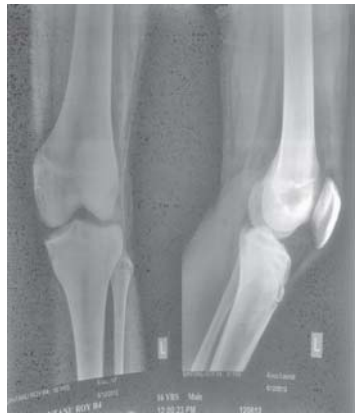

Fig 1- X-ray Knee

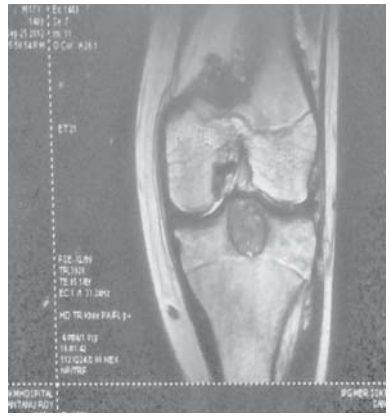

Fig 2- MRI Showing Lobulated SOL

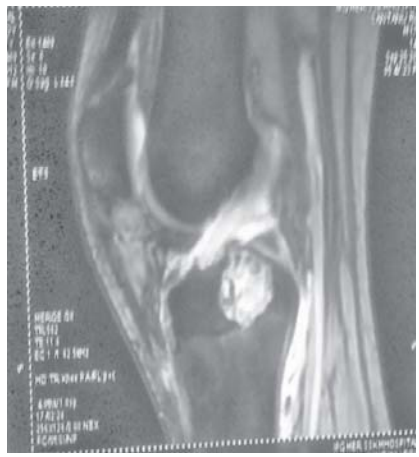

Fig 3- MRI Showing Lobulated SOL

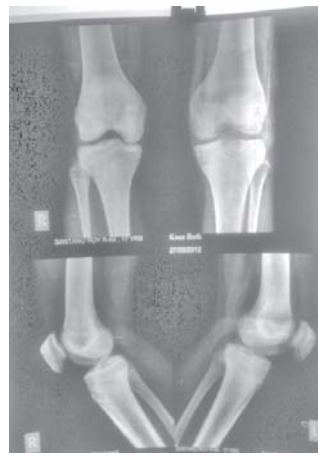

Fig 4- X-ray Showing Translucent Area of Upper Tibia

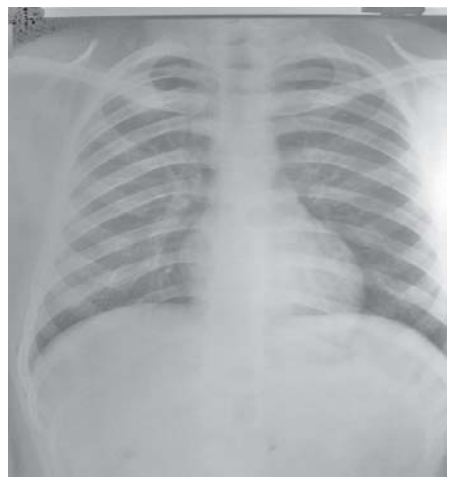

Fig 5- Chest X-ray (Normal)

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Comparison of Ultrasonic Therapy, Sodium Hyaluronate Injection and Steroid Injection in the Treatment of Peri-arthritis Shoulder

Chauhan Sonal[1], Kothari S.Y.[2], Laisram Nonica[3]

Abstract

Peri-arthritis (PA) shoulder is a common cause of shoulder pain and disability. The optimum management of peri-arthritis shoulder has been the subject of great debate, particularly since the condition tends to resolve spontaneously over months to years leaving behind stiff shoulder.

Objectives of this study was to prospectively evaluate the comparative efficacy of intra-articular steroid (methylprednisolone) injection, intra-articular sodium hyaluronate injection and deep heat in patients with peri-arthritis shoulder who were also taught a simple home exercise programme.

A total of 75 subjects were enrolled in the study. Patients of peri-arthritis of shoulder joint were randomly assigned to three groups: Inj. sodium hyaluronate 20mg (group1), inj. methylprednisolone 40mg (group2), ultrasonic therapy (group3). Evaluation was done at 3 weeks, 6weeks and 12 weeks and 24 weeks after starting the treatment.

Outcomes were determined by the assessment of subjective and objective parameters viz. shoulder pain and disability index (SPADI), range of motion. All three groups showed improvement with respect to time. Steroid group and sodium hyaluronate group showed significant improvement as compared to other ultrasonic group (p=0.02) with respect to shoulder pain and disability index and range of motion. Improvement in pain was equal with all three types of treatment..

Key words : **Ultrasonic therapy, sodium hyaluronate injection, steroid injection, peri-arthritis shoulder, shoulder pain and disability index.**

Introduction:

Peri-arthritis (PA) shoulder is a common but poorly understood syndrome of painful shoulder stiffness. In 1992, the American Shoulder and Elbow Surgeons Society, defined by consensus that PA shoulder is a condition of uncertain aetiology characterised by significant restriction of both active and passive shoulder motion that occurs in the absence of a known intrinsic shoulder disorder[1]. The prevalence of PA shoulder in general population is slightly greater than two per cent[2]. The condition still remains an enigma as to the correct origin, tissue involvement, causation, mechanism and the ideal form of treatment. Although PA of shoulder joint is generally considered to be a self-limiting condition that can be treated with physical therapy, the best treatment has been the subject of extensive investigation[2-5]. The types of treatment have included benign neglect, oral corticosteroids, injection of corticosteroids, physical therapy exercises, deep heat modalities, suprascapular nerve block, manipulation under anaesthesia, and arthroscopic and open release of the contracture. Recent studies have emphasised the effectiveness of surgical management of recalcitrant shoulder stiffness. Many of these studies have been flawed because they have lacked objective and subjective outcome criteria. Corticosteroid therapy was suggested in 1955 by Crisp and Kendall[6]. Since then, there have been many reports of uncontrolled experience with local corticosteroids. The reported

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Cite as:
Chauhan S, Kothari SY, Laisram N. Comparison of Ultrasonic Therapy, Sodium Hyaluronate injection and Steroid injection in the treatment of Periarthritis Shoulder. IJPMR Sep. 2012; Vol **23 (3):** 105-10.

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Received on 04/05/2012, Accepted on 20/06/2012

results cover the entire gamut from no benefit to dramatic improvement. Extensive research has been conducted on sodium hyaluronate (HA), a major component of connective tissue. HA relieves pain and has metabolic effects on articular cartilage, synovial tissue, and synovial fluid. The use of intra-articular injection of HA in the treatment of osteo-arthritis knee is well documented but its role in the treatment of PA shoulder is recently gaining interest[7-9]. Though, a few studies (only three studies available) have shown beneficial effects but no study has been reported from India to document its benefits. There is little evidence to support the use of any of the common interventions in managing PA shoulder. Measurement of outcome varies widely between various clinical trials, and the reliability, validity, and responsiveness of these outcome measures are not established The purpose of the present study was to evaluate, prospectively, the comparative efficacy of: intra-articular steroid injection, intra-articular sodium HA injection and deep heat in combination with a standard exercise programme for the management of idiopathic PA. Outcomes were determined by the assessment of subjective and objective parameters viz. shoulder pain and disability index (SPADI) and range of motion (ROM).

Material and Methods:

This prospective study was conducted in the Department of Physical Medicine and Rehabilitation, VMMC and Safdarjang Hospital, New Delhi on outpatients, from May 2007 to May 2008. Patient included were over 18 years age, symptomatic for at least one month, with limitation of both active and passive shoulder motion of >25% in at least 2 directions (abduction, flexion, external rotation, internal rotation) as compared with normal values with or without pain and with a normal anteroposterior radiograph of the glenohumeral joint. Patients having restriction of the joint motion due to other cause including inflammatory, degenerative, infectious, cerebrovascular accident, history of surgery, dislocation, fractures or shoulder trauma, clinical evidence of reflex sympathetic dystrophy, history of injection in the involved shoulder during the preceding six months, history of allergy to steroid and sodium HA or having any cervical pathology or diabetics were excluded from the study. The study was approved by institutional review board and all the subjects gave their informed consent prior to participate in the study. All the patients were evaluated using a questionnaire and clinical examination. Demographic factors included in the questionnaire were age, sex, religion, state of domicile, socio-economic status and occupation. Detail medical history was taken with attention directed at the identification of relevant co-morbidities, recording history of shoulder disorder, including duration of shoulder pain and shoulder restriction. Physical examination of shoulder included, active and passive ROM. Shoulder pain and disability index was recorded. Routine investigations included complete haemogram and blood sugar level. Simple randomisation by computer generated permuted block of 25 patients each using SPSS for windows version 10 was done. Single blinding was done. Pre and post intervention assessment of cases was done by independent observer (a fellow postgraduate student). Participants were randomised to the following three treatment groups: group1, inj. sodium HA (20mg) given weekly by anterior approach for three weeks with home exercise programme; group 2, inj. methylprednisolone (40mg) given weekly by anterior approach for three weeks with home exercise programme; group3, Ultrasonic therapy of 1.5w/cm^2 daily for seven minutes for three weeks with home exercise programme.

Intervention

On the day of randomisation, all injections were given through 1.5 inch, 21 gauge needle by the same physician using a standard sterile injection technique. The patients were placed in a sitting position with their arm in internal rotation and a needle was inserted 1 cm lateral to the tip of coracoid process. This was followed by injection of either sodium HA (20mg) or methylprednisolone acetate (40mg/ml). Magnetic resonance imaging (MRI) confirmation of the injection site was done in a few patients to ensure that they were in the gleno-humeral space. Patients randomised to receive supervised ultrasonic therapy started their programme on the same day with ultrasonic therapy daily for 3 weeks (1.5w/cm^2 for 7 minutes). All patients participating in the study were taught a simple, 10-minute exercise programme to be done at home twice daily. They consisted of pendulum exercises, auto-assisted, active ROM and stretching exercises in the planes of flexion, abduction, external rotation, and internal rotation (hand behind back).Participants were asked to cease non-steroidal anti-inflammatory. The patients were re-evaluated at 3 weeks, 6 weeks, 12 weeks, and 24 weeks after initial visit. On each visit, investigator completed the SPADI score, measured active and passive ROM and noted any adverse reactions.

Follow-up and assessment of outcome

The patients were evaluated at 3 weeks, 6 weeks, 12 weeks, and 24 weeks. On each visit, investigator completed the SPADI score, measured active and passive ROM and noted any adverse reactions. Data was analysed with SPSS for windows version 10. Mean values and proportions of patients at baseline were compared on the Fisher's exact tests/chi-square tests. For continuous variables, the 3 groups were compared using two ways ANOVA and Benforroni comparison test. The results were considered significant at 5% level ($p<0.05$).

Results:

Between May 2007 and May 2008, 75 subjects were enrolled in the study, with 25 subjects in the corticosteroid group, 25 in the sodium HA group and 25 in the ultrasonic therapy group (UST). Out of the 75 patients, 4 patients in the corticosteroid group, 5 in the HA group and 5 in the UST group, did not return for follow-up visits.

Demographic data

Patients included in the study ranged from 35 to 85 years of age; mean age being 54.49±10.84 (Fig 1). Patients had no significant difference of age in the three groups (p=0.55).Out of 61 patient 35 were males (57.4%) and 26 (42.6%) were females (Fig 2). Sex distribution was similar in all the three groups (p=0.95). Forty (65.6%) patients had involvement of left shoulder whereas 21(34.4%) had right side involvement. After receiving treatment for PA shoulder, 26 patients out of 61 reported few side-effects. In steroid group, out of 21 patients, 20 (95%) patients reported increased pain (mild pain) at the injection site for an average duration of 4 days after receiving injection. In HA group, only 3 (15%) patients out of 20 reported side-effects like increased pain at the side of condition. In UST group, 3 (15%) patients out of 20 reported increased pain (Fig 3).

Response to treatment

At three weeks interval, total pain scores showed improved in all three groups with steroids showing more improvement (differences between groups not significant, p=0.08). At six weeks interval, steroids showed more improvement followed by HA and UST (differences not significant, p=0.55). At 12 weeks interval total Pain scores had improved with HA and Steroids showing significant improvement over UST, p=0.038. (Table 1).

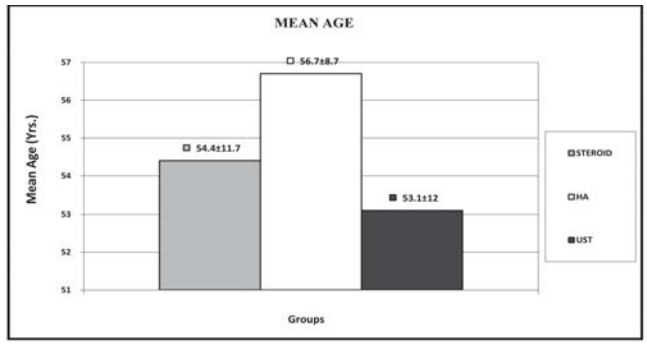

Fig 1- *Mean Age of Patients in Different Groups*

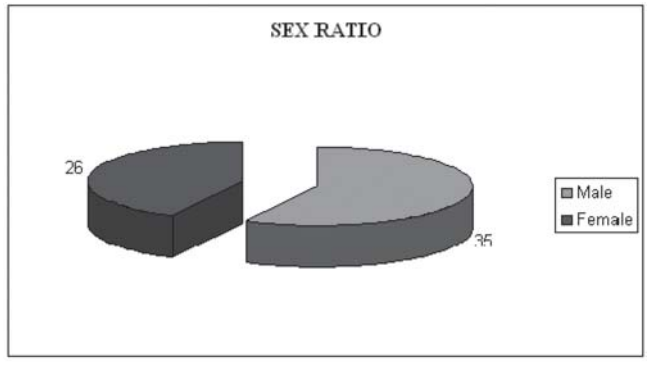

Fig 2- *Sex Distribution*

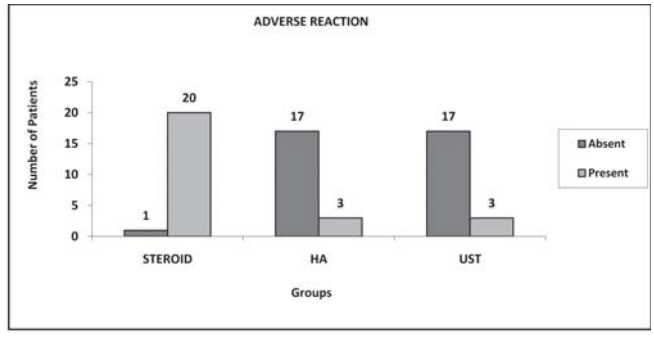

Fig 3- *Adverse Reaction to Treatment (mild pain)*

At 24 weeks interval differences between groups were not significant in all three groups (p=0.461).

All the three groups showed significant improvement on disability score with respect to time, ($p<0.001$).) except in HA group where no significant difference was seen from 0 to 3 weeks (p=0.07) and in UST group from 3 weeks to 6 weeks (0.30). At 3 weeks HA showed more improvement followed by UST and steroid respectively, but the differences between groups were not significant at this level (p=0.99). Six weeks after randomisation HA and steroids showed significant improvement over UST (p=0.03). Twelve weeks after enrollment, HA and steroid groups showed significant improvement over UST therapy (p=0.03). Twenty-four

weeks after enrollment, HA and steroid groups showed significant improvement over UST (p=0.02) (Table 2).

With respect to SPADI, all the three groups showed significant improvement with time (p=0.001) except in UST group from 3 weeks to 6weeks (p=0.1), and from 6weeks to 12 weeks (p=0.20). HA and steroid groups showed significant improvement as compared to UST group at 6 weeks, 12 weeks and 24 weeks respectively. (Table 3). The total active and passive ROM increased in all groups compared with baseline values. The HA group and steroid group had greater improvement than the ultrasonic group.

Discussion:

PA shoulder is a rheumatologic enigma[7]. Precise definition varies. Response to the many recommended treatments is often capricious. Average age of patients in our study was 54.49 years and range from 35 to 85 years which matches favourably with the studies done by Winters *et al*[10] and Van der Windt *et al*[11]. Number of males outnumbered (57.4%) females (42.6%) in our study contrasting sharply with the studies done by Dacre *et al*[12], Shaffer *et al*[4] and Calis *et al*[7]. Sixty-five per cent patients had involvement of left shoulder and 5% patient had bilateral involvement. Various studies have shown involvement of dominant extremity to be

Table 1: *Improvement in Pain Score (Mean Value ± SD)*

Improvement in Pain Score from baseline				
Group	**P1 (P3w-P0)**	**P2 (P6w-P0)**	**P3 (P12w-P0)**	**P4 (P24w-P0)**
Steroid injection	18.4(±7.9)	20.4(±7.2)	26.9(±8.3)	33.2(±11.3)
HA injection	10.3(±3.3)	19.2(±5.50)	31.3(±10.2)	35.7(±8.85)
US therapy	12.1(±4.5)	16.4(±5.2)	21.3(±7.3)	31(±10.3)

P0=Score at 0 week, **P3w**=Score at 3 weeks, **P6w**=Score at 6 weeks, **P12w**=Score at 12weeks, **P24w**=Score at 24 weeks.

Table 2: *Improvement in Disability Score (Mean Value± SD)*

Improvement in Disability Scores from baseline				
Group	**D1**(D3w-D0)	**D2** (D6w-D0)	**D3** (D12w-D0)	**D4(**D24w-D0)
Steroid injection	7.8(±3.3)	20.3(±7.3)	32.3(±11.3)	45.8(±13.5)
HA injection	9(±3.39)	25.5(±7.8)	36(±11.3)	44.7(±13.5)
US therapy	7.8(±2.6)	12.8(±4.2)	17.5(±4.2)	35.7(±12.2)

D0=Score at 0 week, **D3w**=Score at 3 weeks, **D6w**=Score at 6weeks, **D12w**=Score at 12weeks, **D24w**=Score at 24weeks.

Table 3: *Improvements in SPADI Score*

	Improvement in SPADI Score			
Group	**T1** (T3w-T0)	**T2**(T6w-T0)	**T3** (T12w-T0)	**T4** T24w-T0
Steroid injection	20(±7.54)	31.3(±11.3)	45.53(±13.5)	60.76(±15.7)
HA injection	14.85(±5.4)	34.38 (±11.5)	51.77(±15.76)	61.85(±17.5)
US therapy	15.31(±6.54)	22.47(±6.76)	29.77(±10.7)	51.3(±12.9)

T0=Score at 0 week, **T3w**=Score at 3 weeks, **T6w**=Score at 6weeks, **T12w**=Score at 12weeks, **T24w**=Score at 24 week

more than non-dominant extremity[10, 13] whereas a few studies have shown the opposite trends. There seems to be no consensus regarding the extremity involved. In steroid group after receiving injection, 95% of patients reported few side-effects that include increased pain (mild pain) at the injection site for an average duration of 4 days. This finding matches with that of Van der Windt *et al*[10] who also found mild adverse reactions, mainly increased pain after treatment by more than 50% of the patients. In their study, adverse reactions to corticosteroids were particularly frequent in women that include facial flushing and irregular menstrual bleeding. Our patients reported no such side-effects. Eustace *et al*[14] also reported that patients complain of some degree of discomfort after injection.

Though it is a self limiting disease, it leaves behind stiff, shoulder. Although the natural history of PA shoulder is of ultimate resolution, this may not be complete. In a prospective study of 41 patients with five to ten year's follow-up Reeves[3] (1976) found that 39% had full recovery, 54% had clinical limitation without functional disability, and seven per cent had functional limitation. Shaffer *et al*[4] (1992) showed that 50% of his 61 patients with PA shoulder had some degree of pain and stiffness seven years after onset of the disease. Our findings with respect to pain score match with that of Carette *et al*[15] who compared the efficacy of a single intra-articular corticosteroid injection, a supervised physiotherapy programme, a combination of the two, and placebo in the treatment of PA shoulder. They found that at 12 months, the 4 groups did not differ significantly with respect to pain confirming the notion that PA shoulder has a favourable natural history with respect to pain. They also concluded that a single intra-articular injection of corticosteroid administered under fluoroscopy combined with a simple home exercise programme is effective in improving shoulder pain and disability in patients with adhesive capsulitis. Adding supervised physiotherapy provides faster improvement in shoulder range of motion. When used alone, supervised physiotherapy is of limited efficacy in the management of PA shoulder. Bulgen *et al*[13] evaluated intra-articular steroids, mobilisations and ice therapy against control. Steroid injection improvement pain and range of movement in the early stages though in the long term all the modalities had same effect. There appears to be little place for physiotherapy alone, and, if used, it should not be continued for more than four weeks. Dacre *et al*[12] compared steroid injections and physiotherapy for the painful stiff shoulder, the local steroid injections being as effective as physiotherapy alone or a combination. So far only three earlier studies have compared the effect of sodium HA with other treatment regimens. Calis *et al*[7] compared the effects of HA, steroid and physical therapy modalities with a fourth group serving as control and found best results with physical therapy modalities which is in sharp contrast to our results. In another study by Rovetta *et al*[9] where he compared the effect of intra-articular injections of HA plus steroid with steroid and physiotherapy alone, the results indicated an improvement of pain and joint motion after 6 months in all patients, especially in patients treated with HA. Another study by Itokazu *et al*[8] showed similar results. Many reports of uncontrolled experience with local corticosteroids and physiotherapy have shown conflicting results. None of these studies attempted to assess the accuracy with which the steroids were injected.

Limitation of study:

Though our study clearly establishes superiority of intra-articular steroid and sodium HA in the treatment of PA shoulder, many issues remain unclear about intra-articular injections–number of injections needed, the stage of disease at which injections should be administered, the most effective corticosteroid, and the most effective dosage. HA injections have low reaction profile but bigger studies of longer durations are needed to establish its place in routine treatment of PA shoulder.

Conclusion:

In conclusion, intra-articular injection of steroid and HA combined with a simple home exercise programme were equally effective in improving shoulder pain and disability. Deep heat is significantly inferior to intra-articular injection of steroid and HA. Intra-articular injection of steroid is a cost effective treatment for PA shoulder.

What we already knew and what we have learned from this article

PA or frozen shoulder is a common but poorly understood syndrome of painful shoulder stiffness. There are variety of treatments available, most common being use of therapeutic exercises along with some deep heating modality. We have clearly shown in the study that though deep heat is also an effective treatment modality but it is significantly inferior to intra-articular injection of steroid

and sodium HA. We already knew that steroid is effective treatment for PA shoulder along with therapeutic exercises as many previous authors have shown but efficacy of sodium HA in improving pain and disability was established by our study.

Financial disclaimer:

No financial help of any kind was taken from any person or authority for the conduction of this study.

References:

1. Zuckerman J D, Cuomo F. Frozen shoulder in the shoulder: a balance of mobility and stability, 1993: 253-67.
2. Binder AI, Bulgen DY, Hazleman BL, Roberts S. Frozen shoulder: a long-term prospective study. *Ann Rheum Dis* 1984; **43:** 361-4.
3. Reeves B. The natural history of the frozen shoulder syndrome. *Scand J Rheumatol* 1975; **4:** 193-6.
4. Shaffer B, Tibone JE, Kerlan RK. Frozen shoulder: a long-term follow-up. *J Bone Joint Surg Am* 1992; **74:** 738-46.
5. Lee PN, Lee M, Haq AM, Longton EB, Wright V. Periarthritis of the shoulder: trial of treatments investigated by multivariate analysis. *Ann Rheum Dis* 1974; **33:** 116-9.
6. Crisp EJ, Kandall PH. Treatment of periarthritis shoulder with hydrocortisone. *BMJ*, 1955; **1:** 1500-144.
7. Calis M, Demir H, Ulker S, *et al*. Is intraarticular sodium hyaluronate injection an alternative treatment in patients with adhesive capsulitis? *Rheumatol Int* 2006; **26:** 536-40.
8. Itokazu M, Matsunaga T. Clinical evaluation of high-molecular-weight sodium hyaluronate for the treatment of patients with periarthritis of the shoulder. *Clin Ther* 1995; **17:** 946-55.
9. Rovetta G, Monteforte P. Intraarticular injection of sodium hyaluronate plus steroid versus steroid in adhesive capsulitis of the shoulder. *Int J Tissue React* 1998; **20:** 125-30.
10. Winters JC, Sobel JS, Groenier KH, Arendzen HJ, Meyboom-de Jong B. Comparison of physiotherapy, manipulation, and corticosteroid injection for treating shoulder complaints in general practice: randomised, single blind study. *BMJ* 1997; **314:** 1320-5.
11. Van der Windt DA, Koes BW, Deville W, Boeke AJ, De Jong BA, Bouter LM. Effectiveness of corticosteroid injections versus physiotherapy for the treatment of painful stiff shoulder in primary care: randomized trial. *BMJ* 1998; **317:** 1292-6.
12. Dacre JE, Beeney N, Scott DL. Injections and physiotherapy for the painful stiff shoulder. *Ann Rheum Dis* 1989; **48:** 322-5.
13. Bulgen DY, Binder AI, Hazleman BL, Dutton J, Roberts S. Frozen shoulder: prospective clinical study with an evaluation of three treatment regimens. *Ann Rheum Dis* 1984; **43:** 353-60.
14. Eustace JA, Brophy DP, Gibney RP, Bresnihan B, Fitz Gerald O. Comparison of the accuracy of steroid placement with clinical outcome in patients with shoulder symptoms. *Ann Rheum* 1997; **56:** 59.
15. Carette S, Moffet H, Tardif, *et al*. Intraarticular corticosteroids, supervised physiotherapy, or a combination of the two in the treatment of adhesive capsulitis of the shoulder: a placebo-controlled trial. *Arthritis Rheum* 2003; **48:** 829-38.

Editorial

Post Graduate Medical Education in Physical Medicine and Rehabilitation

Rehabilitation is "The use of all means aimed at reducing the impact of disabling and handicapping conditions and at enabling people with disabilities to achieve optimal social integration". PMR is an independent medical specialty concern with promotion of physical and cognitive functioning, activities (including behaviour), participation (including quality of life) and modifying personal and environmental factors. It is thus responsible for the prevention, diagnosis, treatment and rehabilitation management of people with disabling medical conditions and co-morbidity across all ages. PMR specialist develops an intervention plan based on diagnosis and disability of patient.

The goal of post graduate training is to train specialists who will devote their time and efforts to a particular area of medicine. Extensive training, the acquisition of special knowledge and skills, and years of practical experience are necessary. The role of the specialist can be catagorized according to three main areas of activity i.e. care, education and training, and research. Care is based on special clinical skills of specialist. Education and training in rehabilitation is a learning process for both the patient, the family and other members of the team. Research should not be restricted to medical school; it can also be performed in the daily medical activities or other medical institutions such as hospital, medical centre and other community settings. The objective of the medical education institution is to shape the necessary attitudes, skills and knowledge according to the concepts and methodology of rehabilitation medicine and to fulfill the educational requirements so that the specialist is able to function in the rehabilitation field. Specialists should be capable of planning and coordinating the entire rehabilitation process as well as leading the team and views patients holistically. He or she must be familiar with how to care for patients as well as their relatives in crisis and should meet regularly with the team, patient and family. Cooperation with other specialists is essential and close cooperation with personnel who are responsible for primary care should be initiated. The specialist should have knowledge of diseases and injuries encountered in rehabilitation. The specialist must understand and be able to promote the concept that help can not be imposed upon the patient, only offered to the patient.

A difficulty exist in that few medical colleges have created department for PMR.Thus not enough physicians are being trained in this specialty and not enough hospitals with good rehabilitation departments are available to meet the needs of patients. The specialty has different nomenclature in different parts of the globe. Physical Medicine, Physical and Rehabilitation Medicine, Rehabilitation Medicine and Physical Medicine and Rehabilitation (in India) are some of them. Like the different nomenclatures the post graduate training also differs in duration and content. In Europe residency is four years but in India MD (PMR) & DNB (PMR) is three years, DIP (PMR) is two years respectively. With only 500 PMR specialists, India could use over 5000 to meet the level of coverage of China and other emerging countries. However MCI rules require only 1 or 2 trainees per faculty members and a full three years training. This means that it would take perhaps half a century to meet the basic need. This problem needs to be addressed specifically how will India and others meet their need?

To overcome the situation following measure may be helpful to create more specialist and faculty.

- Formulation of a universal, short, practicable and modern PG course curriculum.
- Permit more resident (2 or 4) per faculty member.
- After completion of three years basic training in PMR, the diploma holder in PMR may be treated as faculty.
- Additional one year training in PMR for the degree holder of allied specialty like Orthopedic, General Medicine, Peadiatric Medicine, General Surgery may be treated as faculty.
- Post doctoral training in combination with PMR i.e Cardiology, Rheumatology, Neurology, Neurosurgery, Plastic Surgery, Urology may be treated as faculty.
- Relaxation by MCI in PG teaching requirement in respect of faculty, bed and other facilities.

The future goals for the specialty cover the development of a "Culture of Rehabilitation" as a fundamental right for people with disabilities and one of the roles of PMR specialist is to realise that.

– R. N. Haldar

Case Report

Pentazocine Induced Contractures: A Case Report of Drug Abuse

Agarwal A.K.[1], Gupta A.K[2], Sharma V.P.[3], Kumar Dileep[4]

Abstract

Contractures around the joints are seen due to multiple causes in our day to day practice where pathology can be superficial or deep. Further it can involve one joint or multiple joints. We are presenting a rare case of drug abuse due to pentazocine (fortwin) here in a 32 years old male, who had generalised and severe contractures of his hips, knees and ankles. In all such cases of myogenic generalised contractures around multiples joints, we must exclude the possibility of drug abuse.

Key words : **Contracture, pentazocine.**

Introduction:

Contractures are seen either due to intra-articular lesions or due to extra-articular lesions. Intra-articular lesions have a definite joint pathology, while extra-articular lesions are due to paralysis, myopathy, spasticity, myositis and vascular ischaemia, etc. There are few reports[1,2] of myopathy following chronic pentazocine administration. The myogenic contractures due to parenteral use of narcotics are rare clinical presentation[3,4]. The association with contractures around the shoulder and hip joints have been reported earlier[5,6] but we have not been able to find such a case of extensive myogenic involvement of bilateral hip, knee and ankle along with lower abdomen due to drug abuse in the literature.

Case Report:

A 32 years old male, Ayurvedic physician presented with the complaints of walking in equinus both sides along with complete stiffness of both hips, knees, ankles, lower lumbar spine and both shoulders in our OPD of Dept of PMR, KG Medical University, Lucknow in 2011. He was non-diabetic, normotensive. He gave the history of chronic abuse of injection pentazocine (up to 2 ampoules per day, intravenous as well as intramuscular) while he was undergraduate i.e., 10 years before, for relief of severe ureteric colic. His father, a general practitioner himself used to give injection to his son for relief of pain and then gradually he became an addict. He used to self administer the injections on his shoulders, anterior abdominal wall, buttocks, hips, thigh, calves, forearms and upper arms. Later he developed multiple subcutaneous and muscular abscesses (calves and thighs). He also gave history of road traffic accidents leading to multiple fractures around knee joint (bilaterally), left elbow and dislocation of right shoulder.

On examination, his cardiorespiratory and neurological examination showed no abnormality except stiffness of lower abdominal wall. On local examination of both lower limbs thick scar marks of abscess drainage (Fig 1) was seen and tone of musculature gave feeling of abnormal stony hardness with shining skin all over lower limbs (Fig 2). No active and passive ROM was observed in both hip and knee. His feet were in equinus; more severe on right side and few degrees (10-15 degree) of dorsiflexion was seen on either side. He walks on toes with straight knees as if fused in full extension (bilateral) and rotated pelvis for each step.

He was unable to do dressing, squatting and cross-legged sitting and to sit on chair.

His routine blood investigations were within normal limits, Hb-14g/dl, Total leucocyte count-9100/cmm,

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Cite as:
Agarwal A.K., Gupta A.K, Sharma V.P., Kumar Dileep. Pentazocine induced contractures: A case report of drug abuse. IJPMR September 2012; Vol **23 (3):** 117-9.

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Received on 24/02/2012, Revised on 06/09/2012, Accepted on 10/09/201

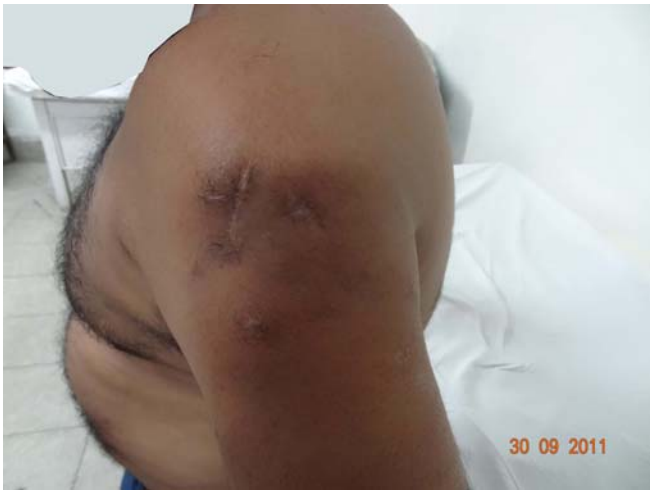


Fig 1- *Scar Marks of Abscess Drainage*

Differential leucocyte count: Neutrophils- 66%, lymphocytes-30%, eosinophils-3%, monocytes-1%, ESR (Wintrobe's Method)-10 mm in first hour, serum calcium-9.7 mg/dl, serum phosphorus-3.8 mg/dl, serum alkaline phosphatase-230 IU, Blood sugar (random)-128mg%, serum creatine-0.7mg/dl, serum CPK-74 IU. Elisa test for HIV, hepatitis C and hepatitis B surface antigen, all were found negative.

EMG of bilateral gastrocnemius, tibialis anterior and vastus medialis revealed normal EMG pattern. High resolution sonography with colour flow imaging and extended field of view imaging have been done for evaluation of both thighs with direct contact scanning technique with 10 & 12 MHz transducers. Both thigh muscles were well visualised. The muscles were echogenic in texture but normal muscle bundle appearance was lost. The pinnate fibre was lost. It involved the diffuse muscle in anterolateral compartments. No evidence of any mass or calcification was seen. On colour flow imaging, no flow was seen in the muscle bundle. However normal flow was seen in common femoral and superficial femoral arteries on both sides. The findings were suggestive of ecogenic pattern of the thigh muscle with loss of normal muscle texture and suggestive of diffuse fibrosis with normal study of thigh vessels.

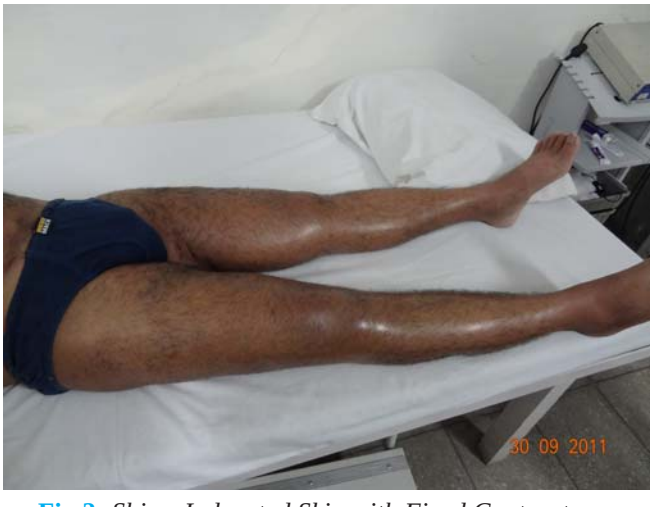


Fig 2- *Shiny, Indurated Skin with Fixed Contractures*

Skiagram of both knees (AP and lateral) showed normal articular cartilage, without any erosions or calcification. Skiagram also showed orthopaedic implant in situ with presence of radiological sign of fracture union (X-ray 1). Skiagram of pelvis with both hips (AP and lateral view) - showed normal acetabulum and head of femur, without any erosions/destructions or calcification (X-ray 2). Skiagram of LS spine (AP and lateral view) - showed normal disc space, shape of body of vertebrae without any erosions/destruction or calcification in paravertrbral region (X-ray 3).

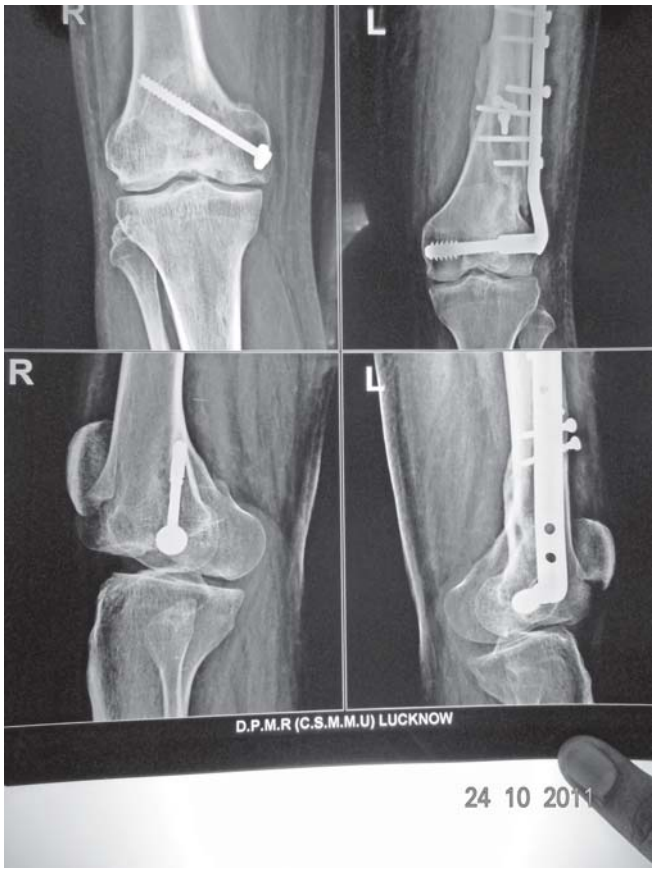
Clinical Diagnosis:

Pentazocine (fortwin) abuse leading to generalised muscle fibrosis in lower limbs, lower back and both shoulder regions.

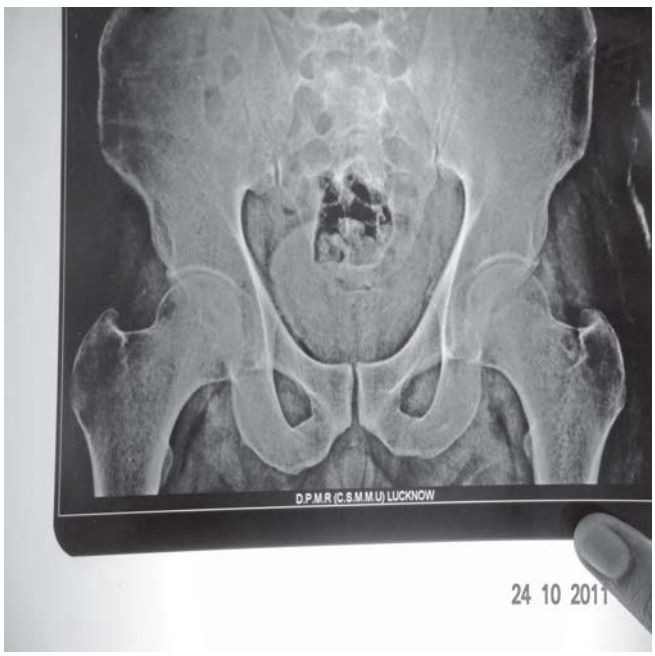
At the end, he came to us for correction of equinus deformity of feet. We had advised gradual passive stretching of plantar flexors, ankle mobilisation exercises, gait training with a suitable walking stick. While he was advised exercises, he was also advised to attend de-addiction programme. His family is now providing him long term good care, support, co-operation and help in his rehabilitation process. The surgical intervention was another option for him for which he has not consented presently.

Discussion:

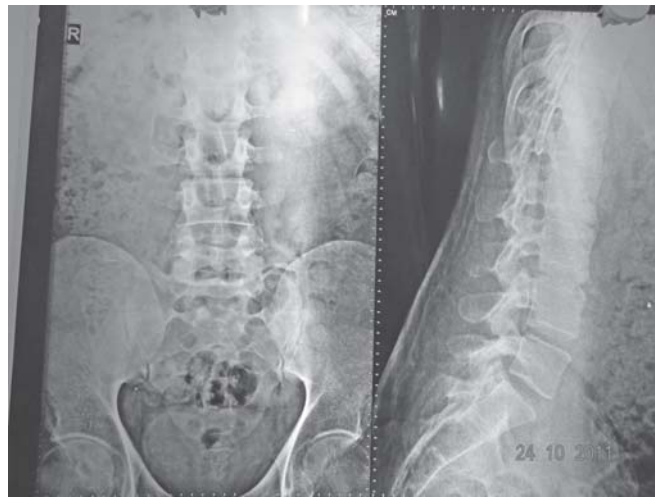
We have not come across such a case of drug abuse in our OPD since many decades. However whenever contracture occurs, it is either due to a joint disease or due to muscular pathology. In the present case, all weight bearing joints of both lower limbs (hip, knee and ankle) were having no joint pathology as evident by normal skiagrams and his multiple fractures have united fairly well in the past. Normal CPK value and normal EMG pattern ruled out any ongoing muscle destruction pathology as reported in few studies. Schlicher *et al*[7] reported that pentazocine injection precipitates in extra-cellular tissue resulting in inflammation. Palestine *et al*[8] had observed fibrosis endarteritis, vascular



X-Ray 1: *Orthopaedic Implant in-situ with Presence of Radiological Sign of Fracture Union*



X-Ray 2: *Normal Acetabulum and Head of Femur, without any Erosions/Destructions or Calcification*



X-Ray 3 – *Normal Skiagram of LS Spine*

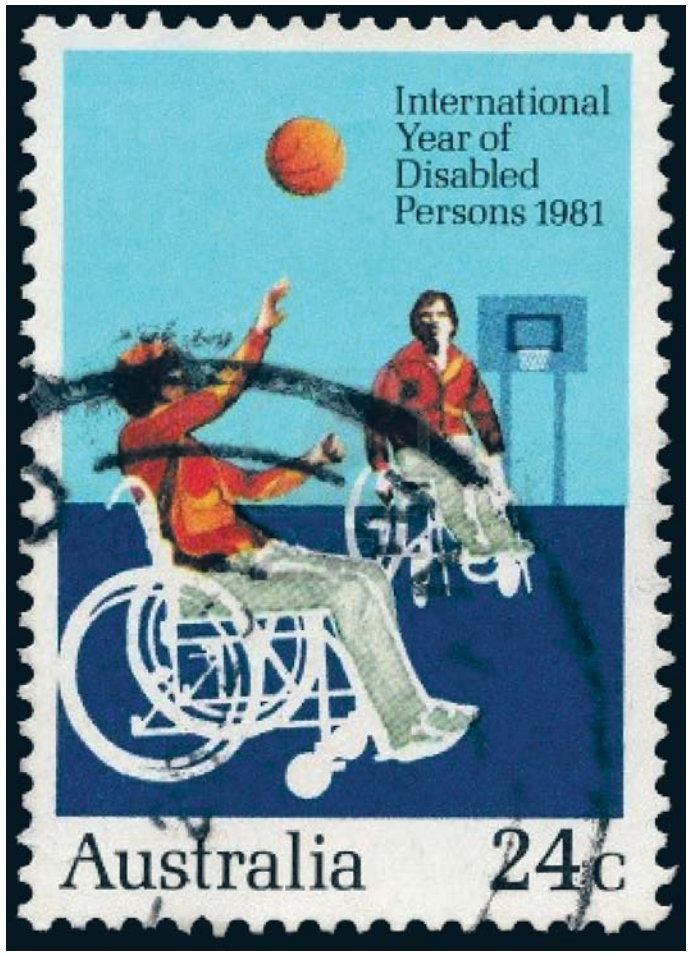
thrombosis, granulomatous inflammation and fat necrosis in histopathological studies in muscles after repeated use of pentazocine parenteraly.

It is a common practice to use pentazocine (fortwin) for management of severe chronic pain and slowly the individual becomes addict. Good numbers of studies are presently available to see the long term use and its ill effect leading to sclerotic ulcers, myopathy and contractures. In such cases, we must start de-addiction therapy, counselling and treatment of contracture as early as possible to save each joint. In every case of contracture, may be locally or generalised we must take proper history of pentazocine abuse.

References:

1. Steiner JC, Winkelman AC, deJesus PV. Pentazocine induced myopathy. *Arch Neurol* 1973; **28:** 408-9.
2. Joong S, Rollins JL, Lewis I. Pentazocine induced fibrous myopathy. *JAMA* 1975; **231:** 271-3.
3. Das CP, Thussu A, Prabhakar S, Banerjee AK. Pentazocine-induced fibromyositis and contracture. *Postgrad Med J* 1999; **75:** 361-2.
4. Srikumar V, Wadhwa S, Singh U, Yadav SL, Handa G. Contractures and drug abuse. *IJPMR* 2009; **20:** 34-5.
5. Branick RL, Robert JL,Glyn JJ, Beatie JC. Talurn (pentazocine) induced deltoid contractures: In: Proceedings of the Western Orthopedic Association. *J Bone Joint Surg Ann* 1976; **58:** 279.
6. Wolbrink AJ, Hsu Z, Bianco AJ. Abduction contracture of the shoulders and hips secondary to fibrous bands. *J Bone Joint Surg Ann* 1973; **55:** 844–6.
7. Schlicher JE, Zuehlke RL, Lynch PJ. Local changes at the site of pentazocine injection. *Arch Dermatol* 1971; **104:** 90-1.
8. Palestine RF, Millns JL, Spigel GT, Schroeter AL. Skin manifestation of pentazocine abuse. *J Am Acad Dermatol* 1980; **2:** 47-55.

Medical Philately



International Year of Disabled Persons 1981

Australia CIRCA 1981: A stasmp printed by Australia, shows disabilities to play wheel chair busketball, CIRCA 1981

Image ID: 10995012

PG Forum

REHAB CHALLENGES

A seventeen years old lady is suffering from C5 level of spinal cord injury due to high voltage electrical injuries. After a long difficult journey of active treatment and rehabilitation she recovered a lot with full function of upper limb and normal bladder and bowel function. Unfortunately her left great toe, second and third toes were amputated due to necrosis at the second month of injury. She was unable to walk due to 2 and 3 spasticity of lower limb.

Then she has been again admitted in rehabilitation ward and treated with antispastic medication and physical therapy. After that a tendo-achillis release operation done on her left leg and phenol block was performed on her right posterior tibial nerve. Her standing balance improved dramatically but she is still facing difficulty in mobility due to genu recurvatum (Fig 1 & 2).

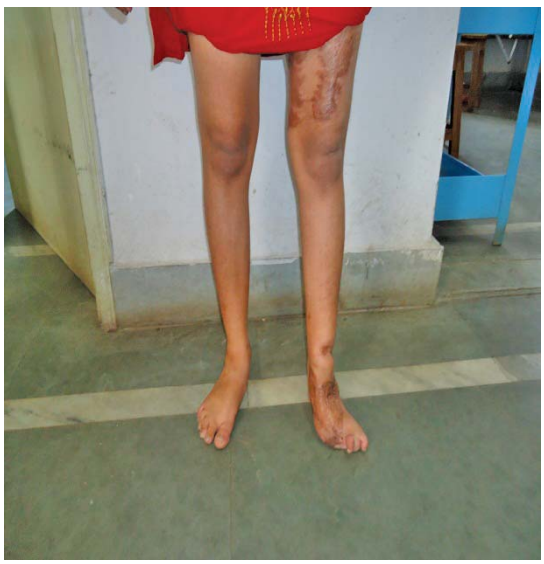


Fig 1- Showing Genu Recurvatum

Fig 2- Showing Genu Recurvatum

On examination it is noted that passive ROM of left ankle is still restricted to neutral position, that is why she is not a candidate for an AFO in dorsiflexed position. She is now desperate for independent mobility without any gait or mobility aids.

Please opine regarding orthoses options for this lady?

PG Forum

REHAB QUIZ

1. Chronaxy is

A) Thrice the rheobase
B) The minimal time required to excite the neuromuscular tissue using a stimulus of twice the rheobase
C) Half the rheobase
D) None of the above

2. Jitter is increased in all except

A) Myasthenia gravis
B) Myotonia dystrophica
C) Progressive spinal muscular atrophy
D) During denervation

3. Somatosensory evoked potentials are useful in the prognoses of

A) Cerebellar infarct
B) Spinal cord injury.
C) Polymyositis
D) None of the above

4. Which of the following braces is preferred to correct a severe equino-varus foot in spinal hemiplegia?

A) Double-upright, short leg brace with Klenzak ankle
B) Spring wire dorsiflexion orthoses
C) Moulded polypropylene AFO
D) Double-upright, short leg brace with T strap attached on the medial side of shoe

5. Lhermitte's sign may be found in

A) Amyotrophic lateral sclerosis
B) Multiple sclerosis
C) Peripheral neuropathy
D) Anterior spinal artery thrombosis

6. In an older female BK amputee with some lateral instability of the knee and a short stump, which prosthesis might best be prescribed?

A) Conventional with thigh corset
B) PTB with supracondylar strap
C) PTB with thigh corset
D) PTS

PG Forum

7. Abducted gait in an AK amputee can be caused by all of the following except

A) Pain in the groin or in the end of the femur
B) A too small socket
C) A too large socket
D) Adductor contracture

8. Tuberous sclerosis is characterized by all of the following except

A) Convulsive seizures
B) Mental retardation
C) Simian crease on the palm
D) Congenital visceral tumours

9. The complication of spina bifida cystica include all of the following except

A) Cardiomegaly
B) Hydrocephalus
C) Pyelonephritis
D) Kyphosis

10. When a patient's strength reaches a plateau, it can be maintained near that level by exercising at least

A) Every other day
B) Once a week
C) Twice a week
D) Every other week

ANSWERS

June issue:

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

Original Article

Traumatic Cervical Spine Injury Pattern– A Snapshot

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Abstract

Study design and subjects: Cross-sectional descriptive study of pattern of cervical spine injury at a tertiary care rehabilitation centre in Rajasthan.

Objectives: To observe the socio demographic profile and injury pattern in cervical spinal cord injury.

Methods: One hundred and forty-one clients of traumatic cervical spine injury (CSI) were admitted from 1st December 2010 to 15th October 2011 at the Department of Physical Medicine and Rehabilitation, S.M.S. Medical College and Hospital, Jaipur. Detailed clinical, neurological evaluation as per American Spinal Injury Association Classification (ASIA) and radiological assessment were done along with identification of mechanism of injury, mode of evacuation and presence of associated injuries. Data analysis was done in October 2011 and results were compiled and analysed.

Results: Mean age in our sample was 35.87 ± 14.38 years that comprised 11 females (7.8%) and 130 males (92.2%) of whom 78 (55.3%) fell in the age group of 25 to 55 years. Majority 64 (45.4%) were illiterate, 80 (56.8%) being farmers and labourers. Greater fraction had road traffic accidents i.e., 66 (46.81%) and fall from height 56 (39.72%) as the mechanism of trauma. Only 69 (49.8%) could arrange an ambulance for transport. Majority of the injured i.e., 84 (59.57%) presented with neurologically complete picture as per ASIA classification and the most common involvement being of 5^{th} and 6^{th} cervical segments i.e., 103 (73.15%).

Conclusion: This study evaluated the demographic variables of cervical spine injury for better understanding of impact that it has and further for better allocation of our health resources, distribution and planning

Key words : **American Spinal Injury Association classification, cervical spine injury, demographic, rehabilitation.**

Introduction:

Spine injury is the most devastating event that can occur in an individual's life, owing to which there is multisystem involvement and long term disability. Despite the ongoing research in the treatment of spinal cord injury (SCI) this condition is not yet amenable to complete restoration of function, which is a big obstacle in independent living of the victim. 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. This is a hospital based study from a single tertiary care rehabilitation centre in Rajasthan, with a view to give a snapshot of the SCI pattern in this 8th largest state of India.

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Cite as:
Joshi M, Agrawal M. Traumatic Cervical Spine Injury pattern–a snapshot. IJPMR September 2012; Vol **23 (3):** 111-6.

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Received on 20/06/2012, Revised on 22/09/2012, Accepted on 30/09/2012.

Material and Methods:

All the patients of traumatic cervical SCI admitted for rehabilitation to the department of PM&R, SMS Hospital, Jaipur, were included in the study and a total of 141 CSCI were admitted from Dec, 2010 to Oct, 2011. This is a cross-sectional descriptive study under which each CSCI individual underwent a detailed clinical evaluation and radiological assessment. All independent variables, on which the admitted patient was examined, were compiled on a database.

Table 1: *Agewise Distribution of Cases*

Age group (years)	No. of patients	Percentage (%)
10-25	47	33.3
26-40	55	39.0
41-55	23	16.3
56-70	15	10.6
>=70	1	0.7
Total	141	

Table 2: *Distribution of Cases according to Occupation and Income Group*

• Occupation		
Labourer	41	29.1
Farmer	39	27.7
Student	12	8.5
Government job	3	2.1
Business	6	4.3
Lineman	2	1.4
Private job	17	12.1
Driver	8	5.7
Others :- housewife, gas supplier, pensioner	13	9.2
• Income group		
<Rs.5,000	83	59.3
5,000-10,000	42	30.0
11,000-20,000	9	6.4
20,000-50,000	6	4.3
>50,000	1	0.7

Table 3: *Educationwise Distribution of Cases*

Education	No. of patients	Percentage (%)
Illiterate	64	45.4
Up to 5th standard	37	26.2
6th to 12th standard	21	14.9
>12th standard	18	12.8

Table 4: *Mechanism of Trauma and Mode of Transport*

• Mechanism of trauma	No. of patients	Percentage (%)
I. Road traffic accident	66	46.8
II. Fall from height	56	39.7
o Fall from vehicle/roof	30	21.3
o Fall from tree	4	2.8
o Fall in well/swimming pool	2	1.4
o Fall from height after electric sock	8	5.7
o Fall on ground	12	8.5
III. Fall of heavy weight	13	9.2
IV. Assault	3	2.1
V. Miscellaneous	3	2.1
• Mode of transport		
Ambulance	69	48.9
Private vehicle	72	51.1

Table 5: *Distribution of Cases according to Vertebral Level and Neurological Level*

• Vertebral level	No. of patients	Percentage (%)
C1 - C2	9	5.7
C3	3	1.9
C4	17	10.8
C5	52	33.1
C6	52	33.1
C7	24	15.3
• Neurological level		
A	83	58.9
B	18	12.8
C	13	9.2
D	15	10.6
E	12	8.5

Results:

Mean age of our sample is 35.87 ± 14.38 years, a significant number i.e., 98 (70%) were from the age group of 18 to 40 years (Table 1). There were 11 females (7.8%) and 130 males (92.2%), with a male to female ratio of 12:1.

Vocation and monthly income (Table 2):

A significant number 80 (56.8%), were farmers and labourers, with an average monthly income of Rs. 5000.

Education (Table 3) and socio-economic status (Fig 1): Sixty four i.e. 45.4% were illiterate. Taking into account educational status, income and job profile of each individual, we attempted to find out the socio-economic strata of our sample through Kuppuswamy score. Kuppuswamy score is the most standard tool to calculate the same. A sound number 70% of the sample belonged to the most vulnerable upper lower group.

Mechanism of trauma and mode of transport (Table 4):

Majority 66 (46.81%) had road traffic accidents and fall from height 56 (39.72%) as the cause of injury. Chi-square value was 118.625 at 4 degree of freedom with a

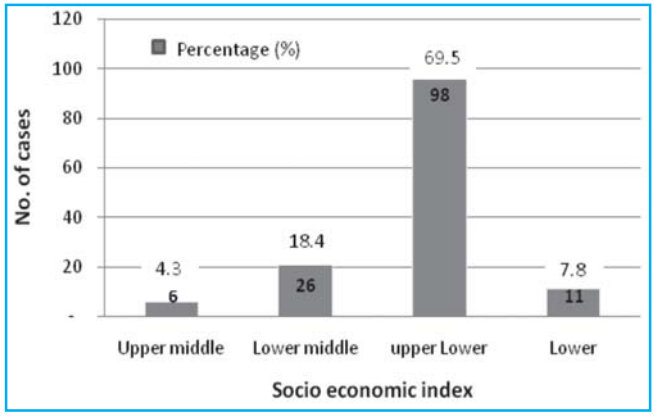

Fig 1- *Kuppuswamy Score*

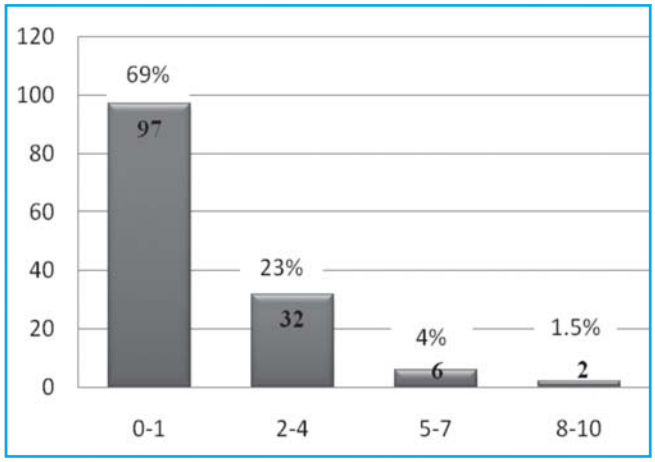

Fig 2- *Delay in Admission*

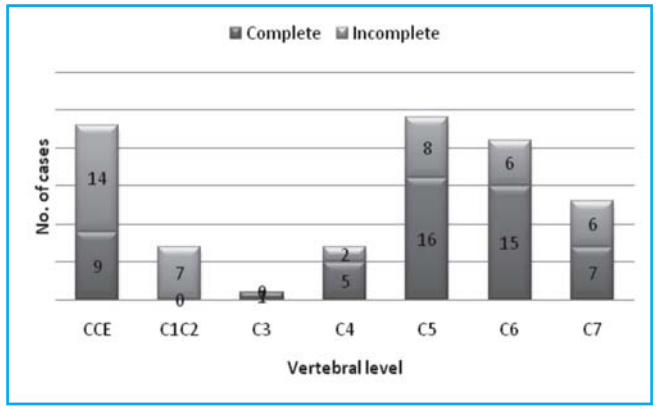

Fig 3- *Vertebral and Neurological Level in Road Traffic Accidents*

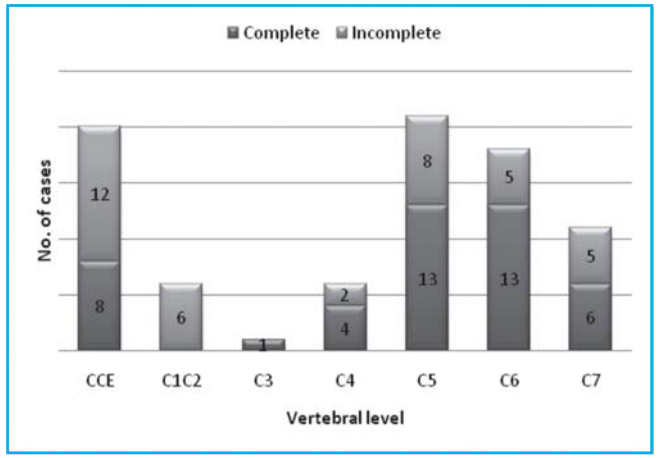

Fig 4- *Vertebral Level and Neurological Level in Fall from Height*

p value <.001 which suggests it to be highly significant. Only 69 (49.8%) received ambulance for transport, leading to a delay in admission in 97 (68.7%) cases to a tertiary care centre for more than 24 hours (Fig 2).

Vertebral and neurological level (Table 5 & Fig 3-4):

Most of the injured presented with neurologically complete picture 84 (59.57%), ratio of complete and incomplete injuries being 2.8:1 at the time of presentation at tertiary care centre. Most common involvement in, 103 (73.15%) cases was of cervical segments 5 and 6.

Discussion:

In the past two decades, India has witnessed rapid urbanisation, motorisation, industrialisation and migration of people resulting from socio-economic growth and development. Injuries are a major public health problem in India. Gururaj[1] in 2011 stated, that road crashes and deaths have increased from 68,351 in 1995 to 1,26,896 by 2009 with a national average of 110/ million population, though the real incidence of SCI is not yet known because of lack of national registry. Sekhon and Fehlings[2] reported that the incidence of SCI varies between 15 and 40 per million each year in developed countries.

The rapid and unprecedented motorisation in India, with not so strong health infrastructure of our country, a poor per capita health spending (1.4% of GDP), and insufficient healthcare financing mechanisms, 66% healthcare expenditure being out of pocket, is probably increasing the burden of SCI[3]. Also, looking at the startling statistics of recovery patterns with less than 12% cases showing some improvement in our study at the end of three months, it is high time to realise that prevention of occurrence of SCI is better than cure. The world over, there is a recognition that more effective preventive health programmes are the only way to reduce spiralling health costs.

Agrawal *et al*[4] reported a sex ratio of 3.6:1 and Li *et al*[5] documented a sex ratio of 3.1:1. Sex distribution in our

study is 12:1, which is similar to other recent studies in a sense that males are more commonly injured than females, but the gap in our study was too large which may probably reflect the difference in sociocultural practices decreasing the women's exposure to outside world and subsequent risk of SCI. Most common age group in our study was 20-39 years. The age distribution of patients is comparable with studies[6-10] from other parts of the world. The prime earning age in which the individuals were rendered completely disabled, emphasises that the focus of our strategies should be towards our work force as they are the once who are at utmost risk on account of their occupation.

Our observation of higher incidence of traumatic cervical SCI in rural population is in close agreement with the previous literature[11-13]. Despite the fact that greater than 68.84% of Indian population lives in rural areas[14], comprehensive trauma care in India (including emergency, acute care and rehabilitation services) is in total disarray amid disparities of high technology and sophistication in urban areas and non-availability of even primary care in rural areas.

Data from developed countries clearly establishes road traffic accidents as the main cause of SCI[15-19] in contrast to the study of Singh *et al*[20] in India that showed fall from height to be the major cause. Lack of strict implementation of rules in various non-metropolitan cities of India along with lack of awareness among the general population regarding adherence to traffic rules still prevails as an important cause of road traffic accident and spinal trauma. Lack of fencing on the terrace and guarding of the staircase make fall from height a realistic possibility. Habit of sleeping on an unprotected terrace leads to falls. Use of substandard material in the construction of rural houses endangers the lives of people living in them.

Secondary injury to the cord can sometimes be much more catastrophic than the primary injury, and it occurs commonly at the time of transport from the site of trauma to specialised centre. Despite the fact that "108" ambulance facilities have been started by our government in all cities of Rajasthan, less than half of the injured in our study could arrange for an ambulance. These services 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. None of the injured in our study received the primary management as per SCI protocols, well in concordance with studies of Nguyen *et al*[21] and Solagberu *et al*[22].

Neurologically complete injuries (ASIA A) were the most common in our study, as against the higher percentage of incomplete injuries in the developed world[23,24]. This can be attributed to lack of observation of strict SCI extrication protocols at the site of trauma which reflects in our data, with more than 61% injured presenting to a tertiary care centre with a delay of >8 hours and rest 39% with a mean delay of 6 days.

According to the World Bank report, nearly 39.72% of India's population in 2005 (456 million)[3] live just above line of deprivation (<1.25$ a day). The upper lower group is the most vulnerable to fall into the category of below poverty line as it cannot sustain health, economical, pathological or social pressure. World Bank estimates show that 2.2 % of India's population (around 24 million people) goes into poverty every year because of catastrophic health expenditure that they have to make despite being treated in government hospital where most of the treatment is either free of cost or largely subsidised. The government's share in the healthcare delivery market is 20 per cent while 80 percent is with the private sector. Therefore, it is imperative for the government to increase the per capita health expenditure and provide for greater number of hospitals and specialised centres where facilities for management and rehabilitation of such chronically ill patients can be provided.

SCI management does not end with spinal instrumentation or a decision to pursue a conservative management regime. SCI rehabilitation is the only way that ensures a successful community reintegration of a SCI patient as an active member. There is complete non-existence of hospital and community rehabilitation in India as a whole, even in Rajasthan; there is only one department of physical medicine and rehabilitation with comprehensive care of inpatients and outpatients. This reflects that health planners are focusing all their resources on acute care and least substantial effort on prevention of ever increasing injuries and rehabilitation of chronically injured are being made.

The home visit programme conducted at Ahmadabad by Prabhaka and Thakkar[25] for spinal cord injured patients decreased the number of readmissions by improving the status of rehabilitation, which raised the quality of care for patients with SCI. Such programmes can be carried out on a broader basis like national

programmes, by involving lady health workers and multipurpose rehabilitation staff to maximise the number of patients who can be benefited.

Our study shows a joint family versus nuclear family ratio of 1.1:1, depicting the increasing trend towards nuclear families. With an average family size of 5, most being illiterate, when the only earning member of the family is disabled, it leads to dire socio-economic consequences for the entire family. To our knowledge, only one vocational rehabilitation centre is working in Rajasthan which is not able to meet the needs of highly dependent challenged individuals. The disability pension which is being provided by the government is meagre to make the two ends meet. Thus, vocational rehabilitation, counselling and training is a must.

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. In order to prevent fall from height, safety guards should be provided for workers at construction sites and negligence on the part of employers regarding safety precautions should be made a punishable offence under law. People should be made aware of the precautions that should be taken while building their houses. It is imperative that our prevention programmes should be formulated with maximum use of local language, pictorial presentation and stage shows being included in the curriculum for better understanding by the rural, illiterate population of India.

Better ambulance facilities with medical and paramedical staff trained in management of SCI is a must. Training programmes to give an opportunity to health workers to improve their knowledge in the comprehensive management of spinal cord injured patients should be carried out on a regular basis. Hospitals managing spinal trauma must have a comprehensive spinal trauma rehabilitation team, led by rehabilitation medicine specialist.

Most of the studies in medical literature are from developed countries where the problem and presentations are different with respect to the mode of injury and other demographic variables. Though this study may not be a true representation of demography of all spinal injuries in India, as it is restricted to a single institute, it may best give a snapshot of existing scenario. Unfortunately, there is no data on those who present to a private hospital, died at the site of trauma or never presented to any hospital. Therefore, there is a dire need to establish a national SCI registry system in order to address both the emerging and prevailing trauma care profile. It should be made compulsory to all the private hospitals and government owned institutions to report each and every case of such injuries in order to prepare a national database so that our government is able to better plan, the funding for specialised medical rehabilitation nationwide.

Conclusion:

In this observational study from a single rehabilitation centre, there were 141 patients in a period of eleven months, admitted for cervical spine injury and these patients were from upper lower socio-economic strata and most of them were labourers and farmers. According to the recent World health Organisation and Government of India survey, this is the most vulnerable strata of the society who are just above the poverty line and drift below the poverty line after being struck by such demanding health problems. Ninety-three per cent of those who were neurologically complete at the time of admission remained complete at the time of discharge as well. As we are aware that cervical spine injury is a lifelong demanding condition which puts heavy burden not only on the health system but also to the carer, it is imperative that a multi-centre observation study should be carried out to document the exact incidence and prevalence of the same. This will not only help us identify the extent of the problem but shall also guide us in its management in detail in coalition with the national health administrators.

References:

1. Gururaj G. Injury & Violence in India: Facts and Figures, National Institute of Mental Health and Neurosciences, Publication no 82. Bangalore: 2011.
2. Sekhon LHS, Fehlings MG. Epidemiology, Demographics, and pathophysiology of acute spinal cord injury. *Spine 2001*; **26:** S2-S12.
3. India new global poverty estimates, www.worldbank.org.in/.../INDIAEXTN/0,,contentMDK:21880725~
4. 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.
5. 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.
6. Transportation of patients with acute traumatic cervical spine injuries. *Neurosurgery* 2002; **50:** S18-20.
7. Kishan S, Vives MJ, Reiter MF. Timing of surgery following spinal cord injury. *J Spinal Cord Med* 2005; **28:** 11-9.

8. Solagberu BA. Spinal cord injuries in Ilorin, Nigeria. *West Afr J Med* 2002; **21:** 230-2.
9. 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.
10. 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:** 2103-7.
11. Baker SP, Whitfield RA, O Neill B. Country mapping of injury mortality. *J Trauma* 1988; **28:** 741-5.
12. Gabella B, Hoffman RE, Marine WW, Stallones L. Urban and rural traumatic brain injuries in Colorado. *Ann Epidemiol* 1997; **7:** 207-12.
13. Hwang HC, Stallones L, Keefe Thomas J. Childhood injury deaths rural and urban differences, Colorado 1980-8. *Inj Prev* 1997; **3:** 35-47.
14. Rural Urban population of India census 2011, censusindia.gov.in/2011-prov.../data.../india/Rural_Urban_2011.pdf
15. 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.
16. Kraus JF, Franti CE, Riggins RS, *et al*. Incidence of traumatic spinal cord lesions. *J Chronic Dis 1975;* **28:** 471-92.
17. Pickett W, Simpson K, Walker J, Brison RJ. Traumatic spinal cord injury in Ontario, Canada. *J Trauma* 2002; (in press).
18. 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.
19. 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.
20. 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.
21. Nguyen TL, Nguyen TH, Morita S, Sakamoto J. Injury and pre-hospital trauma care in Hanoi, Vietnam. *Injury* 2008. **39:** 1026-33
22. 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.
23. 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.
24. Maharaj JC. 1996. Epidemiology of spinal cord injury in Fiji: 1985-94. *Spinal Cord* 1996; **34:** 549-59.
25. Prabhaka MM, Thakkar TH. A follow-up programme in India for patients with spinal cord injury: Paraplegia safari. *J Spinal Cord Med* 2004; **27:** 260-2.