An official publication
of Madhya Pradesh Chapter
of Indian Orthopaedic Association

ORTHOPAEDIC JOURNAL OF M. P. CHAPTER

ISSN 2320-6993
ICV 37.91
www.ajmpc.com

Volume 22

Issue 1

Table of Contents

S.No.	Title	*Author*	Page
1	Editorial	*Gohiya A*	1
	Original Article		
2	Comparative Analysis of results between Conventional and Accelerated Ponseti Technique for idiopathic congenital clubfoot	*Sharma P, Yadav V, Verma R, Gohiya A, Gaur S*	2-7
3	Fracture Shaft Humerus: Plating OR Nailing?	*Choudhari P, Baxi M, Patidar S*	8-14
4	Intradiscal Ozone Oxygen in Lumbar Disc Prolapse	*Gupta V, Singh P K, Banode P, Khan S*	15-19
5	Should Postoperative X-Rays be done in Supracondylar Humerus Fractures after Pinning?	*Choubey R, Jain A, Shukla J*	20-24
6	Results of cemented bipolar hemiarthroplasty in fracture neck of femur in elderly	*Singh V, Bhuyan B K, Sharma S K, Singh M P*	25-29
7	Impact of Educating the patients and attendants on prevention of pressure sores in paraplegics	*Tanwar M, Kundu Z S, Vashisht G*	30-33
	Current Concepts review		
8	Plantar Fasciitis Treatment	*Gohiya A, Choudhari P, Sharma P, Verma R, Sharma S*	34-40
	Case Report		
9	Dislocation of metacarpophalangeal joint of bilateral index finger: A case report	*Mina D K, Nama K G, Gupta S*	41-43
10	Unilateral flail chest with scapular winging treated with tension band wirings of ribs: A case report.	*Tanwar M, Kundu Z S, Vashisht G*	44-46
11	Letter to Editor : Evaluation of role of antibiotic cement impregnated intramedullary nail in infected long bone fractures	*Sharma P, Verma R, Gohiya A, Gaur S*	47-51

Editorial Board

Editorial

One more step on a long road

Gohiya A.

The Orthopaedic Journal of M P Chapter (OJMPC) is official publication of Madhya Pradesh Chapter of Indian Orthopaedic Association (IOA). This journal is academic representation of our esteemed body. Publishing a journal is not easy, it needs lot of determination, time and energy.

Till last year previous editors (Dr. P. K. Rai, Dr. HKT Raza, Dr. Sunil Rajan and Dr. Alok C Agrawal) have put all their efforts to improve the journal in terms of quantity and quality of scientific content. I must acknowledge Dr. Alok C Agrawal for two major breakthroughs in his long tenure of editorship one is getting ISSN and second indexing with Index Copernicus. As this is a free open access journal with no article submission or processing fee overcoming the financial hurdles was a big challenge for previous editors.

After the directives issued by Medical council of India to have publications in print journals with indexing in any of the following Pubmed, Index Medicus, Medline, Scopus and Index Copernicus etc the task became more difficult and technical. After this directive though the number of articles submitted are increasing but at the same time due to the pressing need lots of journals have cropped up thus compromising the quality of the articles. In this scenario it is imperative to maintain ethical practice and publish high quality scientific material.

This is for the first time in history of Orthopaedic Journal of M P Chapter that journal is having its own website and this is the first online issue. From now onwards all manuscript submissions will be online and there will be a double blind peer review process. Journal will now have a National as well International readership.

As the journal will be assessed globally the number of submissions are going to be increased. Our mission is to have stringent peer review, high quality publications, improved indexing and improved impact factor. Very soon we will increase the number of issues published per year. However, being official publication of state chapter of IOA we expect more publications from our own members.

Publishing is a team work I thank all the members of editorial board, all the reviewers and technical team. We cordially invite you all to submit your manuscript in OJMPC, we assure you of good peer review and quick decision on articles. This is our own journal we must work together and contribute toward its growth.

Dr. Ashish Gohiya
Editor OJMPC
Professor
Department of Orthopaedics
Gandhi Medical college, Bhopal, M.P., India

Original Article

Comparative Analysis of results between Conventional and Accelerated Ponseti Technique for idiopathic congenital clubfoot

Sharma P, Yadav V, Verma R, Gohiya A, Gaur S

Investigation performed at Department of Orthopaedics GMC Bhopal, India

Abstract

Background: Ponseti method is a well-accepted treatment modality for children with clubfoot deformity. Accelerated frequency of cast changes in Ponseti method may limit the time spent is casts during the corrective phase of treatment without any effect on the final result. We conducted this study to compare the results of accelerated and the conventional Ponseti Method.

Method: A prospective experimental randomized controlled trial was conducted from July 2014 to June 2015. Forty cases with 53 clubfeet were taken up for the study. Half the cases were given biweekly plaster in the accelerated group and the other half weekly casts as per the conventional Ponseti method. All feet were scored using the Pirani method. Successful correction was labeled as Pirani Score $\leq$1. Failure was labeled as Pirani Score >1 even after 8 corrective casts. The 'treatment time in plaster' refers to the number of days in plaster prior to a tenotomy.

Results: There were no significant difference in the final Pirani score of the two groups. There were no episodes of recurrence at six months. The average duration of treatment in the accelerated group was 15 days whereas in the conventional method was 35 days.

Conclusion: The results of this study support accelerated frequency of cast changes in Ponseti technique. In developing countries where travelling to clinics necessitates time away from home, work, and family, the adoption of 'accelerated casts' can reduce the duration of treatment and perhaps help to improve compliance and overall outcomes.

Key words: Accelerated Ponseti, clubfoot, Pirani

Address for Correspondence: Dr Pulak Sharma
Assistant professor, Dept. Of Orthopaedics
GMC Bhopal, MP, India
Email: drpulaksharma@gmail.com

How to site this article: Sharma P, Yadav V, Verma R, Gohiya A, Gaur S. Comparative Analysis of results between Conventional and Accelerated Ponseti Technique for idiopathic congenital clubfoot. OrthopJMPC 2016;22(1):2-7

Introduction

The incidence of congenital talipes equinovarus (clubfoot) ranges from 1-3 per 1000 live births across the world. [1] Ponseti method has transformed the management of clubfoot in children producing good long-term results and in the last two decades has gained acceptance in the worldwide orthopaedic community.[2- 5]

The Conventional Ponseti method uses serial application of weekly above knee plaster casts to gradually correct the deformity, using a strictly defined sequence of molded plaster changes. The last deformity to be corrected is equines, which often requires a percutaneous tendo

Achilles tenotomy followed by a final plaster. This final plaster is removed after three weeks and foot abduction braces are given to the child which are to be worn for twenty three hours per day for three months and thereafter for twelve hours at night, till the age of three years.

We run a clubfoot clinic at our hospital. The patients who come to our clinic often have to travel long distances for treatment. Transport facilities for these patients are often erratic and not always available. In addition, keeping a plaster clean and dry for a week can be challenging and failure to do so may result in a loss of position.

There is now strong evidence to suggest that accelerated frequency of cast changes has comparable outcomes to those of the conventional Ponseti method with the benefit of limiting the time spent is casts during the corrective phase of treatment. The researchers have modified the frequency of casting from weekly basis to as less as thrice a week and produced comparable results [6-8]. There is still very little published data about effectiveness of accelerated Ponseti technique in the Indian patients.

We conducted this study to determine the feasibility and compare the results of accelerated and conventional Ponseti technique in idiopathic congenital clubfoot.

Methods

A prospective experimental randomized controlled trial was conducted from July 2014 to June 2015 in the clubfoot clinic at our tertiary care center. Forty cases with 53 clubfeet were taken up for the study. The International Guidelines for Biomedical Research involving Human Subjects issued by CIOMS, (Geneva 1982) were complied.

The Inclusion Criteria were*;* age less than three months, unilateral or bilateral idiopathic clubfoot and willingness to take part in the study while the Exclusion Criteria were*;* age more than three months, earlier treated with other methods of

plaster cast application, earlier operated for clubfoot, concomitant major illness, atypical or secondary clubfoot and unwillingness to take part in the study.

All the patients who fulfilled the inclusion criteria were registered in the clubfoot clinic for the study. Randomization was done using computer table and patients were allocated to one of the treatment groups either conventional or accelerated Ponseti casting. All feet were scored using the Pirani method [9], recorded by an independent assessor at each visit. Successful correction was labeled as Pirani Score $\leq$1. Failure was labeled as Pirani Score >1 even after 8 corrective casts. A percutaneous tendo achilles tenotomy was performed if dorsiflexion was < 10° at the end of manipulation and plastering. Both groups were put into plaster, following tenotomy, for three weeks. The defined endpoint of treatment for both groups, labeled 'treatment time in plaster' refers to the number of days in plaster prior to a tenotomy.

Both groups were given abduction braces to wear in accordance with the standard Ponseti program. All patients were treated as outpatients, thereby reducing any bias from altered compliance and enabling us to directly compare the efficacy of the two methods in terms of correction of the deformity. Follow-up was done at monthly intervals for six months.

We used Mann-Whitney U test to compare the data between the two groups, p-value < 0.05 was considered statistically significant.

Results

A total of 40 children (53 feet) with idiopathic clubfoot were recruited into the trial, 13 of whom were bilateral. Half the patients i.e. 20 children (27 feet) were allocated to the

accelerated Ponseti group and the other half (26 feet) to the conventional treatment group. The two groups were demographically similar to each other (Table1). The mean age of the children was 23.54±11.54 days in the accelerated group and 22.95±11.12 days in the conventional group.

There was no significant difference in the Pirani score of the groups, both before and after treatment (Table 2). Of the 40 patients, two were 'not corrected' (Pirani score > 1.0), one from the accelerated group and the other from the control group and they required a surgical procedure to achieve correction.

Variables	Conventional	Accelerated
Number of	20	20
Mean age of	22.95±11.12	23.54±11.54*
Number of	8	12
Bilateral	6	7
Number of	26	27
Number of	20	20
Cases in	1	1
No of feet	25	26

*Not Significant

Table 1: Demographic characteristic of patients enrolled for study in two groups.

Variabl	Convention	Accelerat	p-
Mean	5.32±0.55	5.21±0.37	N.S.
Mean	0.4±0.43	0.23±0.35	N.S.
Mean	4.92±0.77	4.98±0.49	N.S.
Mean	5.08±0.91	4.15±0.61	N.S.
Mean	35.24±5.84	14.19±2.2	<0.00

Table 2: Comparison between conventional and the accelerated Ponseti technique

Follow-up in the accelerated group was for a mean of 233 days (70 to 348) and in the control group for a mean of 248 (25 to 346). There were no episodes of recurrence at six months. No complications due to casting were noted in any of the group.

Discussion

Over the last decade Ponseti method has become the standard method of treating children with clubfoot deformities.[2,3] Various authors have published reports of up to 98% success with this technique.[4,10,11] The Ponseti technique has shown good results in non idiopathic as well as syndromic clubfeet .[12] It has also shown relatively good results in older children who present late for treatment .[13] Even in post-surgical patients who have residual deformity Ponseti technique has shown good results.[14]

Our results suggests that comparable results can be achieved with an accelerated method, changing the plaster two times per week. Morcuende et al [6] undertook a non-randomized retrospective study of 230 patients (319 clubfeet) over an 11- year period. Patients were assigned to a five- or seven-day frequency of plaster changes based solely on geography. The authors found that an accelerated five-day interval can be equally effective. They were concerned that further acceleration in the casting might give rise to problems like swelling in the cast.

Harnettet al [7] further accelerated the regimen to three times a week and got comparable results .They did not come across any problems which Morcunde et al [6] had suggested with faster regimens. Our final results were similar to the results published by Harnettet al.

There are many factors that have contributed to the research in decreasing interval between cast application as part of the Ponseti clubfoot correction. Firstly, there is now good evidence to support that shortening cast time for the idiopathic congenital clubfoot deformity gives equally good results.[6-8,15]

Secondly, there is lot of inconvenience to the patients and their family, who often have to travel long distances over a period of two to three months, to distant clinics for treatment. The time away from home, loss

of working hours, economic burden on family all of which are a common concern in developing countries, may be greatly improved if the duration of treatment is cut short. [6-18] This could provide great savings for costs incurred whilst living away from home, and time lost from work. In turn, compliance may also benefit. The patients who come from remote areas can be admitted for this period and upon application of the last cast after tenotomy can be discharged with a foot abduction brace. They can be instructed to remove the cast after three weeks and continue the treatment with braces thereafter.

Thirdly, less time immobilized in plaster is probably advantageous for the baby in terms of reduced skin sore issues, easier bathing, more normal motor development and possibly lessens the risk of osteopenia.[19] It is important to appreciate that all accelerated casting studies and trials have addressed the idiopathic congenital clubfoot, and that the effects and use in syndromic [20] or complex clubfoot types [21] are unknown.

Some of the limitations of this study include the relatively small sample size, and the short period for data collection. The study also did not have a long follow up to show whether there is more recurrence in the accelerated Ponseti group or not.

Conclusion

The Ponseti method continues to be the best approach to correct children with congenital clubfoot. The results of this study support accelerated frequency of cast changes in Ponseti technique . The rescheduling of the weekly clubfoot clinic for casting, to at least twice a week , may be a possible trend in the near future. In developing countries where travelling to clinics necessitates time away from home, work, and family, the adoption of ‘acclerated casts’ can reduce the duration of treatment and perhaps help to improve compliance and overall outcomes.

References:

1. Mkandawire NC, Kaunda E. Incidence and patterns of congenital talipes equinovarus (clubfoot) deformity at Queen Elizabeth Central Hospital, Banter, Malawi. *East Afr J Surg* 2004; 9:28-31.
2. Cooper DM, Dietz FR. Treatment of idiopathic clubfoot: a thirty-year follow-up note. *J Bone Joint Surg [Am]* 1995; 77(10):1477-89.
3. Morcuende JA, Dolan LA, Dietz FR, Ponseti IV. Radical reduction in the rate of extensive orrective surgery for clubfoot using the Ponseti method. *Pediatrics* 2004;113(2): 376-80.
4. Ponseti IV. *Congenital clubfoot: fundamentals of treatment*. Oxford, Oxford University Press, 1996.
5. MacNicol M. The management of club foot: issues for debate. *J Bone Joint Surg [Br]* 2003; 85-B:167-70.
6. Morcuende J, Abbasi D, Dolan L, Ponseti I. Results of an accelerated Ponseti protocol for clubfoot. *J Pediatr Orthop* 2005;25: 623-6.
7. Harnett P, Freeman R, Harrison WJ, Brown LC, Beckles V. An accelerated Ponseti versus the standard Ponseti method: a prospective randomised controlled trial. *J Bone joint Surg [Br]* 2011; 93(3): 404-408.
8. Sutcliffe A, Vaea K, Poulivaati J, Evans AM. ‘Fast casts’: Evidence based and clinical considerations for rapid Ponseti method. *Foot Ankle Online J* 2013;6(9):2
9. Pirani S**.** Pirani severity scoring. In: Staheli I, ed. *Clubfoot: Ponseti management*. Third ed. Global-HELP, 2009:27.
10. MacNicol M. The management of club foot: issues for debate. *J Bone Joint Surg [Br]* 2003;85-B:167-70.
11. Pulak S, Swamy M. Treatment of idiopathic clubfoot by Ponseti technique of manipulation and serial plaster casting and its critical evaluation. *Ethiop J Health Sci.*2012;22(2):77–84.
12. Janicki JA,Narayan UG,Harvey, et al .Treatment of neuromuscular and syndromic –associated (non-idiopathic) clubfeet using Ponseti method. *J Pediatr Orthop* 2009;29(4):393-97.
13. Hegazy M, Results of treatment of idiopathic clubfoot in older infants using Ponseti method:a preliminary report .*J Pediatr Orthop B*.2009 ;18(2):76-8.

14. Nogueira MP, Ey Battle AM, Alves CG. Is it possible to treat recurrent clubfoot with Ponseti technique after posteromedial release? *Clin Orthop Relat Res*. 2009;(467):1298–365.
15. Ullah S, Inam M, Arif M. Club foot management by accelerated Ponseti technique. *RMJ*. 2014; 39(4): 418-420.
16. Pirani S, Naddumba E, Mathias R, Konde-Lule J, Penny JN, Beyeza T, Mbonye B, Amone J, Franceschi F.Towards Effective Ponseti Clubfoot Care: The Uganda sustainable clubfoot careproject. *Clin Orthop Relat Res* 2009 ;467(5):1154-1163.
17. Evans AM, Van Thanh D. A review of the Ponseti method and development of an infant clubfoot program in Vietnam. *J Am Podiatr Med Assoc* 2009; 99: 306–316.
18. Evans AM. Preliminary evaluation of implementing the Ponseti method for correction of clubfoot in Vietnam. *J Children's Orthop* 2010;4: 553-559.
19. Lourenço AF, Morcuende JA. Correction of neglected idiopathic club foot by the Ponseti method. *J Bone Joint Surg [Br]* 2007;89: 378-381.
20. Dobbs MB, Gurnett CA. Update on clubfoot: etiology and treatment. *Clin Orthop Relat Res* 2009 ;467(5): 1146-1153.
21. Ponseti IV, Zhivkov M, Davis N, Sinclair M, Dobbs MB, Morcuende JA. Treatment of the complex idiopathic clubfoot. *Clin Orthop Rel Res* 2006;451:171-176.

Original Article

Fracture Shaft Humerus: Plating OR Nailing?

Choudhari P, Baxi M, Patidar S

Investigation performed at Department of Orthopaedics, Sri Aurobindo Medical College and Post Graduate Institute, Indore, Madhya Pradesh, India

Abstract

Background*:* Conservative management of fracture shaft humerus yield in satisfactory results in most of the cases. Dilemma between dynamic compression plating and ante grade intra-medullary nailing occurs when a surgery is indicated.

Method*:* A total of 42 patients with fracture shaft humerus were treated surgically. 22 were subjected to plating and 20 were subjected to intra-medullary nailing. Functional outcome of patients were recorded using Constant and Murley score along with other parameters such as duration of surgery, intra-operative blood loss, complications and union time.

Results*:* Mean duration of surgery in plating group was 125.13 minutes and in the nailing group was 51.95 minutes. Average amount of blood loss in plating group was 209.09 ml and in nailing group was 60.5 ml. In the plating group 17 (77.27%) patients had complication free recovery period. 2 (9.09%) patients were found to have post-operative radial nerve palsy. 3 (13.63%) patients reported with superficial surgical site infection with wound dehiscence. In the nailing group 17 (85%) patients had uneventful recovery. 2 (10%) reported pain at shoulder and 1 (5%) patient complained of decreased abduction of shoulder at 1 year follow up. As per the Constant and Murley score, in the plating group 14 (63.63%) patients yielded excellent, 4 (18.18%) good, 2 (9.09%) fair and 2 (9.09%) poor results. Whereas, in the nailing group 14 (70%) patients yielded excellent, 4 (20%) good, 1 (10%) fair and 1 (10%) poor results. Mean radiological union time in plating group was 15.63 weeks and in the nailing group was 14 weeks.

Conclusion*:* Both intra-medullary nailing and dynamic compression plating are excellent methods for surgical fixation of shaft humerus fractures. Both of these methods yield in comparable results in terms of functional outcomes and union rates. Intra-medullary nailing holds edge over plating in terms of lesser blood loss, lesser operative time, shorter stay in hospital and less incidence of complications such as radial nerve palsy.

Keywords: Shaft humerus, dynamic compression plate, intra-medullary interlocking nailing

Address for Correspondence: Dr Pradeep Choudhari, 7/3/3, Ahilaya Mata Colony, Near Charak Hospital, Rani Sati Gate, Indore-452003, India.

Email:pchoudhari@rediffmail.com

How to site this article: Choudhari P, Baxi M, Patidar S. Fracture Shaft Humerus: Plating OR Nailing?OrthopJMPC 2016;22(1):8-14.

Introduction

Fractures of shaft humerus are those fractures which lie distal to the surgical neck of the humerus and proximal to the supra-condylar ridge distally [1]. These are frequently encountered injuries in practice with an overall incidence of 1-2% [2] of all the fractures and 14% of all fractures occurring in humerus [3]. These occur in all the age groups with equal incidence in both the genders, while in the elderly, higher incidences are seen among females [4, 5]. High energy trauma caused by falls and motor vehicle accidents are the main etiological factors associated with these fractures in younger population, whereas low energy trauma is the commonly implicated mechanism in the elderly [4].

The first recorded evidence of these fractures date back to 17th century B.C., during the time of ancient Egypt. Writings on papyrus suggest occurrence of shaft humerus fractures and their treatment by conservative methods [6]. Nothing much has changed since ages, as most of the fractures are still treated in a similar fashion as conservative measures have remained the mainstay of the treatment. A good final outcome in these is credited to adequate coverage of the shaft with muscle and soft tissues. The wider acceptability parameters for adequate union are also encouraging for employment of non surgical measures. Acceptable parameters include 30^0 of varus angulation, 20^0 of anterior bowing, $15^0$of mal-rotation, and 3 cm of shortening [7].

But in recent times, in view of fulfilment of the demands of modern patients like early relief from pain, quicker return to function and faster union, a surgery is warranted in some cases. Also what encourages the surgical treatment is the fact that benefits of non-surgical treatments are not that angelic as once thought [8, 9]. In certain scenarios outcomes of surgery can be beneficial. What constitutes the absolute indications for surgery in these cases are fractures associated with neuromuscular injury, open fractures, multiply injured patient, floating elbow, a pathological fracture and failure to achieve satisfactory reduction through non-operative treatment [8,10].Once an operative management is planned, plating or intra-medullary nailing are commonly employed measures. The precise indications for each of these procedures are unclear. Various outcome studies report benefits of one procedure over the other for both nailing and plating [11, 12].

In this study, we aim to present a comparative analysis of two series of patients operated with dynamic compression plating and ante-grade intra-medullary interlock nailing respectively with focus over their functional outcomes, complications and other important parameters.

Materials and Methods

In this prospective study, a total of 42 patients with fracture shaft humerus treated surgically from December 2013 to November 2015 were included. Skeletally immature patients, patients not fit for surgery, patients with associated fractures, head injury; pathological or open fractures were excluded from the study. All patients with displaced fracture of humerus were selected for Surgery. Randomization was done using computer tables and patients were allocated to either plating (open reduction and internal fixation with compression plating) or nailing (closed reduction and internal fixation with ante-grade intra-medullary interlocking nailing) group. These patients were subjected to surgery three days following admission after obtaining fitness for surgery. Patients were positioned in supine position on a radiolucent table for nailing and anterolateral plating while prone position with arm hanging by side of the table used for posterior plating. All the procedures were carried out under regional anaesthesia.

As a rule, patients subjected to plating were approached with a standard anterolateral approach for fractures spanning over proximal two thirds of shaft. While distal third fractures were addressed through posterior midline approach to the shaft of humerus. After adequate reduction fixation was done with a 4.5 mm dynamic compression plate or a 4.5 mm locking compression plate with or without lag screws depending upon the fracture morphology. Reduction was visualized under IITV guidance. Minimum six cortices proximally and six distally were fixed with screws. A suction drain was put prior to closure.

Patients undergoing intra-medullary interlock nailing were approached with a skin incision given over anterolateral corner of acromion, followed by location of entry point under IITV guidance. Sequential reaming was done with reamer of 1 mm diameter above the determined nail diameter. Nail length and diameter was determined intra-operatively under fluoroscopy guidance. Two locking bolts proximally and two distally were inserted.

Limb was immobilized for initial 48 hours, following which range of motion exercises were encouraged. Removal of drain in cases of plating was done 48 hours following surgery. Full range of motion was allowed after suture removal. Patients were followed up at 6, 12, 24 weeks, 1 year and every 6 months subsequently. Functional outcome of patients were recorded using Constant and Murley score on each follow-up [13]. Radiological union was determined by taking radiographs at each follow-up. Bridging of three of the four cortices and disappearance of the fracture line on the plain radiographs in two standard orthogonal projections (antero-posterior and lateral) was considered as radiological union.

Statistical analysis was done using Graphpad Software (Trial Version) to see the difference in frequency of discrete variables in two groups.

Results

A total of 42 patients underwent surgery. 22 patients were operated with plate fixation and 20 with intra-medullary interlock nail insertion. There was no demographic difference in two groups. The mean age in plating group was 39.65 years (range 22 to 69 years)in nailing group was 41.09 years (range 20 to 62 years).

Gender - Majority of patients in both the groups were males. In the plating group 15 (68.18%) patients were male and 7 (31.81%) were female. In the nailing group 12 (60%) patients were male and 8 (40%) were female.

Mode of injury - Road traffic accidents were the most common mode of injury. 16 (72.72%) and 13 (65%) of fractures were attributed to road traffic accidents in plating and nailing groups respectively.

Duration of surgery - Mean duration of surgery was found to be morein the plating group (125.13 minutes) in comparison with nailing group (15.95hours). There exits a statistically significant difference in these two groups. Surgical time is calculated as time taken for surgery from incision to closure of wound.

Amount of blood loss - Average amount of blood loss was higher in plating group (209.09 ml) in comparison with nailing group (60.5 ml). This difference was found to be statistically significant. Amount of blood loss is calculated by Volume of blood in Suction Flask.

Complications - In the plating group 17 (77.27%) patients had complication free recovery period. 2 (9.09%) patients were found to have post-operative radial nerve palsy. 3 (13.63%) patients reported with superficial surgical site infection with wound dehiscence. In the nailing group 17(85%) patients had uneventful recovery. 2 (10%) reported pain at shoulder and 1 (5%) patient complained of decreased abduction of shoulder.

Mean duration of hospital stay - Mean duration of hospital stay was more in plating group (9.68 days) as compared to nailing grouped (4.65 days). This difference was statistically significant.

Constant and Murley score - In the plating group 14 (63.63%) patients yielded

excellent, 4 (18.18%) good and 2 (9.09%) fair and 2 (9.09%) poor results. Whereas, in the nailing group 14 (70%) patients yielded excellent, 4 (20%) good, 1 (10%) fair and 1 (10%) poor results.

Union Time - Although the mean radiological union time was shorter in nailing group (14 weeks) as compared to plating group (15.63 weeks), this difference was not statistically significant.

These results are further elaborated in Table 1, Figure 1 and 2.

Attributes		Plating Group	Intra-medullary	*p* value
Number of Patients (total=40)		22	20	
Age	Range (years)	22-69	20-62	
	Mean (years)	39.65	41.09	0.6351
Gender	Male	15	12	
	Female	7	8	
Mode of Injury	Traffic Accidents	16	13	
	Other	6	7	
Mean Duration of Surgery (minutes)		125.13	51.95	0.0068
Mean Amount of Blood Loss (ml)		209.09	60.5	<0.001
Mean Duration of Hospital (days)		9.68	4.65	0.0010
Complications	Number of Cases	5	3	
	Superficial Infection	3	0	
	Radial Nerve Palsy	2	0	
	Shoulder Pain	0	2	
	Decreased Shoulder	0	1	
Constant and Murley Score	Excellent	14	14	
	Good	4	4	
	Fair	2	1	
	Poor	2	1	
	Mean Grading	13.64	11.95	0.4338
Mean Radiological Union Time		15.63	14	0.06

Table 1: Table showing various results of the plating and nailing group

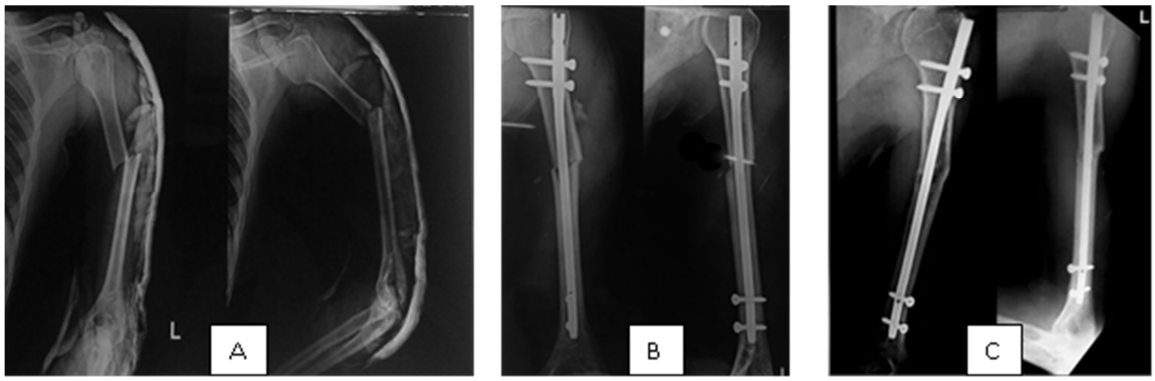

Figure 1 : 45 year old male with fracture shaft humerus treated with intra-medullary nailing. A: Pre-operative radiograph; B: Immediate post-operative radiograph; C: Radiograph on 1 year follow-up

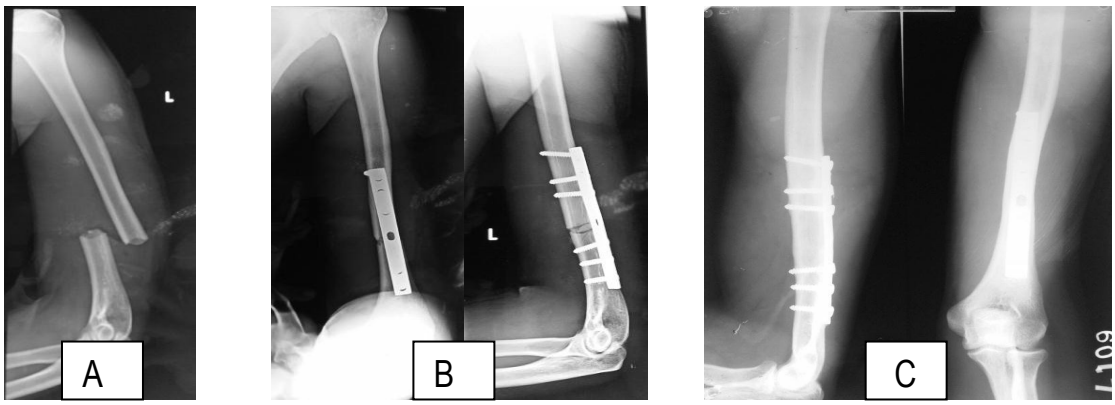

Figure 2: A 25 year old male with fracture shaft humerus treated with plating. A: Pre-operative radiograph; B: Immediate post-operative radiograph; C: Radiograph on 1 year

Discussion

Most of the humeral diaphyseal fractures are conservatively manageable, dilemma occurs when a surgery is indicated. Both compression plating and intra-medullary nailing are a surgical standard of care in such fractures. But a consensus regarding which method is better has not yet been established. In a meta-analysis of 3 studies comprising of 155 patients, Bhandari et al. could not establish a conclusive method [11]. In a series of 84 such fractures treated either with plating or intra-medullary nailing, Chapman et al. concluded both as predictable methods for fracture stabilization and ultimate healing. [12].

Traditionally, compression plating is regarded as gold standard of surgical treatment [14], yielding in high union rates, less complications and early return to function [15]. It can be used effectively even in fractures with proximal and distal extensions. But on the flip side, it is associated with extensive soft tissue handling, periosteal stripping, longer durations of surgery, high infection rate and radial nerve palsy [16-18]. In our study the duration of surgery was more in plating group. The incidence of radial nerve palsy in various studies is reported from 6-15% [19-21]. Similarly, in our series 2 (9.09%) patients were complicated with radial nerve palsy.

Use of intra-medullary nailing provides with advantage of biological fracture healing such as preservation of fracture haematoma, minimal handling of soft tissue and stripping of periosteum [21]. Nailing also provides advantage in terms of lesser operative time and decreased blood loss [17, 18]. Thus, making it a handy tool in management of injured patients. The same was observed in our study regarding lesser operative time and blood loss in the nailing group.Nailing has certain disadvantages. Is associated with insertion site morbidity such as impairment of shoulder movements [18, 21], impingement at acromion [17] and incursion of rotator cuff [17, 18]. Likewise, we observed shoulder pain in 2 (10%) cases and decreased shoulder movements in 1 (5%) case operated with intra-medullary nailing. Incidence of non-union is higher due to propensity of shaft humerus for residual fracture site distraction following nailing [22] and thus ultimately leading to higher re-operation rates [11, 12, 23]. Although in our serious none of the patients reported non union and none were subjected to re-surgery.

In a randomized controlled trial, Changulani et al. in their series of 47 patients reported similar union rates in both the groups, but

shorter healing time in nailing group and lesser shoulder mobility in plating group [24]. Similarly in this study we found that there no significant dissimilarities between both the groups in terms of union time and functional outcome but intra-medullary nailing is superior to plating in terms of lesser surgical time and lesser blood loss. Whereas it is associated with more shoulder morbidity as compared to plating.

There are certain limitations of the study. Sample size and secondly follow up period is too less for effective analysis and placing a firm conclusion.

Conclusion

Both intra-medullary nailing and plating are excellent method for surgical fixation of shaft humerus fractures. Both of these methods yield in comparable results in terms of functional outcomes and union rates. Intra-medullary nailing holds edge over plating in terms of lesser blood loss and operative time and less incidence of complication such as radial nerve palsy.

References

1. Schemitsch EH, Bhandari M. Fractures of the diaphyseal humerus. Skeletal trauma, 3rd edn. WB Saunders, Toronto. 2001:1481-511.
2. Brinker MR, O'Connor DP. The incidence of fractures and dislocations referred for orthopaedic services in a capitated population. J Bone Joint Surg Am. 2004; 86(2):290-7.
3. Lovald S, Mercer D, Hanson J, Cowgill I, Erdman M, Robinson P, Diamond B. Complications and hardware removal after open reduction and internal fixation of humeral fractures. Journal of Trauma and Acute Care Surgery. 2011; 70(5):1273-8.
4. Ekholm R, Adami J, Tidermark J, Hansson K, Törnkvist H, Ponzer S. Fractures of the shaft of the humerus an epidemiological study of 401 fractures. Journal of Bone & Joint Surgery, British Volume. 2006; 88(11):1469-73.
5. Tytherleigh-Strong G, Walls N, McQueen MM. The epidemiology of humeral shaft fractures. Journal of Bone & Joint Surgery, British Volume. 1998; 80(2):249-53.
6. Sullivan R. The identity and work of the ancient Egyptian surgeon. J R Soc Med. 1996; 89 (8):467–473.
7. Klenerman L. Fractures of the shaft of the humerus. Journal of Bone & Joint Surgery, British Volume. 1966; 48(1):105-11.
8. Denard A, Richards JE, Obremskey WT, Tucker MC, Floyd M, Herzog GA. Outcome of nonoperative vs operative treatment of humeral shaft fractures: a retrospective study of 213 patients. Orthopedics. 2010; 33(8).
9. Rutgers M, Ring D. Treatment of diaphyseal fractures of the humerus using a functional brace. Journal of orthopaedic trauma. 2006 Oct 1; 20(9):597-601.
10. Templeman DC, Sims SA. Humeral shaft fractures. Surgical treatment of orthopaedic trauma. New York: Thieme Medical Publishers, Inc. 2007:263-84.
11. Bhandari M, Devereaux PJ, D Mckee M, H Schemitsch E. Compression plating versus intramedullary nailing of humeral shaft fractures—a meta-analysis. Acta orthopaedica. 2006 Jan 1; 77(2):279-84.
12. Chapman JR, Henley MB, Agel J, Benca PJ. Randomized prospective study of humeral shaft fracture fixation: intramedullary nails versus plates. Journal of orthopaedic trauma. 2000 Mar 1; 14(3):162-6.
13. Constant CR, Murley AG. A clinical method of functional assessment of the shoulder. Clinical orthopaedics and related research. 1987 Jan 1; 214:160-4.
14. Mauch J, Renner N, Rikli D. [Intramedullary nailing of humeral shaft fractures--initial experiences with an unreamed humerus nail]. Swiss surgery= Schweizer Chirurgie= Chirurgie suisse= Chirurgia svizzera. 1999 Dec; 6(6):299-303.
15. Tingstad EM, Wolinsky PR, Shyr Y, Johnson KD. Effect of immediate weightbearing on plated fractures of the humeral shaft. Journal of Trauma and Acute Care Surgery. 2000 Aug 1; 49(2):278-80.
16. Ingman AM, Waters DA. Locked intramedullary nailing of humeral shaft fractures. Implant design, surgical technique, and clinical results. Journal of Bone & Joint Surgery, British Volume. 1994 Jan 1; 76(1):23-9.
17. Watanabe RS. Intramedullary fixation of complicated fractures of the humeral shaft. Clinical orthopaedics and related research. 1993 Jul 1; 292:255-63.
18. Hall RF, Pankovich AM. Ender nailing of acute fractures of the humerus. A study of closed fixation by intramedullary nails without reaming.

J Bone Joint Surg Am. 1987 Apr 1; 69(4):558-67.
19. Garcia A, Maeck BH. Radial nerve injuries in fractures of the shaft of the humerus. The American Journal of Surgery. 1960 May 31; 99(5):625-7.
20. Kettelkamp DB, Alexander H. Clinical review of radial nerve injury. Journal of Trauma and Acute Care Surgery. 1967 May 1; 7(3):424-32.
21. Christensen NO. Kuntscher Intramedullary Reaming and Nail Fixation for Nonunion of the Humerus. Clinical orthopaedics and related research. 1976 May 1; 116:222-6.
22. Brumback RJ, Bosse MJ, Poka A, Burgess AR. Intramedullary stabilization of humeral shaft fractures in patients with multiple trauma. J Bone Joint Surg Am. 1986 Sep 1; 68(7):960-70.
23. Bolano L. E., Iaquinto J. A., Vasicek V. Operative treatment of humerus shaft fractures: A prospective randomized study comparing intramedullary nailing with dynamic compression plating. Presented at the Annual Meeting of the American Academy of Orthopaedic Surgeons. 1995
24. Changulani M, Jain UK, Keswani T. Comparison of the use of the humerus intramedullary nail and dynamic compression plate for the management of diaphyseal fractures of the humerus. A randomised controlled study. International orthopaedics. 2007 Jun 1; 31(3):391-5.

Original Article

Intradiscal Ozone Oxygen in Lumbar Disc Prolapse

Gupta V, Singh P K, Banode P, Khan S

Investigation performed at Department of Orthopaedics Hiranandani Hospiatl, Mumbai, India

Abstract

Background: Lumbar disc herniation is one of common cause of hospitalization in current orthopaedics practice. There are great controversies whether to conserve or intervene for contained disc prolapsed. The purpose of current study to evaluate usefulness of intradiscal ozone infiltration for contained disc prolapsed.

Methods: Total 122 patients were treated with intrasdical ozone infiltration. All the patients who had contained disc prolapsed without neurological involvement were included in the study. Visual analogue scores and Mcnab scoring were used to evaluate results of the patients.

Results: The mean age of the patient was 41.64 ± 7.3 and most of the patients were male who involved strenuous hard work. The mean pre-treatment VAS score was 7.40 ± 0.50, and at the end of follow up was 3.40 ± 1.25.

Conclusion: We can conclude that intradiscal oxygen-ozone is an alternative treatment modality for contained lu mbar disk herniation.

Keywords: Intradiscal ozone; Disc prolapse; Contained disc

Address for Correspondence: Dr. Varun Gupta . Department of Orthopaedics, Dr. L H Hiranandani Hospital, Powai, Mumbai 400087.

Email: drvarun1234@gmail.com

How to site this article: Gupta V, Singh P K, Banode P, Khan S. Intradiscal ozone oxygen in lumber disc prolapse. OrthopJMPC 2016;22(1): 15-19.

Introduction

Low back pain is the most frequent medical cause of absence from work. It is now a major welfare and economic problem. In the era of industrialization, low back pain is extremely common with a prevalence ranging from 60-90% [1,2]. The appropriate treatment for lumbar sciatica and disc herniation is a challenge, particularly because the concept of a disc hernia represents only a simplification of the problem. There are many largely unknown or poorly understood factors involved in the pathophysiology of this disease. Clinically symptomatic contained disc poses lot of problem related to decision making of the procedure. These type of disc usually fall in the grey area where surgeries are not absolutely indicated [3]. Intradiscal injection of oxygen-ozone have been proposed as a treatment for lumbar disc herniation [4,5]. Ozone consists of three oxygen atoms and is a colourless gas that is heavier than air with a pungent smell. Medical ozone is administered to the patient always in the form of a mixture of pure oxygen and pure ozone and in a certain concentration [6]. Oxygen zone therapy is minimally invasive treatment for lumbar disc herniation that exploits the biochemical properties of a gas mixture of oxygen and ozone. Disc herniation is the most common cause for spinal surgery and many clinicians employ epidural steroid injections with limited success. Intradiscal injection of ozone gas has been used as an

alternative to epidural steroids and surgical discectomy. Early results are positive but long-term data are limited [7]. The purpose of our study is to evaluate effectiveness of intradiscal oxygen ozone in treatment of lumbar disc herniation with respect to pain and function.

Material & Methods

Present cohort study was done in our department between 2011 and 2013. Total 122 disc levels were treated with intradiscal ozone-oxygen mixture in 122 patients. Intradiscal ozone-oxygen was considered in those patient who had low back pain resistant to conservative management (drugs, physiotherapy, and others), lasting at least 3 months between ages of 18-65 years. All the patients who had low back pain with positive signs of nerve root involvement, with or without paraesthesia or hypoesthesia, with appropriate dermatome distribution were included. Radiological criterion for inclusion were a single level, broad based contained non extruded disc prolapse in line with the patient's clinical symptoms, without breach of posterior longitudinal ligament . However, the patients who showed advance degenerative changes in the disc, facet or in the body were excluded from the study. Patients with motor deficit were excluded from the study. All eligible patients were treated with single shot of intradiscal oxygen ozone under fluoroscopy. Ethical committee approval was taken prior to research recruitment.

Intradiscal Ozone Technique

The area was prepared with anti-septic solution and draped with sterile linen. The target disc was identified. After local anaesthesia (1% lidocaine) and needle tip position confirmation, 22G spinal needle was advanced by posterior para-median approach towards the disc at an angle of 45 degree under fluoroscopy control. When needle entered into the disc a specific resistance was felt. Before injection, it was confirmed that needle tip was into the nucleopulposus under the anteroposterior (AP) and lateral views to avoid injection into the outer annulus. Fluoroscope was positioned in true AP view and then fluoroscope was tilted cranially or caudally to abolish any double endplates for getting widest possible view of the disc (Figure 1). After that fluoroscope was rotated in axial plain so that ipsilateral facet joint divides width of vertebral body into two. Clinical outcome was assessed 48 hrs, 4 weeks, 12 weeks and 6 months after treatment. VAS score was evaluated at 48 hrs, 4 weeks, 12 weeks and 6 months whereas modified Macnab's method and SLR were was applied only at the end of 6 months.

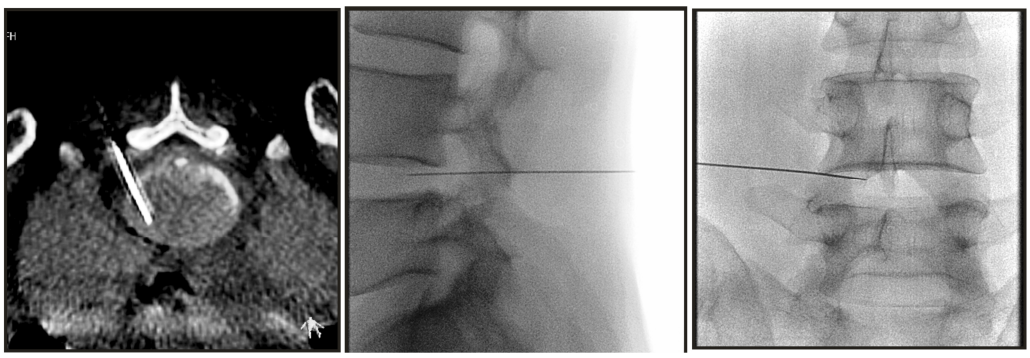

Figure 1: Fluoroscopic images showing needle in the intradiscal space

Observation and Result

The mean age of patients with lumbar disc herniation in was 41.64 ± 7.3 years. In our study, 68% patients were males and 32% patients were females (Table 1). Causative injury was lifting of heavy weight in 66% of patients and fall in 28% patients. 6% patients had no causative injury. 72% patients had L4-L5 disc disease, 28% had L3-L4 involvement, 12% had L5-S1 involved. None of the patient had L1-L2 involvement. The mean pre-treatment VAS score (Table 3) at day 0 was 7.40 ± 0.50, whereas on subsequent follow-up at 48hrs was 5.44 ± 1.04, at 4 weeks 4.92 ± 1.11, at 12 weeks 4.12 ± 1.23 and 6th month 3.40 ± 1.25. By using students paired t test significant difference is found at day 0 and 48 hrs (t=8.92, p=0.00), 48 hrs and 4 weeks (t=2.98, p=0.006), at 4 weeks and 12 weeks (t=3.57, p=0.000), at 12 weeks and 6th month (t=3.16, p=0.004) (Table 4). The end result of the procedure was measured by Mcnab criteria which showed excellent result in 61 patients, good result in 43 patients and 18 patient showed poor result and subsequently surgery was done in 12 patients.

Age group(yrs)	**Number f patients**		**χ2-value**	**p-value**
20-29	17			
30-39	43			
40-49	36			
50-59	19			
60-69	11			
70&Above	0		0.83	0.93 NS, p>0.05
Total	122			
Mean age	41.64	42.76		
SD	12	10.87		
Range	22-65	23-65		
Gender	Number of patients		Binomial	p-value
			0.5	0.24 NS, p>0.05
Male	83			
Female	39			
Total	122			
Occupation	Number of patients		**χ2-value**	p-value
Light work	30		0.09	0.75 NS, p>0.05
Strenuous work	92			
Total	122			

Table 1: Demographic profile of the patients.

Level of disc	Patients %	**χ2-value**	**p-value**
L1-L2	0(0%)		
L2-L3	1(4%)		
L3-L4	7(28%)		
L4-L5	18(72%)		
L5-S1	3(12%)		
		3.74	0.44 NS, p>0.05

Table 2: Causative injury and level of disc disease

	Mean	N	Std.Deviation	Std. Error Mean
Day 0	7.40	25	0.50	0.10
48hrs	5.44	25	1.04	0,20
4wks	4.92	25	1.11	0.22
12wks	4.12	25	1.23	0.24
6months	3.40	25	1.25	0.25

Table 3: Comparison of pain on VAS at day 0, 48 hrs, 4 weeks, 12 weeks and 6 months in Group A.

Paired Difference									
	Mean	Std.Deviation	Std.Error ..	95% Confidence interval of		t	df	p-value	
				lower	upper				
Day 0-	1.96	1.09	0.21	1.50	2.41	8.92	24	0.000	S,
48hrs-	0.52	0.87	0.17	0.16	0.87	2.98	24	0.006	S,
4wks-	0.80	1.11	0.22	0.33	1.26	3.57	24	0.002	S,
12wks-	0.72	1.13	0.22	0.25	1.18	3.16	24	0.004	S,

Table 4: Descriptive statistics paired t test.

Discussion

Non-invasive procedures, minimally invasive percutaneous injection and surgery represent the gamut of treatment available in the management of lumbar disc herniation. Minimally invasive treatments were developed to offer good clinical results combined with a well-tolerated, low cost procedure. Our study addressed the use of an oxygen-ozone mixture, the least invasive technique currently available for lumbar disc herniation. In our study the mean age of patients with lumbar disc herniation was 41.64 years. Spangfort's [8] series had an average age at presentation of 40.8 years. Average age at presentation in People, Griffith's [9] series was 42 years. Kerr's [10] studies of 100 patients had an average age of 40 years. Spangfort's(8) study showed that males constituted almost twice the number as females. That affection of males twice as often as females in their study may be attributed to the heavier nature of their work. Occupation of the patients is closely related to the disc pathology [11] and has been observed in 84% of patients were involved in occupations that caused physical stress. In our study occupation of 68% patients with lumbar disc herniation was strenuous work.

On analysing the VAS score significant difference was found when compared to their pre ozone infiltration status. "The overall estimated mean improvement was 3.9 for VAS and 25.5 for ODI. The estimated chance of showing improvement in the Modified MacNab scale was 79.7% [12]. In our study analysis of VAS score revealed significant difference in pre-treatment and subsequent post treatment when compared between pre-treatment and 48 hrs, 4 weeks. 12weeks and 6 months after the procedure (paired t-test p=0.00). In our study outcome was measured using modified Macnab criterion excellent in 50.3% patients and good in 35%patients. Treatment failure were noted in 14.7% patients and surgery was required in 10% patients. Gallucci M et al used Modified Macnab criteria as a tool to depict the outcome of treatment and found excellent results in 32% of patients [13]. In our study one patient had a complication of infective discitis. However the protocol for aseptic technique was followed strictly throughout the study [3].Thomas Lehnert in his study evaluated 283 patients who received intra discal and periganglionic injection of ozone oxygen mixture under CT guidance and found that there is significant reduction in disk volume of lumbar herniated

disk [14]. Double blind randomized controlled trials should be conducted in order to conclude utility of Intradiscal Ozone techniques.

Conclusion

Through this study we can conclude that intradiscal oxygen-ozone can be useful treatment modality for contained lumbar disk herniation which has failed to respond to the conservative management in selected patient.

References

1. Brodke DS, Ritter SM (2005) Nonsurgical management of low back pain and lumbar disk degeneration. Instr Course Lect 54: 279-286.

2. Bressler HB, Keyes WJ, Rochon PA, Badley E (1999) The prevalence of low back pain in the elderly: a systematic review of the literature. Spin 24: 1813-1819.

3. Andreula CF, Simonetti L, de Santis F, Agati R, Ricci R, et al. (2003) Minimally Invasive Oxygen-Ozone Therapy for Lumbar Disk Herniation. AJNR Am J Neuroradiol: 996-1000.

4. Paradiso R, Alexandre A (2005) The different outcomes of patients with disc herniation treated either by microdiscectomy, or by intradiscal ozone injection. Acta Neurochir Suppl 92: 139-142.

5. Bonetti M, Fontana A, Cotticelli B, Volta GD, Guindani M, et al. (2005) Intraforaminal O(2)-O(3) versus periradicular steroidal infiltrations in lower back pain: randomized controlled study. AJNR Am J Neuroradiol 26: 996-1000.

6. Magalhaes FN, Dotta L, Sasse A, Teixeira MJ, Fonoff ET. Ozone therapy as a treatment for low back pain secondary to herniated disc: a systematic review and meta-analysis of randomized controlled trials. Pain Physician 2012; 15:115-E129
7. Buric J, Rigobello L, Hooper D. Five and Ten Year Follow-up on Intradiscal Ozone Injection for Disc Herniation. *International Journal of Spine Surgery*. 2014;8:17. doi:10.14444/1017.
8. Spangfort EV (1972) The lumbar disc herniation: A computer aided analysis of 2,504 operations. Acta. Orthop. Scand (suppl) 142: 5-95.

9. Pople IK, Griffith HB (1994) Prediction of an extruded fragment in lumbar disc patients from clinical presentations. Spine 19: 156-159.

10. Kerr RSC, Cadoux Hudson TA, Adam CBT (1988) The value of accurate clinical assessment in the surgical management of the lumbar disc protrusion. J Neurol Nuerosurg Psychiat 51: 169-173.

11. O' Connell JEA (1951) Protrusions of the lumbar intervertebral discs A clinical review based on five hundred cases treated by excision of the protrusion. J.Bone and Joint Surg 33: 8-30.

12. Kieran Murphy, MD (2010) A Metanalysis of the Effectiveness and Safety of Ozone Treatments For Herniated Lumbar Discs. Journal of Vascular and Interventional Radiology 21: 534-548.

13. Gallucci M, Limbucci N, Barile LZ, Stavroulis E, Ricci A (2007) SciaticaTreatment with Intradiscal and Intraforaminal Injections of Steroid and Oxygen-Ozone versus Steroid Only. Radiology 242.

14. Lenhert T, Naquib NN, Wutzler S, Nour – Eldin NE, Bauer RW, Kerl JM et al. Analysis of disk volume before and after Ct guided intradiscal and periganglionic ozone – oxygen injection for thw treatment of lumber disc herniation. J Vasc Interv Radiol 2012; 23(11): 1430-1436

Original Article

Should Postoperative X-Rays be done in Supracondylar Humerus Fractures after Pinning?

Choubey R, Jain A, Shukla J

Investigation performed at Department of Orthopaedics Bundelkhand Medical College, Sagar, MP, India

Abstract

Background: Most author advocates the need for early postoperative clinical and radiographic follow-up in operative treatment of completely displaced supracondylar fractures of the humerus in children but in central India specially rural population is there, for whom it is difficult to get weekly X-rays done. Therefore we decided to determine the necessity of postoperative x rays after k-wire fixation for the operative treatment of completely displaced supracondylar fractures of the humerus in children.

Methods: 103 patients who underwent operative management of Gartland type III fractures at our institution from November 2012 to January 2016 were reviewed. Intraoperative C-arm images were compared with postoperative radiographs to identify changes in fracture alignment and k-wire placement.

Results: A total of 103 patients (48 females, 55 males) with a mean age of 7.1 years (range, 3.1 to 12.0) were reviewed which were classified as type III. Fracture displacement or k-wire back out was seen in three patients (2.9%) at the first postoperative visit. None of these patients required further operative management. On statistical evaluation, no significant difference was seen in terms of time to first postoperative visit, days to k-wire removal, or average follow-up time. The overall complication rate was 7.76% (9/103)

Conclusions: Fracture displacement and k-wire migration observed in postoperative radiographs after k-wire fixation of supracondylar humerus fractures have little effect on clinical management or long-term complication. Radiographs can therefore be delayed until the time of k-wire removal provided sufficient intraoperative stability was obtained.

Key-words: Supracondylar Humerus Fractures, K-Wire, Radiographs

Address for Correspondence: Dr Raghvendra Chaubey, Assistant Professor, Department of Orthopaedics, Bundelkhand Medical College, Sagar, MP, India

Email: dr_raghvendra2006@yahoo.co.in

How to site this article: Choubey R, Jain A, Shukla J. Should Postoperative X-Rays be done in Supracondylar Humerus Fractures after Pinning? OrthopJMPC 2016;22(1):20-24.

Introduction

Paediatric supracondylar humeral fractures are the most common fracture, accounting for 50–60% of fractures in the elbow region and 30% of all extremity fractures [1]. In the treatment of non-displaced humeral fractures conservative methods are used, while in displaced cases, closed or open reduction and percutaneous Kirschner-wire (K-wire) fixation may be used [2]. Most author advocates the need for early postoperative clinical and radiographic follow-up [3,4,5]. In central India where the rural population is predominant it is practically impossible for them to come for weekly follow-up X-rays, therefore this study was undertaken with purpose of determining the necessity of postoperative x rays after K-wire fixation

Materials and Methods

123 paediatric patients who had undergone treatment for supracondylar humeral fracture from November 2012 to January 2016 were evaluated. Exclusion criteria

were; 1) Any neurological and vascular injuries, 2) Ipsilateral arm or forearm fractures, 3) open fractures, 4) Patients treated by other methods or whose medical records were incomplete, and 5) Fractures having intra-articular extension.

103 patients who were able to attend up to the final examination were included in the study. Fractures were classified according to Gartland's system. Operative fixation was performed by three different surgeons. The patients were operated upon within 48 hours after the trauma. Closed reduction was performed on all patients, the adequacy of which was assessed by C-arm fluoroscopy. Then k-wire fixation was done with all aseptic precaution. More than ninety percent cases fracture were treated with percutaneous two parallel lateral entry k-wires. They were considered stable only if near anatomic configuration was obtained and fracture remains stable intraoperative range of motion under continuous mode of C arm machine. After fixation K-wires were left out of the skin after bending for subsequent removal. Patients were placed in an above elbow slab postoperatively. There was postoperative assessment for any complications and treated according to guidelines. The patients were discharged after twenty four hours after completion of surgery.

Intraoperative C-arm images were compared with postoperative X-rays taken at 3 follow up visits: the first postoperative visit (third day), second visit on the date of k-wire removal (three weeks), and third visit on the date of final follow-up (three months). Radiographs were assessed for fracture displacement and k-wire migration.

Changes in k-wire alignment and fracture displacement were assessed by the attending surgeon during subsequent follow up. The Student t test was used to determine differences relative to patient age and follow-up time between those with k-wire back out and those with maintenance of k-wire configuration.

Results

Our results were based on 103 displaced fractures in Hundred and three patients (48 females, 55 males) with a mean age of 7.1 years (range, 3.1 to 12.0) which were classified as type III. The causes of injury were as follows: a fall from height in sixty two cases (61%), bicycle and game accidents in thirty one cases (30%) and motor vehicle accidents in ten cases (9%). Superficial k-wire site infection was seen in five cases (4.8%) K-wire back out or fracture displacement was seen in three patients (2.9%) at the first postoperative visit. None of these patients required further operative management. On statistical evaluation, no significant difference was seen in terms of time to first postoperative visit, days to k-wire removal, or average follow-up time. Fracture severity did not correlate with change in alignment. The overall complication rate was 7.76% (9/103).

No postoperative neurological deficit was observed in patients. K-wires were removed at an average of twenty six days after fixation (range, 21 to 35 d). Time to final clinical follow up was ninety nine days,(range, 90 to 150 d).

Discussion

Supracondylar fractures of the humerus are the commonest types of elbow fractures in children and adolescents accounting for 50–70% of all elbow fractures. They are seen most frequently in children between the ages of three to ten years [1,2]. Some of the methods used in the treatment of paediatric humerus supracondylar fractures are traction, closed reduction and plaster fixation, closed or open reduction and K-wire fixation.

There has been no uniformity of postoperative follow up of these patients clinically as well as radiographically to determine healing, alignment, and appropriate time for k-wire and cast removal. Most author advocate procuring serial radiographs to identify changes in fracture alignment and k-wire position [3,4,5]. Very few studies are there regarding true requirement of radiological follow-up in the early postoperative period. In central India rural population it is practically impossible to obtain weekly follow-up moreover it is time consuming as well as increases economic burden over parents. So this study was panned to examine whether these observed radiographic changes provoked a change in clinical care or in final patient outcome.

Ponce and colleagues reviewed hundred and four supracondylar humerus fractures to evaluate the need for early follow-up and in these patients they found no increased rate of complications in those who had late radiographic follow-up [6].

Our series demonstrated a 2.9% rate of k-wire back out or change in fracture alignment. In all cases, the change in fracture alignment was <2 mm. None of these patients showed clinical evidence of postoperative neuropraxia or cubitus varus at final follow-up. K-wire-site infections are another identified complication of percutaneous k-wire fixation, with published rates from 2% to 7% [7]. In our series, k-wire-site infections were seen in five patients (4.8%). All of these infections were superficial and resolved with a short course of oral antibiotics. Compartment syndrome was diagnosed in one patients in the early postoperative period. Neither of these patients was observed to have neurological deficits or loss of fixation. According to Karamitopoulos et al if stability of pin construct is confirmed at surgery, mild alignment changes and pin migration observed in postoperative radiographs after pinning of supracondylar humerus fractures have little effect on clinical management parameters or long term sequelae [8], our study had similar results. Within the obtained results, complications, and limitations of the present study, delaying postoperative X-rays can be considered without significant risk of complication until the time of expected k-wire removal provided that adequate intraoperative radiographic stability was obtained. If stability of k-wire construct is confirmed at surgery, mild alignment changes and k-wire migration observed in postoperative radiographs after k-wiring of supracondylar humerus fractures have little effect on clinical management parameters or long term complication.

Conclusions

Fracture displacement and k-wire migration observed in postoperative radiographs after k-wire fixation of supracondylar humerus fractures have little effect on clinical management or long-term complication. Radiographs can therefore be delayed until the time of k-wire removal provided sufficient intraoperative stability was obtained.

References

1. Hanlon CR, Estes WL (1954) Fractures in children: a statistical analysis. J Bone Joint Surg Am 87: 312.
2. McIntyre W (1996) Supracondylar fractures of the humerus. In: Letts RM (ed) Management of pediatric fractures, vol 11. Churchill Livingstone, New York. pp 167–198
3. Boyd DW, Aronson DD. Supracondylar fractures of the humerus: a prospective study of percutaneous k-wirening. J Pediatr Orthop. 1992; 12: 189–194.
4. Gordon JE, Patton CM, Luhmann SJ, et al. Fracture stability after k-wirening of displaced supracondylar distal humerus fractures in children. J Pediatr Orthop. 2001; 21: 313–318.
5. Kallio PE, Foster BK, Paterson DC. Difficult supracondylar elbow fractures in children: analysis of percutaneous k-wirening technique. J Pediatr Orthop. 1992; 12: 11–15.
6. Ponce BA, Hedequist DJ, Zurakowski D, et al. Complications and timing of follow-up after closed reduction and percutaneous k-wirening of supracondylar humerus fractures: follow-up after percutaneous k-wirening of supracondylar humerus fractures. J Pediatr Orthop. 2004; 24: 610–614.
7. Mehlman CT, Crawford AH, McMillon TL, et al. Operative treatment of supracondylar humerus fractures in children: the Cincinnati experience. Acta Orthop Belg. 1996; 62(suppl 1): 41–50.
8. Karamitopoulos MS, Dean E, Littleton AG, Kruse R. Postoperative Radiographs After Pinning of Supracondylar Humerus Fractures: Are They Necessary? J Pediatr Orthop 2012; 32: 672–674.

Original Article

Results of cemented bipolar hemiarthroplasty in fracture neck of femur in elderly

Singh V, Bhuyan B K, Sharma S K, Singh M P

Investigation performed at Department of Orthopaedics R D Gardi Medical College, Ujjain, MP, India

Abstract

Background: Treatment of neck of femur fractures in elderly has been controversial as restoration of pre-fracture function is the goal. Currently, choices available for an orthopaedic surgeon for treating these fractures in elderly are unipolar hemiarthroplasty, bipolar hemiarthroplasty and total hip arthroplasty. Cemented Bipolar Hemiarthroplasty appears to be the best option for fracture neck femur in the elderly population. This study was conducted with the aim to assess the functional outcome of fracture neck of femur treated with cemented bipolar hemiarthroplasty in elderly.

Material and method: Sixty patients of femoral neck fracture were operated by cemented hemiarthroplasty from June 2012 to June 2014 and their functional outcome were assessed on the basis of Harris Hip Score.

Results: There were 65 patients in this study, but on the follow up period of 2 years, 3 patients died (due to other medical reasons) and 2 patients did not revert back, so remaining 60 cases were included in the study. At 12 months of follow-up the average Harris Hip Score of 44 patients was 85.70 with a maximum score of 94.40 and a minimum score of 66.38.

Conclusion: We conclude that cemented bipolar prosthesis for treating fracture neck of femur in elderly gives good functional outcome.

Keywords: Hemiarthroplsty, Bipolar Prosthesis, fracture neck femur.

Address for Correspondence: Dr Vivek Singh, Professor, Department of Orthopaedics, R D Gardi Medical College, Ujjain, MP, India

Email: drviveksingh29@rediffmail.com

How to site this article: Singh V, Bhuyan B K, Sharma S K, Singh M P. Results of cemented bipolar hemiarthroplasty in fracture neck of femur in elderly. OrthopJMPC 2016;22(1): 25-29.

Introduction

Neck of femur fractures occurs predominantly in the elderly age group, typically results from low-energy trivial falls and may be associated with osteoporosis. In elderly, fracture of femoral neck is one of the most common injuries and always a great challenge to orthopaedic surgeons. The prevalence of this fracture doubles after the fifth decade of life. High rate of non-union and avascular necrosis are the poor outcomes of the patient treated with open reduction and internal fixation. Currently, choices for orthopaedic surgeons for treating these fractures in elderly are unipolar hemiarthroplasty, bipolar hemiarthroplasty and total hip arthroplasty.

Acetabular erosion and loosening of stem giving rise to pain are the main problems encountered with unipolar prostheses (Austin Moore's Prosthesis [1] and Thompson's Prosthesis [2]). In 1974, Bateman [3] introduced the Bipolar prosthesis (initially popular as Bateman's prosthesis) having mobile head element and had head surface additional to allow

movements in the acetabulum. Greater range of movements, less post-operative pain, reduced incidence of acetabular erosion, reduction in the loosening of stem (when cement is used), higher percentage of satisfactory results, more rapid return to unassisted activity are the advantages of bipolar prosthesis over unipolar endoprosthesis. Total hip arthroplasty is still not popular as a treatment modality for these fractures because majority of the patients do well with hemiarthroplasty and also due to high costs involved. Use of the cement gained in popularity after Sir John Charnley [4] began using PMMA, intended for denture repair, to anchor femoral head prosthesis in the femur during total hip arthroplasties. Cemented Bipolar hemiarthroplasty thus appears a good option for fracture neck femur in the elderly population.

Material and methods

Sixty patients of femoral neck fracture who were admitted in R.D.Gardi Medical College and C.R.G. Hospital, Ujjain from June 2012 to June 2014 were included in this study. The inclusion criteria were patients with fracture of the femoral neck with Age of patient > 60 years, failed internal fixation, avascular necrosis of femoral head secondary to fracture of the femoral neck.

Patients below 60 years, patients with arthritic changes involving the acetabulum, pathological fractures, patients not willing for surgery and patients medically unfit for surgery were excluded from this study.

Patients satisfying the inclusion criteria, who required surgical intervention, were worked up clinically and radiologically. All patients selected for the study were examined according to protocol, associated injuries, if any, were noted and investigations carried out in order to evaluate fitness for anesthesia. All the surgeries were performed under regional anaesthesia all patients were operated in lateral decubitus position by Moore's posterior approach.

Regular follow up of all cases was done at 1.5 month, 3 months, 6months, 9 months and 12 months. At each follow up patients were evaluated clinically using the Harris Hip Score and radiologically with appropriate X-rays.

Results

The average age was 71.6 years (range 61 – 90 years). Female predominance (65%). Left side affected in 39 (65%) and right side in 21(35%) patients. There were so many associated co morbidities, 11.66% of study patients had heart disease, 13.33% had diabetes, 13.33% had COPD, 31.66% had hypertension, 10% had ipsilateral knee osteoarthritis and 20% had no co-morbidity. The duration of surgery in 55% of cases was 90 -120 mins, 45% cases was 60-90mins. Average blood loss during the procedure in majority of the patients was below 200 ml. Limb lengthening (<1 cm) was observed in two patients (3.3%) postoperatively. The minimum duration of hospital stay amongst the study patients was 14 days and maximum duration was 29 days with the average being 22 days. Superficial infection in the form of a wound dehiscence was seen in four patients who were diabetic. The infection resolved without any sequelae and there was no late reactivation of the same. There were no late postoperative complications like loosening, dislocation, erosion, secondary osteoarthritis, protrusio acetabuli or periprosthetic fracture.

Type	No. of patients	Percentage (%)
1.	0	0
2.	5	8.33
3.	21	35

4.	34	56.66

Table 1: Garden classification [5]

The average Harris Hip Score [6] of 60 patients at 1.5 month after surgery was 61.88 with the highest score being 79.34 and the lowest being 42.81. The average Harris Hip Score at the second follow-up of 3 months was 71.78 (range 56.61 to 88.41). Average Harris Hip Score at 6 months was 80.66 (range 58.43 to 92.30). At nine months the average Harris Hip Score was 83.91 (range 62.34 to 94.36). At 12 months of follow-up the average Harris Hip Score of 44 was 85.70 with a maximum score of 94.40 and a minimum score of 66.38. Though a steady increase in the Harris Hip Score was seen in most patients between each follow-up there was not much change between the fourth (nine month) and fifth (twelfth month) follow-up.

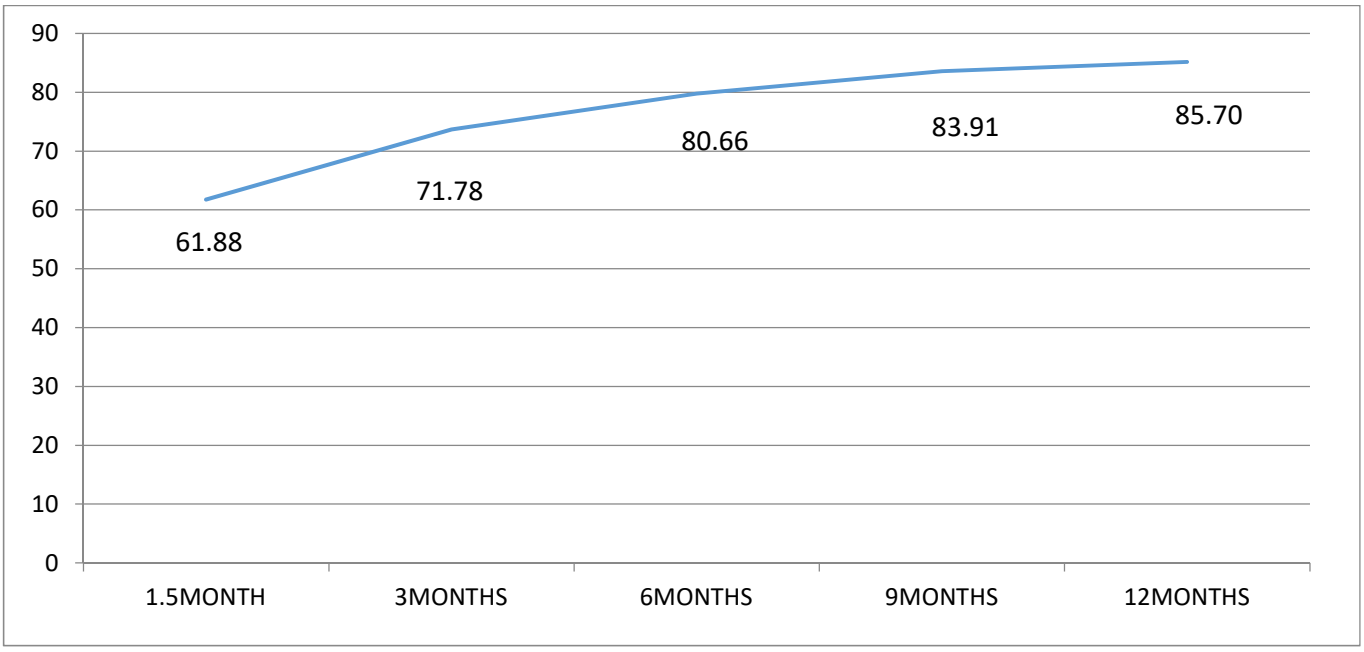

Figure 1: Graph showing average Harris hip score

In our study, out of 44 cases which were available for final 1 year of follow up 19 patients (43.18%) achieved excellent results, 17 patients (38.63%) achieved good results, 5 patients (11.36%) achieved fair results and 3 patients (6.8%) achieved poor results. 81.81% of the patients achieved an excellent or good result.

Discussion

The aim of surgery in fracture neck femur is early return to daily activities. This is particularly applicable to the elderly age group where complications need to be prevented. The mean age of the patients in the present study was 71.6 years. Patients with hip fractures have an increased mortality rate during the first year after fracture but after one year the mortality rate is comparable to that of the general population. The results of our study showed that age of the patient had minimal influence on the final clinical result.

As in most standard studies, the present study also had a higher number of females with the left side more commonly affected than the right. Majority of our study patients (53.33%) sustained the injury due to a trivial trauma like tripping or slipping. This is a very common occurrence in elderly population where poor vision and lack of neuro-muscular coordination is a problem.

All of our study patients had a displaced fracture of the neck of femur. Majority of the patients (61.66%) had a trans-cervical

fracture while 21.66% patients have sub-capital and 16.66 have basal fracture. The anatomical type of fracture and the displacement did not have any effect on the final function.

Diabetes was found to be the most common co-morbidity seen in 13.33% of the study patients. All patients had Type II Diabetes and were on oral hypoglycaemic agents. They were shifted to insulin pre-operatively and blood sugar values optimized before taking up for surgery. The other co-morbid conditions seen in the order of frequency were hypertension (31.66%), COPD (13.33%), heart disease (11.66) and ipsilateral knee osteoarthritis (10%). It was observed that the post-operative rehabilitation of patients was significantly affected by the presence of the above co-morbidities. This also had an effect on the final functional result of the procedure. Similar observations have been made by Koval et al and Bath [7,8,9].

In more than half of the cases, the blood loss was < 200ml for the whole procedure and in 23.33% of the others it was between 200-400ml. Only 13.33% of cases had a blood loss of >400 ml requiring a blood transfusion. It has been reported in literature that the average blood loss with hip hemiarthroplasty is less in the anterior approach as compared to the posterior approach. Most of the surgeries were completed between 90-120 minutes of starting the procedure. Similar duration of the procedure has been reported by Haidukewych, et al [10] and Drinker & Murray, et al [11]. Neither the intraoperative blood loss nor the duration of the procedure had any effect on final function.

Superficial infection in the form of a wound dehiscence was seen in one patient (10%) who was a diabetic. They were managed by adequate control of the diabetic status and appropriate antibiotics based on culture-sensitivity results. The infection resolved without any sequelae and there was no late reactivation of the same. Infection rate of 3.9% after bipolar hemiarthroplasty is reported by Nottage, et al [12].

The minimum duration of hospital stay amongst the study patients was 14 days and maximum duration was 29 days with the average being 22 days. Average hospital stay of 18 days with bipolar hemiarthroplasty has been reported by Lestrange [13]. Drinker and Murray et al [11] have reported an average hospital stay of 23 days with the same procedure. There were no late postoperative complications like loosening, dislocation, erosion, secondary osteoarthritis, protrusio acetabuli or periprosthetic fracture. We are unable to comment upon long term acetabular erosion due to relative short follow up. None of our patient reported with post-operative femoral fractures. Langslet E et al [14] reported the prevalence of post-operative femoral fractures in 0.9% with cemented hemiarthroplasty. Maricevic et al [15] reported no poor results in elderly patients with femoral neck fracture treated with bipolar hemiarthroplasty, this study has 6.8% poor results.

In a meta-analysis of 106 reports on displaced femoral neck fractures, Lu-Yao et al [9] found the incidence of reoperation within 2 years to range from 20% to 36% after internal fixation in greater than 65 years old patients. The reoperation rate after hemiarthroplasty within the same time interval was 6% to 18%. He had 33% nonunion and 16% avascular necrosis for patients treated with internal fixation. He found rate of re-operation was double when unipolar prosthesis is used. None of our patients required revision surgery. As reported by Bhandari et al [16] in a meta-analysis of nine trials comparing arthroplasty with internal fixation in 1162 patients, found that arthroplasty significantly reduced the risk of revision surgery.

Overall, 19 patients (43.18%) had Excellent result, 17 patients (38.63%) had Good result, 5 patients (11.36%) had fair result and 3 patients (6.8%) had poor result. Overall, 81.81% of the patients had an excellent or good result. Our results are comparable with standard studies of bipolar hemiarthroplasty performed for fracture neck femur. Moshein et al [17] reported excellent results in 40% of the cases and good results in 22% of cases. Similarly, another study by Lestrange [13] reported excellent results in 39.6% of cases and good results in 31.2% of cases.

Shortcomings of this study are non-randomised, non controlled study with short follow up.

Conclusion

Cemented Bipolar hemiarthroplasty for fractures of the femoral neck in elderly gives good functional outcome as per Harris Hip Score. A randomised controlled study with long follow up can prove superiority of cemented bipolar prosthesis over other prosthesis.

References

1. Moore AT. The Self-Locking Metal Hip Prosthesis. J Bone Joint Surg Am.1957;39:811-827.
2. Thompson FR. Two and a half years' experience with a vitallium intramedullary hip prosthesis. J Bone Joint Surg Am. 1954;36:489-500.
3. Bateman JE. Single assembly total hip prosthesis: Preliminary report. Orthop Dig 1974;2:15-19.
4. Charnley J. Total hip replacement by low friction arthroplasty. Clin Orthop 1970;72:7-21.
5. Garden RS. Low-angle fixation in fractures of the femoral neck. J Bone Joint Surg 1961;43B:647–663.
6. Harris WH. Traumatic arthritis of the hip after dislocation and acetabular fractures: Treatment by mould arthroplasty. An end result study using a new method of result evaluation. J Bone Joint Surg Am 1969;51-A(4):737-755.
7. Koval KJ, Zuckerman JD. Current Concepts Review: Functional Recovery after Fracture of the Hip. J Bone Joint Surg Am 1994;76:751-766.
8. Bath, R. Problems in the treatment of femoral neck fractures. Proceedings of the Royal Society of Medicine 1975; 63:1120-1128.
9. Lu-Yao GL, Keller RB, Littenberg B, Wenneberg JE. Outcomes after fracture of the femoral neck: A meta analysis of one hundred and six published reports. J Bone Joint Surg 1994;76(A):15-25.
10. Haidukewych GJ, Israel TA, Berry DJ. Long term survivorship of cemented bipolar hemiarthroplasty for fracture of the femoral neck. Clin Orthop 2002;403:118-126
11. Drinker H, Murray WR. The universal proximal femoral endoprosthesis – A short term comparison with conventional hemiarthroplasty. J Bone Joint Surg 1979;61A:1167-1174.
12. Nottage WM, McMaster WC. Comparison of bipolar implants with fixed-neck prostheses in femoral-neck fractures. Clin Orthop Relat Res. 1990 Feb;(251):38-43.
13. Lestrange NR. Bipolar arthroplasty for 496 hip fractures. Clin Orthop 1990;251:7 -18.
14. Langslet E,Frihagen F,Opland V,Madsen JE.Cemented versus uncemented hemiarthroplasty for displaced femoral neck fractures.Clin Orthop Res.2014 Apr472(4)1291-9.
15. Maricevic A, Erceg M, Gekic K. Treatment of femoral neck fractures with bipolar hemiarthroplasty. Lijec-Vjesn 1998;120(5):121-124.
16. Bhandari M, Devereaux PJ, Swiontowski MF, Tornetta P, Obremskey W,Koval KJ, et al. Internal fixation compared with arthroplasty for displaced fractures of the femoral neck. J Bone Joint Surg Am 2003; 85:1673-1681
17. Moshein J, Alter AH, Elconin KB, Adams WW. Transcervical fractures of the hip treated with the bateman bipolar prosthesis. Clin Orthop 1990;25

Original Article

Impact of Educating the patients and attendants on prevention of pressure sores in paraplegics

Tanwar M, Kundu Z S, Vashisht G

Investigation performed at Department of Orthopaedics PGIMS Rohtak Haryana, India

Abstract

Background: A pressure ulcer is localized injury to the skin and/or underlying tissue usually over a bony prominence, as a result of pressure, or pressure in combination with shear [1]. Pressure sores have been a common complication in cases of paraplegic / quadriplegic patients. The main cause is unrelieved prolonged pressure usually over bony prominences along with various intrinsic and extrinsic causes in patients with impaired sensations. Prevention of pressure sore has been the objective of educating the patient and the attendant regarding this dreaded complication. This study aims at evaluating the outcome of educating the patients and the attendees and defining their role in prevention of development of pressure sores.

Materials and methods: One hundred & fifty patients (98 males & 52 females) of traumatic and non-traumatic spinal cord injury (SCI) were enrolled from the in-patient department of Paraplegia and Rehabilitation in our institute from 2010-15. The patients were assessed for the presence of pressure ulcers and skin condition at the time of admission. The patients & their attendees, during the stay were educated for their risk of developing pressure ulcers and its prevention as per NPUAP/EPUAP (National Pressure Ulcer Advisory Panel and European Pressure Ulcer Advisory Panel) guidelines and patient teaching protocol for pressure ulcers prevention and management in a comprehendible language [2]. The patients were monitored daily and reassessed at discharge, 1, 6 and 12 months' time.

Results: The assessment was done according to quality indicators suggested by NPUAP/EPUAP guidelines in the form of point prevalence of pressure ulcers and incidence of facility acquired rate of pressure sores in hospitalized patients. It was seen that there was a statistically significant difference in the patients of both the groups with respect to development of bed sores and their prevention. The patients and attendees with higher scores on patient teaching protocol for pressure ulcers prevention and management had significantly lower incidence of developing pressure sores in comparison to patients with lower scores.

Conclusion: The need for patient and attendant education is most important for the prevention and management of Bed sores. In a country like ours where the ratio of health care providers to the number of patients availing facilities is very high, patient and attendant education on prevention & progression of pressure sores remains the key to reducing morbidity and decreasing burden for both the patient and health care system. In coherence to the same fact, our study had shown significantly low rate of development of bed sores were seen with educated attendees who could verbally reproduce the guidelines of care and prevention.

Keywords: bed sore, paraplegia, back care, posture change

Address for Correspondence: Dr. Z. S. Kundu; Professor, Department of Orthopaedics PGIMS Rohtak, Haryana, India;

Email: zskundu2003@rediffmail.com

How to site this article: Tanwar M, Kundu Z S, Vashisht G. Impact of Educating the patients and attendants on prevention of pressure sores in paraplegics. OrthopJMPC 2016;22(1): 30-33

Introduction

Pressure ulcers/sores have been a point of concern as an important source of morbidity & mortality in paraplegic/quadriplegic patients. A pressure ulcer is localized injury to the skin and/or underlying tissue usually over a bony prominence, as a result of pressure, or pressure in combination with shear. The chief cause is a partial or complete loss of sensation due to traumatic

or non-traumatic insult to the spinal cord at any level. Many causes have been identified to predispose the patient to development of pressure sores. Of these are mainly classified into intrinsic & extrinsic causes. Extrinsic factors include interface pressure, shear forces & friction. Intrinsic factors include nutritional state of the patient, age of patient, associated comorbidities, ongoing medications, cognitive deficit & dehydration [3]. Pressure ulcers are classified into 4 stages according to clinical severity. Two more groups have been recently added as per the NPUAP (National Pressure Ulcer Advisory Panel and European Pressure Ulcer Advisory Panel) classification. These are for suspected deep tissue injury and unknown depth of involvement [1].

Prevention is better than cure. It is rather truer for pressure sore. In our country it is not only the nursing care but the education of the attendants and patients which is very important for minimizing the occurrence of pressure ulcers. This study aims at evaluating the outcome of educating the patients and the attendees and defining their role in prevention of development of pressure sores.

Material & methods

One hundred & fifty (98 males & 52 females) patients of traumatic and non-traumatic spinal cord injury were enrolled from the in-patient department of Paraplegia and Rehabilitation at our institute from 2010-15. The patients were assessed for the presence of pressure ulcers and skin condition at the time of admission. Ninety six patients were diagnosed as traumatic spinal cord injury and fifty four were categorized as non-traumatic spinal cord injury. Tuberculosis (44%) and tumor (18%) were the two most common causes of non-traumatic SCI. The patients & their attendees, during the stay were educated for their risk of developing pressure ulcers and its prevention as per NPUAP/EPUAP guidelines and patient teaching protocol for pressure ulcers prevention and management in a comprehensible language. The patients with cervical and cervico-dorsal injuries were classified as tetraplegics and those with dorsal, dorso-lumbar and lumbar spine affections were classified as paraplegics. The patients were monitored daily and reassessed at discharge, 6 and 12 months' time. Neurological examination was done as per the American Spinal Injury Association (ASIA) score [6]. No patient with a pre-existing bed sore was included in the study. Patient and attendant scores were measured by average number of successfully met outcomes. Every outcome that the patient/attendant could not verbalize/comprehend or needed further instructions was taken as null response. Outcome response was taken as successful if the patient attendees could reproduce half of the information given at the time of hospital stay.

Results

The patients were reassessed at one month, six months and 12 months the time of follow-up post discharge. There were 35 drop outs that were excluded from the study as loss to follow up. Thirteen in-patient deaths were reported of which eleven patients were earlier diagnosed cases of spine tumors & two cases were diagnosed case of spinal tuberculosis. The remaining patients and attendants were subjected to the Patient Teaching Protocol for Pressure Ulcer Prevention and Management at follow up of 1, 6 & 12 months. The mean score in the cohort was 4.8±1.3. Statistically significant difference were seen in clinical outcomes of patients with higher reproducibility (>50%) on teaching protocol as compared with those having low (<50%) reproducibility of outcomes. ($p<0.05$)

The patients with quadriparesis (low ASIA score) had significantly poor prognosis despite good patient education and good

reproducibility of patient teaching protocol for pressure ulcers prevention and management. Young patients were found to have better clinical outcomes as compared to old and frail patients with SCI with respect to pressure sores.

Discussion

The assessment & identification of risk of development of pressure ulcer is the framework to the start of preventive measures. Patients at risk include bedfast or chair fast patients due to traumatic or non-traumatic spinal cord injury (SCI). Of these comprehensive skin assessments in the form of blanching response, localized heat, edema, and induration remain important especially in patients with darkly pigmented skin. Associated bladder bowel comorbidity, poor nutritional status, increased skin moisture, increasing age, increased temperature, patients with associated poly trauma are poor prognostic factors predisposing to pressure ulcers.

The attending of the patient should be instructed for a head-to-toe assessment with particular focus on skin overlying bony prominences at regular intervals especially the sacrum, ischial tuberosity, greater trochanter and heel with every change of posture [4,5].

The patients' attendees should be educated to avoid positioning the individual on an area of erythema whenever possible & keeping the skin clean and dry with help of Talc and calamine lotion at regular intervals. Instructions to not massage or vigorously rub skin that is at risk of pressure ulcers are also vital. Cleaning of skin dry, promptly following episodes of incontinence is also an important consideration in patients with bladder co morbidities.

Education should also be imparted to consider using a skin moisturizer to hydrate dry skin in order to reduce risk of skin damage & the use of air/water beds for preventing/treating pressure sore development even post discharge should also be imparted. Due stress should be laid on importance of rehabilitation physiotherapy and proper lifting of individuals while repositioning for prevention of any folds in linen. The patient attendants were clearly instructed to not use tight under clothing.

Intrinsic causes hold as important consideration as extrinsic causes. The patient and attendees should also be instructed regarding adequate calorie intake and maintaining good hydration status. High protein diet and adequate vitamin / mineral supplementation has also proven efficacy in paraplegic patients. Maintaining positive nitrogen balance is also essential for healing of pressure ulcers.

Presence of a grade 1 ulcer is a predisposing factor for progress to next grade or for developing ulcer at other sites. In patients where instrumentation/stabilization is done, instruction for frequent sitting should be given. Reposition and turn the individual at periodic intervals, in accordance with the individual's wishes, comfort and tolerance still remains the key to prevention of pressure ulcers.

Conclusions

The present study concludes that patients and attendants who had a better comprehension / verbal remembrance scores of the outcomes as per Patient Teaching Protocol for Pressure Ulcer Prevention and Management had statistically significant difference in the incidence of developing pressure ulcers at 1 month, 6 months and 12 months follow up in comparison to patients with poor comprehension and verbal reproducibility of the score. Although the result was not similarly reproducible in tetraplegic patients. Despite good reproducibility in a few cases

there was a worse outcome, probably due to the severe nature of the injury. Young patients fared better than older ones.

Prevention of pressure sores is the key to reduction of morbidity and mortality. Patient education regarding preventive and treatment measures has a statistically significant association with low incidence/prevalence of pressure sores in para/quadriplegic patients. It was observed that attendant education regarding care was as important as the attending medical staff and reinforcement at various stages of follow up is of utmost importance.

References

1. National Pressure Ulcer Advisory Panel and European Pressure Ulcer Advisory Panel. Prevention and Treatment of Pressure Ulcers: Clinical Practice Guideline. Washington, DC: National Pressure Ulcer Advisory Panel; 2009.
2. Warner D, Konnerth K. A patient teaching protocol for pressure ulcers prevention and management: Ostomy and Wound Management, 1993; 39: 35-43.
3. Gehin C, Brusseau E, Meffre R, Schmitt PM, Deprez JF, Dittmar A. Which techniques to improve the early detection and prevention of pressure ulcers? Conf Proc IEEE Eng Med Biol Soc. 2006;1:6057-60.
4. Australian Wound Management Association (AWMA). Pan Pacific Clinical Practice Guideline for the Prevention and Management of Pressure Injury. Osborne Park, WA: Cambridge Media; 2012.
5. European Pressure Ulcer Advisory Panel. Pressure Ulcer Treatment Guidelines. Oxford, England: EPUAP, 1998. Available from: http://www.epuap.org/gltreatment.html.
6. Maynard Jr FM, Bracken MB, Creasey G, Ditunno Jr JF, Donovan WH, Ducker TB et al. International Standards for Neurological and Functional Classification of Spinal Cord Injury: American Spinal Injury Association. Spinal Cord 1997; 35: 266–274.

Current Concepts Review

Plantar Fasciitis Treatment

Gohiya A, Choudhari P, Sharma P, Verma R, Sharma S

- Plantar Fasciitis is the most common cause of painful heel.
- Approach to heel pain involves a detailed history, thorough clinical examination and relevant investigations.
- Majority of the patients respond to non-operative treatment
- Out of number of non surgical options available which one to use first and in which one in particular group of patients is not clear

Address for Correspondence: Dr. Ashish Gohiya, F-1, Doctor's Qtr, Hamidia Hospital Campus, Bhopal, M.P. India

Email: gohiya@gmail.com

How to site this article: Gohiya A, Choudhari P, Sharma P, Verma R, Sharma S. Plantar Fasciitis Treatment. OrthopJMPC 2016;22(1): 34-40

Introduction

Plantar fasciitis is the most common cause of heel pain. Pain typically arise due to degenerative irritation at the insertion of plantar fascia on the medial process of the calcaneal tuberosity. In general plantar fasciitis is correlated with the heel spur which is not true. Approximately 10% of the United States population experiences bouts of heel pain, which results in 1 million visits per year to medical professionals for treatment of plantar fasciitis [1]. The etiology can be multifactorial however most cases are due to overuse stresses.

Even though the condition is self-limiting it poses a challenge to the treating orthopaedician. Most of the patients respond to non-operative treatment measures [2].

Treatment

Careful and complete history, thorough clinical examination, organized, evidence based, stepwise approach to treatment gives good outcome. Self-limiting nature of the disease gives 90% success rate with non-operative measures.

Understanding the etiology of the problem and directing treatment accordingly is the key to successful treatment of plantar fasciitis. Close attention must be paid during the history and physical examination to ensure that other potential causes of heel pain are not missed. An organized, evidence-based, stepwise approach to treatment will help achieve good outcomes. Also essential is educating the patient about the expected time of recovery [3,4,5].

Pain is due to irritation due to inflammation, so initial measures are aimed at reducing inflammation like icing, nonsteroidal anti-inflammatory drugs (NSAIDs), activity modification, corticosteroids, orthoses. Other modalities aim at resolving degeneration like autologous blood injection, Platelet-rich plasma (PRP) injection, nitroglycerin patches, extracorporeal shock wave therapy (ESWT) and surgery. Physical therapy targets both goals. Combination of these modalities can be used

Icing

It reduces inflammation it should be done after stretching and strengthening exercises.

Activity modification

Activity modification to the level of relative rest is critical for improvement. In patients with severe pain, a period of casting or immobilization in a boot cast may be necessary. In one study, 25% of patients considered rest to be the most effective form of treatment [6].

NSAIDs

Anti-inflammatory drugs are first line in management. Although there is controversy as to whether NSAIDs actually assist in the physiologic healing process, these agents can be useful as an adjunct for controlling pain while the individual's plantar fasciitis is being treated with stretching, strengthening, and relative rest [6,7]. Daily dose during acute phase of treatment is necessary.

Corticosteroids

These can be used orally or via injections. Corticosteroid injections involve local, concentrated administration and are generally reserved for refractory cases [8]. Whether or not injected corticosteroids alter the long-term pathology of chronic inflammation, many patients experience acute symptomatic improvement [9,10]. One study found that ultrasound guided steroid injection provided short-term relief from pain in plantar fasciitis for up to 4 weeks and improvement in plantar fascia swelling for up to 12 weeks [11]. Whether or not the use of ultrasound guidance improves outcome of corticosteroid injections is unknown at present [12,13,14]. It can be relied on when palpation based injection has been unsuccessful [15]. A corticosteroid injection may be given through a plantar or a medial approach.

Studies have reported success rates of 70% or better [3, 16].Corticosteroid injections have been shown to improve symptoms at 1 month but not at 6 months. It is recommended not to give more than 3 steroid injections within a year.

A randomized, controlled study demonstrated that intralesional corticosteroid injection is more efficacious and more cost-effective than low- energy ESWT in the treatment of plantar fasciitis that has persisted for more than 6 weeks [17].

The complications of corticosteroid injection include skin atrophy, skin hypopigmentation, soft-tissue atrophy, infection, bleeding, and failure to work. A steroid flare-up, which consists of increased pain for up to several days, may occur in up to 2% patients [9]. Plantar fascia rupture was reported in 10% of patients in one case series [18]. Allergic reaction and infection are rare complications.

Botulinum toxin A

A short-term, randomized, controlled, double-blind study found that botulinum toxin type A injection appeared to provide significant improvements in pain relief [19]. Another study found that ultrasound-guided injection of botulinum toxin type A did not induce the complication of fat pad atrophy but was successful at improving the maximal center of pressure loading in the foot [20]. A randomized, controlled, double-blind study compared botulinum toxin type A injection to corticosteroid injection in 36 patients and found more rapid and sustained response in the botulinum toxin injected group [21].

Autologous blood

Injection of autologous blood into the calcaneal attachment of plantar fascia is thought to stimulate an acute inflammatory reaction, providing factors that stimulate fibroblast activity and vascular growth and thereby healing of lesion. Few studies support use of this modality for treatment of

heel pain attributed to plantar fasciitis [22,23,24].

Platelet rich plasma

There is some evidence to suggest that platelet-rich plasma may be beneficial in the treatment of chronic plantar fasciitis [25, 26]. Although both autologous blood and PRP injections appear to relieve symptoms of plantar fasciitis, these have no significant difference compared to corticosteroid injection [27,28].

Cryopreserved human amniotic membrane

Cryopreserved human amniotic membrane which contain growth factors, cytokines and matrix component are considered to promote tissue healing. This experimental treatment was evaluated by a randomized, controlled, double blind, study of 23 patients, at 12 week follow-up results were comparable to corticosteroid injection group [29].

Extracorporeal Shock-wave Therapy (ESWT)

ESWT has been proposed as a treatment option for plantar fasciitis. Bombardment of the tissue with high-pressure sound waves stimulate blood flow to stimulate healing, and shut down the neuronal pain pathways through the pulses hitting the affected nerves. ESWT is noninvasive, has few adverse side effects, and is associated with a satisfactory results in patients with chronic plantar fasciitis. In 2013, two meta-analyses concluded that ESWT could be a safe and effective nonsurgical treatment for plantar fasciitis [30, 31]. Some studies shown favorable results with success rate of 50-90% but overall results have been mixed so it is recommended to be used only after other measures have failed [32-35]. A Comparative study between ESWT and conventional physiotherapy showed similar results at 3 month follow-up [36].

Night Splints

During sleep plantar flexion leads to shortened plantar fascia, night splint maintain plantigrade position providing passive stretch to plantar fascia [37]. The passive stretching provided by night splint helps prevent microtrauma at the plantar fascia attachment with the first steps out of bed in the morning.

Use of night splint though cumbersome has 95% compliance [38] various studies shown excellent results in terms of improvement in symptoms [38-42]. Night splints are especially useful in individuals who have had symptoms of plantar fasciitis for longer than 12 months as suggested by some studies [38-42].

Night Splints

In one study 14 % patients considered shoe change a satisfactory treatment [6].

Shoe inserts can be used with shoes. A randomized, prospective study suggested that more supportive orthotics resulted in better pain relief as compared to softer, non-supportive orthotics [43].

Orthosis

Foot strike generates forces which are not absorbed and patients with low arch experience stress [44]. Studies support use of taping, arch support and custom orthotic devices for conservative treatment [6, 45, 46].

Taping may be more cost-effective for the acute onset of plantar fasciitis, whereas OTC arch supports and orthotics may be more cost-effective for chronic or recurrent cases of plantar fasciitis and for the prevention of injuries. Heel pads are widely used, but they are generally useful only for shock absorption and do not provide support or structural control [47]. A meta-analysis concluded that kinesiotaping was no more effective than standard taping techniques [48].

Physical Therapy

Physical therapy along with contrast bath, ultrasonography and iontophoresis help in resolution of symptoms. In one study, iontophoresis was found to improve symptoms faster but it had no effect on long-term outcome [49]. Physical therapy programs may be divided into stretching, strengthening, and maintenance phases.

- Stretching: Stretching of calf and foot resulted in successful relief in 83% patients, though the exact benefit are not known [6,50]. Wall stretching with the knee in both the extended and flexed positions, stair stretching, and towel stretching are all commonly employed. Stretching targeted at the plantar fascia are particularly important, passive stretching of toes and Achilles tendon increases the effectiveness [51].
- Strengthening: Strengthening of intrinsic foot muscles have proved beneficial [52] exercises include towel curls, marble pickups and toe taps [53].
- Maintenance Phase: Stretching and strengthening at least 2-3 times per week should be continued to prevent recurrence of symptoms.

Fasciotomy

Surgery may be required in 5-10% of patients not responding to non-operative measures for 6-12 months [3,4,5,54]. Plantar fascia release performed by sectioning part or all of the fascia has been the mainstay of treatment [55,56]. However release of the plantar fascia results in instability of the medial column of the foot and lateral column pain due to overload [57]. 70 – 90 % success rate is reported with surgical release [58-63]. Bazaz & Ferkel [64] reported endoscopic release to provide improved outcomes for patients with less severe symptoms. Potential complications of surgical intervention include flattening of the longitudinal arch leading to strain and heel hypoesthesia [18, 65].

Percutaneous Partial Fasciotomy

Percutaneous release though offer quick return to function, have similar long term results as open fasciotomy [66].

Cryosurgery

A prospective study of 61 cases using small cryoprobe inserted percutaneously to destroy pathologic tissue at -70^0 C temperature concluded it to be an effective modality of treatment [67]. Another study reported 77% success rate at 2 year follow-up in 137 feet by this modality [68].

Bipolar Radiofrequency Microdebridement

This new technique applies radiofrequency pulse to the plantar fascia, gives equivalent results as compared to traditional surgical methods. It has added advantage of earlier pain relief, decreased morbidity and early return to work. After 11 months of this procedure patients in a study achieved an average American Orthopaedic Foot and Ankle Society (AOFAS) hind foot score of 92 out of 105 [69]. Long term randomized double blind studies are recommended to prove it's superiority over other modalities.

References

1. Riddle DL, Schappert SM. Volume of ambulatory care visits and patterns of care for patients diagnosed with plantar fasciitis: a national study of medical doctors. *Foot Ankle Int*. 2004 May. 25(5):303-10.
2. Lennard TA. Fundamentals of procedural care. Lennard TA, ed. *Physiatric Procedures in Clinical Practic*. Philadelphia: Hanley & Belfus; 1995. 1-13.
3. Furey JG. Plantar fasciitis. The painful heel syndrome. *J Bone Joint Surg Am*. 1975 Jul. 57(5):672-3.

4. Gill LH, Kiebzak GM. Outcome of nonsurgical treatment for plantar fasciitis. *Foot Ankle Int*. 1996 Sep. 17(9):527-32.
5. Davis PF, Severud E, Baxter DE. Painful heel syndrome: results of nonoperative treatment. *Foot Ankle Int*. 1994 Oct. 15(10):531-5.
6. Wolgin M, Cook C, Graham C, Mauldin D. Conservative treatment of plantar heel pain: long-term follow-up. *Foot Ankle Int*. 1994 Mar. 15(3):97-102.
7. Stanley KL, Weaver JE. Pharmacologic management of pain and inflammation in athletes. *Clin Sports Med*. 1998 Apr. 17(2):375-92.
8. Crawford F, Atkins D, Young P, Edwards J. Steroid injection for heel pain: evidence of short-term effectiveness. A randomized controlled trial. *Rheumatology (Oxford)*. 1999 Oct. 38(10):974-7.
9. Pfenninger JL. Joint and soft tissue aspiration and injection. Pfenninger JL, Fowler GC, eds. *Procedures for Primary Care Physicians*. St. Louis, Mo: Mosby-Year Book; 1994. 1036-54.
10. Yucel I, Yazici B, Degirmenci E, Erdogmus B, Dogan S. Comparison of ultrasound-, palpation-, and scintigraphy-guided steroid injections in the treatment of plantar fasciitis. *Arch Orthop Trauma Surg*. 2009 May. 129(5):695-701.
11. McMillan AM, Landorf KB, Gilheany MF, Bird AR, Morrow AD, Menz HB. Ultrasound guided corticosteroid injection for plantar fasciitis: randomised controlled trial. *BMJ*. 2012 May 22. 344:e3260
12. Chen CM, Chen JS, Tsai WC, Hsu HC, Chen KH, Lin CH. Effectiveness of device-assisted ultrasound-guided steroid injection for treating plantar fasciitis. *Am J Phys Med Rehabil*. 2013 Jul. 92(7):597-605.
13. Ball EM, McKeeman HM, Patterson C, Burns J, Yau WH, Moore OA, et al. Steroid injection for inferior heel pain: a randomised controlled trial. *Ann Rheum Dis*. 2013 Jun. 72(6):996-1002.
14. Ball EM, McKeeman HM, Patterson C, et al. Steroid injection for inferior heel pain: a randomised controlled trial. *Ann Rheum Dis*. 2013 Jun. 72(6):996-1002.
15. Kane D, Greaney T, Bresnihan B, Gibney R, FitzGerald O. Ultrasound guided injection of recalcitrant plantar fasciitis. *Ann Rheum Dis*. 1998 Jun. 57(6):383-4.
16. Kane D, Greaney T, Bresnihan B, Gibney R, FitzGerald O. Ultrasound guided injection of recalcitrant plantar fasciitis. *Ann Rheum Dis*. 1998 Jun. 57(6):383-4.
17. Porter MD, Shadbolt B. Intralesional corticosteroid injection versus extracorporeal shock wave therapy for plantar fasciopathy. *Clin J Sport Med*. 2005 May. 15(3):119-24
18. Acevedo JI, Beskin JL. Complications of plantar fascia rupture associated with corticosteroid injection. *Foot Ankle Int*. 1998 Feb. 19(2):91-7.
19. Babcock MS, Foster L, Pasquina P, Jabbari B. Treatment of pain attributed to plantar fasciitis with botulinum toxin a: a short-term, randomized, placebo-controlled, double-blind study. *Am J Phys Med Rehabil*. 2005 Sep. 84(9):649-54.
20. Huang YC, Wei SH, Wang HK, Lieu FK. Ultrasonographic guided botulinum toxin type A treatment for plantar fasciitis: an outcome-based investigation for treating pain and gait changes. *J Rehabil Med*. 2010 Feb. 42(2):136-40.
21. Elizondo-Rodriguez J, Araujo-Lopez Y, Moreno-Gonzalez JA, Cardenas-Estrada E, Mendoza-Lemus O, Acosta-Olivo C. A comparison of botulinum toxin a and intralesional steroids for the treatment of plantar fasciitis: a randomized, double-blinded study. *Foot Ankle Int*. 2013 Jan. 34(1):8-14.
22. Martin RP. Autologous blood injection for plantar fasciitis: a retrospective study. Paper presented at: Annual meeting of the American Medical Society for Sports Medicine; April 16-20, 2005; Austin, Texas. *Clin J Sport Med*. 2005 Sept. 15:387-8.
23. Kiter E, Celikbas E, Akkaya S, Demirkan F, Kiliç BA. Comparison of injection modalities in the treatment of plantar heel pain: a randomized controlled trial. *J Am Podiatr Med Assoc*. 2006 Jul-Aug. 96(4):293-6.
24. Lee TG, Ahmad TS. Intralesional autologous blood injection compared to corticosteroid injection for treatment of chronic plantar fasciitis. A prospective, randomized, controlled trial. *Foot Ankle Int*. 2007 Sep. 28(9):984-90.
25. Kumar V, Millar T, Murphy PN, Clough T. The treatment of intractable plantar fasciitis with platelet-rich plasma injection. *Foot (Edinb)*. 2013 Jun-Sep. 23(2-3):74-7.
26. Van Egmond JC, Breugem SJ, Driessen M, Bruijn DJ. Platelet-Rich-Plasma injection seems to be effective in treatment of plantar fasciitis: a case series. *Acta Orthop Belgica*. 2015 Jun. 81:315-20.
27. Lee TG, Ahmad TS. Intralesional autologous blood injection compared to corticosteroid injection for treatment of chronic plantar fasciitis. A prospective, randomized, controlled trial. *Foot Ankle Int*. 2007 Sep. 28(9):984-90.
28. Kiter E, Celikbas E, Akkaya S, Demirkan F, Kiliç BA. Comparison of injection modalities in the treatment of plantar heel pain: a randomized controlled trial. *J Am Podiatr Med Assoc*. 2006 Jul-Aug. 96(4):293-6.
29. Hanselman AE, Tidwell JE, Santrock RD. Cryopreserved human amniotic membrane injection for plantar fasciitis: a randomized,

controlled, double-blind pilot study. *Foot Ankle Int*. 2015 Feb. 36:151-8.
30. Aqil A, Siddiqui MR, Solan M, Redfern DJ, Gulati V, Cobb JP. Extracorporeal shock wave therapy is effective in treating chronic plantar fasciitis: a meta-analysis of RCTs. *Clin Orthop Relat Res*. 2013 Nov. 471(11):3645-52.
31. Dizon JN, Gonzalez-Suarez C, Zamora MT, Gambito ED. Effectiveness of extracorporeal shock wave therapy in chronic plantar fasciitis: a meta-analysis. *Am J Phys Med Rehabil*. 2013 Jul. 92(7):606-20.
32. Rompe JD, Decking J, Schoellner C, Nafe B. Shock wave application for chronic plantar fasciitis in running athletes. A prospective, randomized, placebo-controlled trial. *Am J Sports Med*. 2003 Mar-Apr. 31(2):268-75.
33. Hyer CF, Vancourt R, Block A. Evaluation of ultrasound-guided extracorporeal shock wave therapy (ESWT) in the treatment of chronic plantar fasciitis. *J Foot Ankle Surg*. 2005 Mar-Apr. 44(2):137-43.
34. Alvarez R., Cross, G.L., Levitt, R., Gould, et al. Chronic proximal Plantar Fasciitis Treatment Results with the Ossatron ESW System. FDA Investigational Study P990086, approval 10-12-2000.
35. Chuckpaiwong B, Berkson EM, Theodore GH. Extracorporeal shock wave for chronic proximal plantar fasciitis: 225 patients with results and outcome predictors. *J Foot Ankle Surg*. 2009 Mar-Apr. 48(2):148-55.
36. Greve JM, Grecco MV, Santos-Silva PR. Comparison of radial shockwaves and conventional physiotherapy for treating plantar fasciitis. *Clinics (Sao Paulo)*. 2009. 64(2):97-103.
37. Martin JE, Hosch JC, Goforth WP, Murff RT, Lynch DM, Odom RD. Mechanical treatment of plantar fasciitis. A prospective study. *J Am Podiatr Med Assoc*. 2001 Feb. 91(2):55-62.
38. Berlet GC, Anderson RB, Davis H, Kiebzak GM. A prospective trial of night splinting in the treatment of recalcitrant plantar fasciitis: the Ankle Dorsiflexion Dynasplint. *Orthopedics*. 2002 Nov. 25(11):1273-5.
39. Batt ME, Tanji JL, Skattum N. Plantar fasciitis: a prospective randomized clinical trial of the tension night splint. *Clin J Sport Med*. 1996 Jul. 6(3):158-62.
40. Wapner KL, Sharkey PF. The use of night splints for treatment of recalcitrant plantar fasciitis. *Foot Ankle*. 1991 Dec. 12(3):135-7
41. Powell M, Post WR, Keener J, Wearden S. Effective treatment of chronic plantar fasciitis with dorsiflexion night splints: a crossover prospective randomized outcome study. *Foot Ankle Int*. 1998 Jan. 19(1):10-8.
42. Mizel MS, Marymont JV, Trepman E. Treatment of plantar fasciitis with a night splint and shoe modification consisting of a steel shank and anterior rocker bottom. *Foot Ankle Int*. 1996 Dec. 17(12):732-5.
43. Walther M, Kratschmer B, Verschl J, Volkering C, Altenberger S, Kriegelstein S, et al. Effect of different orthotic concepts as first line treatment of plantar fasciitis. *Foot Ankle Surg*. 2013 Jun. 19(2):103-7.
44. Reid DC. Running: injury patterns and prevention. *Sports Injury Assessment and Rehabilitation*. New York, NY: Churchill Livingstone; 1992. 1131-58.
45. Lynch DM, Goforth WP, Martin JE, et al. Conservative treatment of plantar fasciitis. A prospective study. *J Am Podiatr Med Assoc*. 1998 Aug. 88(8):375-80.
46. Van de Water AT, Speksnijder CM. Efficacy of taping for the treatment of plantar fasciosis: a systematic review of controlled trials. *J Am Podiatr Med Assoc*. 2010 Jan-Feb. 100(1):41-51.
47. Chia KK, Suresh S, Kuah A, Ong JL, Phua JM, Seah AL. Comparative trial of the foot pressure patterns between corrective orthotics,formthotics, bone spur pads and flat insoles in patients with chronic plantar fasciitis. *Ann Acad Med Singapore*. 2009 Oct. 38(10):869-75.
48. Morris D, Jones D, Ryan H, Ryan CG. The clinical effects of Kinesio® Tex taping: A systematic review. *Physiother Theory Pract*. 2013 May. 29(4):259-70.
49. Gudeman SD, Eisele SA, Heidt RS Jr, Colosimo AJ, Stroupe AL. Treatment of plantar fasciitis by iontophoresis of 0.4% dexamethasone. A randomized, double-blind, placebo-controlled study. *Am J Sports Med*. 1997 May-Jun. 25(3):312-6.
50. Radford JA, Landorf KB, Buchbinder R, Cook C. Effectiveness of calf muscle stretching for the short-term treatment of plantar heel pain: a randomised trial. *BMC Musculoskelet Disord*. 2007 Apr 19. 8:36.
51. DiGiovanni BF, Nawoczenski DA, Lintal ME, et al. Tissue-specific plantar fascia-stretching exercise enhances outcomes in patients with chronic heel pain. A prospective, randomized study. *J Bone Joint Surg Am*. 2003 Jul. 85-A(7):1270-7.
52. Martin RL, Irrgang JJ, Conti SF. Outcome study of subjects with insertional plantar fasciitis. *Foot Ankle Int*. 1998 Dec. 19(12):803-11.
53. Young CC, Rutherford DS, Niedfeldt MW. Treatment of plantar fasciitis. *Am Fam Physician*. 2001 Feb 1. 63(3):467-74, 477-8.
54. Miyamoto W, Takao M, Uchio Y. Calcaneal osteotomy for the treatment of plantar fasciitis. *Arch Orthop Trauma Surg*. 2010 Feb. 130(2):151-4.

55. Tomczak RL, Haverstock BD. A retrospective comparison of endoscopic plantar fasciotomy to open plantar fasciotomy with heel spur resection for chronic plantar fasciitis/heel spur syndrome. *J Foot Ankle Surg*. 1995 May-Jun. 34(3):305-11.
56. Kinley S, Frascone S, Calderone D, Wertheimer SJ, Squire MA, Wiseman FA. Endoscopic plantar fasciotomy versus traditional open heel spur surgery: a prospective study. *J Foot Ankle Surg*. 1993. 32:595-603.
57. Malay DS, Pressman MM, Assili A, et al. Extracorporeal shockwave therapy versus placebo for the treatment of chronic proximal plantar fasciitis: results of a randomized, placebo-controlled, double-blinded, multicenter intervention trial. *J Foot Ankle Surg*. 2006 Jul-Aug. 45(4):196-210.
58. Daly PJ, Kitaoka HB, Chao EY. Plantar fasciotomy for intractable plantar fasciitis: clinical results and biomechanical evaluation. *Foot Ankle*. 1992 May. 13(4):188-95.
59. Leach RE, Seavey MS, Salter DK. Results of surgery in athletes with plantar fasciitis. *Foot Ankle*. 1986 Dec. 7(3):156-61.
60. Benton-Weil W, Borrelli AH, Weil LS Jr, Weil LS Sr. Percutaneous plantar fasciotomy: a minimally invasive procedure for recalcitrant plantar fasciitis. *J Foot Ankle Surg*. 1998 Jul-Aug. 37(4):269-72.
61. Sollitto RJ, Plotkin EL, Klein PG, Mullin P. Early clinical results of the use of radiofrequency lesioning in the treatment of plantar fasciitis. *J Foot Ankle Surg*. 1997 May-Jun. 36(3):215-9; discussion 256.
62. Conflitti JM, Tarquinio TA. Operative outcome of partial plantar fasciectomy and neurolysis to the nerve of the abductor digiti minimi muscle for recalcitrant plantar fasciitis. *Foot Ankle Int*. 2004 Jul. 25(7):482-7.
63. Jerosch J, Schunck J, Liebsch D, Filler T. Indication, surgical technique and results of endoscopic fascial release in plantar fasciitis (E FRPF). *Knee Surg Sports Traumatol Arthrosc*. 2004 Sep. 12(5):471-7.
64. Bazaz R, Ferkel RD. Results of endoscopic plantar fascia release. *Foot Ankle Int*. 2007 May. 28(5):549-56.
65. Sellman JR. Plantar fascia rupture associated with corticosteroid injection. *Foot Ankle Int*. 1994 Jul. 15(7):376-81.
66. Fallat LM, Cox JT, Chahal R, Morrison P, Kish J. A retrospective comparison of percutaneous plantar fasciotomy and open plantar fasciotomy with heel spur resection. *J Foot Ankle Surg*. 2013 May-Jun. 52(3):288-90.
67. Allen BH, Fallat LM, Schwartz SM. Cryosurgery: an innovative technique for the treatment of plantar fasciitis. *J Foot Ankle Surg*. 2007 Mar-Apr. 46(2):75-9.
68. Cavazos GJ, Khan KH, D'Antoni AV, Harkless LB, Lopez D. Cryosurgery for the treatment of heel pain. *Foot Ankle Int*. 2009 Jun. 30(6):500-5..
69. Sorensen MD, Hyer CF. *Bi-Polar Radiofrequency Microdebridement in the Treatment of Chronic Recalcitrant Plantar Fasciitis*. Presented at the American College of Foot & Ankle Surgeons Annual Meeting, 2009, Washington, D.C

Case Report

Dislocation of metacarpophalangeal joint of bilateral index finger: A case report

Mina D K, Nama K G, Gupta S

Investigation performed at Department of Orthopaedics MBS Hospital, Kota, Rajasthan, India

Abstract

Abstract: Occurrence of bilateral dislocation of metacarpophalangeal joint of index finger are very uncommon. Most of the dislocation are complex in nature and require surgical open reduction. The need for surgical reduction is primarily due to entrapment of fibrocartilaginous volar plate between proximal phalanx and metacarpal head. The dislocation can be approached by either volar or dorsal approach. We advocates dorsal approach because of its definitive advantage over volar approach like reduced neurovascular injury and direct exposure of volar plate.

Key word- Fibrocartilagenous volar plate, metacarpal, dorsal approach, Kaplan dislocation.

Address for Correspondence: Dr. shobhit gupta, 40,new jaihind nagar,Link road,police line, Kota, Rajasthan, India 324001

Email- drshobhitgupta@gmail.com

How to site this article: Mina D K, Nama K G, Gupta S. Dislocation of metacarpophalangeal joint of bilateral index finger: A case report. OrthopJMPC 2016;22(1): 41-43.

Introduction

In 1957**,** Kaplan[1], brought attention to the patho-anatomy of the complex dorsal dislocation of the metacarpophalangeal joint (MCP Joint) of the index finger and its management. Since then various authors reported this phenomenon in other digits like middle [2], ring, little fingers either as isolated or in combination. .

Dislocation can be either in volar or dorsal directions. 50% cases are complete and complex dislocations for which treatment of choice is open reduction. Complexity of dislocation is due to its unique anatomical event i.e. entrapment of fibro cartilaginous volar plate (detached from weakest point i.e. metacarpal neck) between metacarpal head and proximal phalangeal base. Other supporting anatomical structures which help in entrapment are lumbricals on radial side, flexor tendon and pretendinous band on ulnar side, natatary ligament with volar plate are on distal and dorsal to metacarpal head, superficial transverse ligament across metacarpal neck volar and proximally [1] Besides this lateral collateral ligaments, which are now abnormally displaced, locks the proximal phalanx in dorsal displaced position.

Case report

A 18 year old male, farmer, presented with mild pain and swelling over both hands around index finger's MCP joint with 1 week old history of fall on outstretched volar aspect of index finger.

On examination there was tenderness, swelling and mild extension at 2nd

metacarpophalangeal joint of both index fingers and these were slightly ulnar deviated. Bilaterally interphalangeal joints of index finger were flexed (Figure 1). Volarly there were bony bulge formed by the head of 2nd metacarpal head with puckering of skin dorsally bilaterally. Neurovascular status of both digits was normal.

X-ray of both hand AP and lateral was obtained and shows dorsal dislocation of proximal phalanx of index finger bilaterally.(Figure 2)

Figure 1: Clinical Photograph showing B/L Dislocated MCP Joint. Figure 2: Pre Op X ray both Hands. Figure 3: Post op X ray after reduction and K wire fixation.

After unsuccessful attempt of closed reduction, we planned for open reduction by dorsal approach.

Under all aseptic condition a 3 cm long straight skin incision was made on dorsum of 2nd metacarpophalangeal joint. . Extensor tendon with dorsal capsule was split longitudinally. With traction joint was distracted and volar plate identified carefully, which was main hurdle in reduction. It was longitudinally cut. With the division of volar plate the proximal phalanx was restored to its normal position and there was freedom of movement at 2 nd MCP joint. Under C-arm guidance the position of joint was confirmed and a k- wire placed in 30-degree flexion in MCP joint (Figure 3). There was avulsion of minute chip fragment from dorsal cortex with dorsal capsule, which was excised and dorsal capsule was repaired. Tourniquet was released and homeostasis achieved and the wound was closed in layers. .

The patient was given cock-up slab for 2 weeks, after which k- wire removed and active early range of motion exercise was begun using a removable 10 degree dorsal extension block splint. After 4 weeks, the splint was used only for protection and discontinued at 6 weeks. At 6 weeks follow up range of movement at metacarpophalangeal joint and both interphalangeal joints were normal

bilaterally. There was decreased grip strength i.e. 18kg on right and 16kg on left. Neurovascular evaluation was with in normal limits. X-rays confirmed maintenance of reduction. Patient return to full activity after 12 weeks.

Discussion

Kaplan et al [1] and Barry K et al [3] described a volar approach to complex MCP joint dislocations. This approach has certain disadvantages like risk of damaging the radial digital nerve of index finger during exposure[4], limited view of entrapped volar plate, extensive and unnecessary release of other supporting volar structures. Because of these demerits some authors like Becton et al [5] advocated dorsal approach, which has certain definitive advantages over volar approach. Like it is simple and easy, with less chance of damaging the radial nerve [3,4], accurate management of fractured osteochondral fragment of metacarpal head, there is complete exposure of fibro cartilaginous volar plate that is main structure blocking reduction.

There are few demerits of this approach like it is not possible to repair the volar plate which results delay in recovery and instability to the joint. Other offending structures like natatory ligament, lumbrical muscle, and superficial transverse ligament cannot be addressed with this approach.

Conclusion

The complex dorsal dislocation of MCP joint can be managed with dorsal as well as volar approach. The dorsal approach has advantage over the other as discussed above. Though, further clinical evaluation is to be done to assess the effectiveness of both methods.

References

1. Kaplan EB. Dorsal dislocation of the metacarpophalangeal joint of the index finger. J Bone Joint Surg Am. 1957; 39(5): 1081-86.
2. 2.. May JW Jr, Rohrich RJ, Sheppard J. Closed complex dorsal dislocation of the middle finger metacarpophalangeal joint: anatomic considerations and treatment. Plast .Reconstr Surg. 1988; 82(4):690-93.
3. Barry K, McGee H, Curtin J. Complex dislocation of the metacarpo-phalangeal joint of the index finger: a comparison of the surgical approaches. J Hand Surg Br. 1988;13(4):466-68.
4. Chadha M, Dhal A. Vulnerability of the radial digital neurovascular bundle of the index finger while using the Kaplan's volar approach for irreducible dislocation of the second metacarpophalangeal joint. Injury 2004; 35(11):1182-84.
5. Becton JL, Christian JD Jr, Goodwin HN, Jackson JG III. A simplified technique for treating the complex dislocation of the index metacarpophalangeal joint. J Bone Joint Surg Am. 1975;57(5):698-700.

Case Report

Unilateral flail chest with scapular winging treated with tension band wirings of ribs: A case report

Tanwar M, Kundu Z S, Vashisht G

Investigation performed at Department of Orthopaedics PGIMS Rohtak Haryana, India

Abstract

Tension band wiring is becoming increasingly popular method for stabilizing a flail chest resulting from multiple rib fractures. The indications for fixation of flail chest injuries remain controversial mostly because of a lack of adequate studies [1]. Recent guidelines recommend surgical stabilization of a flail chest based on consistent evidence of its efficacy and lack of major safety concerns. But complications of this procedure can occur and are wide ranging [2].

We report an interesting case of a patient who underwent fixation with tension band wiring for multiple unilateral rib fractures that successfully healed with good functional outcome.

Address for Correspondence: Dr. Z. S. Kundu; Professor, Department of Orthopaedics PGIMS Rohtak, Haryana, India;

Email: zskundu2003@rediffmail.com

How to site this article: Tanwar M, Kundu Z S, Vashisht G. Unilateral flail chest with scapular winging treated with tension band wirings of ribs: A case report. OrthopJMPC 2016;22(1): 44-46.

Introduction

Tension band wiring for flail chest is now commonly used method for stabilizing a flail chest resulting from multiple rib fractures over plating due to ease of technique and time salvage in emergent conditions. Studies have shown that when patients undergo open reduction with internal fixation (ORIF) of rib fractures they require shorter periods of ventilator support, which in turn reduces morbidity and mortality associated with mechanical ventilation, and reduces risk of contracting infections or septicaemia [4,5]. Complications of ORIF include fracture non-union, infection, pneumothorax, failure of fixation, and post-operative chest wall “rigidity” necessitating wire removal [6-11].

We report this case in view of its rare mode of injury and the life saving immediate fixations of ribs for better chest physiotherapy leading to excellent outcome in a young patient.

Case Report

A 38 year old male suffered cave-in injury and was excavated out of earth using an Earth mover where he suffered massive trauma to the left side of the chest in form of scapular winging and complete scapula-thoracic dissociation as one of the prong got pierced in the thoracic wall. The patient presented with complete lung contusion on the left side with complete tear of subscapularis, lattisimus dorsi, rhomboids and partial tear of the trapezius muscle. He had severe shortness of breath and alarming low oxygen saturation on presentation. X-ray showed fractures of four ribs from 3rd to 6th with flail chest (Figure:1).The patient was managed in the emergency care theatre while stabilizing vitals following the principles of Advanced

Trauma Life Saving (ATLS). The patient was revived from hypovolumic shock pre-operatively using crystalloids and blood component transfusion.

After stabilization he was operated under general anaesthesia with tension band wiring for multiple (3rd to 6th) unilateral rib fractures on left side (Figure:2). The wound was thoroughly washed and chest tube was inserted during the repair of the chest wall for pneumothorax and primary closure of the full thickness chest wall flap was done. The surgery was uneventful.

During the post-operative period the patient was unable to maintain adequate saturation for the first post-operative week. The patient improved with simultaneous intravenous antibiotics and regained saturation from 3rd to 6th week postoperatively and chest tube was removed with evidence of loss of column movement for 3 days during the second week post-operatively. There was associated patchy consolidation in the middle and upper lobe of the left lung (Figure:3) which completely resolved by 8th week. There was complete loss of long thoracic nerve function with no neuro-vascular deficit in the left upper limb. Nerve conduction velocity and electro-myographic studies showed normal latency for median, ulnar and radial nerves and a complete recruitment in flexor and extensor group of both arm and the forearm muscles on the 7th postoperative week.

Post-operative chest x-ray in the 16th week was normal and showed no signs of any consolidation (Figure:4). There was marked winging of the scapula on the left side with associated atrophy of the left shoulder. There was weakness in anterior elevation of the left upper limb. The EMG studies showed injury of the long thoracic nerve with no signs of re-innervation. In accordance with the general recommendations the patient started formal physical therapy at eight weeks after the operation. Physical therapy emphasized active range-of-motion exercises and strengthening of the rotator cuff and the trapezius. The ultimate outcome at one year was excellent and the patient is having full lung functions and no pain in the chest wall and shoulder.

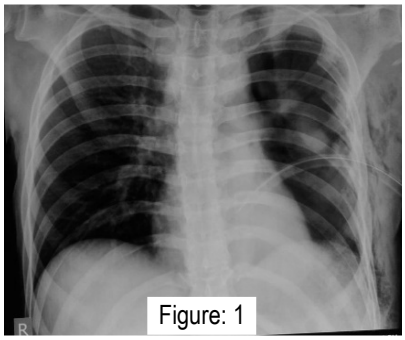
Figure: 1


Figure: 2


Figure: 3


Figure: 4

Discussion: Tension band wiring has been used for the fixation of rib fractures. Management of unilateral flail chest with associated long thoracic nerve injury with Tension Band Wiring has not been reported previously, to the best of our knowledge. It is difficult to prove if the nerve injury in our patient was an iatrogenic complication occurring during the surgical procedure or was present pre operatively, caused by the multiple rib fractures. The possibility that our patient's long thoracic nerve injury was caused by the trauma is supported by the severity of the injuries on the affected side, including the complete and partial tears of the musculature forming the chest wall. Long thoracic nerve injury is a well-known complication of chest wall trauma without any fractures and also with associated ipsilateral and bilateral rib fractures [12-14].

In contrast to these prior studies, to our knowledge, long thoracic nerve injury has not been described as the direct result of rib fracture open reduction internal fixation. One of the reason for importance of this case is to caution the surgeons about the paralysis of long thoracic nerve injury as a potential complication of ORIF which might be a result of direct injury to the chest wall. In either case the winging would most likely not be recognized pre-operatively because of the need of emergent resuscitation first and associated recumbence. The diagnosis is very likely to be missed and the exact aetiology is difficult to establish.

This type of injury should be treated immediately after stabilization of general condition by a team of general surgeon, orthopaedic surgeon and specialist anaesthetist in critical care.

Legends for figures

Fig-1.X-ray chest showing multiple rib fractures with lung opacities and chest wall in situ.

Fig-2.Per-operative photograph showing cerclage wires being used for rib fixations.

Fig-3. Immediate post-operative photograph with ribs fixed with wires with lung contusions.

Fig-4. . Post-operative X-ray showing full lung expansion at three months.

References

1. Fitzpatrick DC, Denard PJ, Phelan D, Long WB, Madey SM, Bottlang M. Operative stabilization of flail chest injuries: review of literature and fixation options. Eur J Trauma Emerg Surg 2010; 36:427–433.
2. John G, Skedrosa, Chad S, Mearsb, Tanner D. Langstonb, Don H. Van Boerumc,Thomas W. Whitec.Medial scapular winging associated with rib fractures and plating corrected with pectoralis major transfer.Int J Surg Case Rep 2014; 5: 750–753.
3. Albrecht F, Brug E. Stabilization of the flail chest with tension band wires of ribs and sternum (author's transl) Zentralbl Chir. 1979;104:770–776.
4. Nirula R, Allen B, Layman R, Falimirski ME, Somberg LB. Rib fracture stabilization in patients sustaining blunt chest injury. Am Surg 2006; 72: 307–9.
5. Althausen PL, Shannon S, Watts C, Thomas K, Bain MA, Coll D, et al. Early surgical stabilization of flail chest with locked plate fixation. J Orthop Trauma2011; 25:641–7.
6. Gardenbroek TJ, Bemelman M, Leenen LP. Pseudarthrosis of the ribs treated with a locking compression plate. A report of three cases. J Bone Joint Surg Am 2009; 91:1477–9.
7. Paris F, Tarazona V, Blasco E, Canto A, Casillas M, Pastor J, et al. Surgical stabilization of traumatic flail chest. Thorax 1975; 30: 521–7.
8. Lardinois D, Krueger T, Dusmet M, Ghisletta N, Gugger M, Ris HB. Pulmonary function testing after operative stabilisation of the chest wall for flail chest. Euro J Cardiothoracic Surg 2001;20:496–501.
9. Reber PU, Kniemeyer HW, Ris HB. Reconstruction plates for internal fixation of flail chest. Ann Thorac Surg 1998;66 :2158.
10. Hellberg K, de Vivie ER, Fuchs K, Heisig B, Ruschewski W, Luhr HG, et al. Stabilization of flail chest by compression osteosynthesis – experimental and clinical results. Thorac Cardiovasc Surg 1981; 29 :275–81.
11. Nirula R, Mayberry JC. Rib fracture fixation: controversies and technical challenges. Am Surg 2010;76:793–802.
12. Philadelphia: W.B.Saunders Company. Gregg JR, Labosky D, Harty M, Lotke P, Ecker M, DiStefano V, et al. Serratus anterior paralysis in the young athlete. J Bone Joint Surg Am 1979;61:825–32.
13. Foo CL, Swann M. Isolated paralysis of the serratus anterior. A report of 20 cases.J Bone Joint Surg Br 1983;65:552–6.
14. Rasyid HN, Nakajima T, Hamada K, Fukuda H. Winging of the scapula caused by disruption of "sterno-claviculoscapular linkage": report of 2 cases. J Shoulder Elbow Surg 2000; 9 :144–7.

Letter to Editor

Evaluation of role of antibiotic cement impregnated intramedullary nail in infected long bone fractures

Sharma P, Verma R, Gohiya A, Gaur S

Address for Correspondence: Dr Pulak Sharma
Assistant professor, Dept. Of Orthopaedics
GMC Bhopal, MP, India

Email: drpulaksharma@gmail.com

How to site this article: Sharma P, Verma R, Gohiya A, Gaur S. Evaluation of role of antibiotic cement impregnated intramedullary nail in infected long bone fractures - Letter to editor . OrthopJMPC 2016;22(1): 47-51.

Sir,

I read with interest the article by Mantri D et al.[1] titled as “Evaluation of role of antibiotic cement impregnated intramedullary nail in infected long bone fractures”. Infection has always been a dreaded complication in orthopaedic surgeries. Role of antibiotic cement impregnated nails promises to be a good treatment option for infection of long bones. We congratulate the authors for the wonderful effort that they have put in for this study.

However there are a few concerns that I would like to share.

The Author states that Ilizarov fixator and limb reconstruction system (LRS) do not address infection control. The primary indication of ilizarov external fixator is infected non-union of long bones. Combining with debridement and thorough irrigation of the wound it has been a very effective tool in controlling infection.[2] In cases with low grade infection it can be an effective modality even when used without debridement . Same principle applies to LRS.[3] These two (Illizarov & LRS) are the only treatment options in infected non-union when the bone defect is more than 2 cm.

1. Impact of Antibiotic coated nail in infection control is not clear.

The author has combined the use of debridement, reaming of the medullary cavity and irrigation with antibiotic solution along with the use of antibiotic impregnated nails. It may be possible that primary procedures were responsible for infection control and nail had little contribution to that. [4] A RCT between uncoated and coated nails along with these primary procedures might have been more useful in answering the question.

2. Wound was again irrigated thoroughly and closure performed if possible otherwise skin grafting done on same sitting or later depending on wound size.

The author says that the average time for infection control was 3.7 weeks. Active infection is considered as contraindication for skin grafting. [5] In how many cases did the author performed skin grafting in the same sitting and did they encounter any complication in that.

3. The authors have used K nails with antibiotic cement placed in the nail slot sparing the eyes.

Using a smaller size interlocking nail / K nail and coating it with antibiotic cement [6] might have been a better option as it would

have increased the surface area of contact with the bone and better delivery of antibiotic in the medullary cavity.

Reference

1. Mantri D, Soni SK, Sonkar DK. Evaluation of role of antibiotic cement impregnated intramedullary nail in infected long bone fractures. Orthopaedic Journal of M. P.Chapter 2015;21(2):36-9
2. Marsh DR, Shah S, Elliott J, Kurdy N. The Ilizarov method in nonunion, malunion and infection of fractures. J Bone Joint Surg [Br] 1997;79-B:273-9.
3. Hashmi MA, Ali A, Saleh M. Management of nonunion with monolateral external fixation. Injury. 2001; 32: 30–4
4. Cross WW, Swiontkowski MF. Treatment principles in the management of open fractures. Indian J Ortho .2008;42: 377–386.
5. Unal S, Ersoz G, Demirkan F, et al. Analysis of skin-graft loss due to infection: infection-related graft loss. Ann Plast Surg. 2005;55(1):102–106.
6. Shyam AK,Sancheti PK,Patel SK,Rocha S,Pradhan C,Patil A. Use of antibiotic cement impregnated intramedullary nail in treatment of infected non union of long bone .Indian J Orthop 2009;43:396-402

Author's Reply

Sir

Thanks for showing keen interest in our study [1] and raising the pertinent queries [2] . I have gone through all points of concern and my submission to them is as follows

1. We have stated that illizarov fixator and LRS system don't address infection per se because they don't have a local antibiotic delivery system. With use of these modalities infection is controlled by increased local vascular supply which encounters infection at the fracture site[3], while ACIINS has local antibiotic delivery system which primarily helps to control infection

2. Debridement and reaming alone are well known tools to control and eradicate infection, but the success rate was not that good that's why need for local antibiotic delivery system to combat bone infections evolved and that is well proven in the literature in the form of antibiotic cement beads and spacers

3. Wound closure was done depending on wound size and wound condition. Out of 5 STSG done 2 were done at same sitting and 3 done after 1 week

4. There are various ways the antibiotic cement coated nail can be prepared. We have used K Nail and we have given our explanation in point no 3 and 4 in original article under heading why K Nail used.

Reference

1. Mantri D, Soni SK, Sonkar DK. Evaluation of role of antibiotic cement impregnated intramedullary nail in infected long bone fractures. Orthopaedic Journal of M. P.Chapter 2015;21(2):36-9 .
2. Sharma P, Verma R, Gohiya A, Gaur S. Evaluation of role of antibiotic cement impregnated intramedullary nail in infected long bone fractures - Letter to editor . OrthopJMPC 2016;22(1): 44.
3. Marsh DR, Shah S, Elliott J, Kurdy N. The Ilizarov method in nonunion, malunion and infection of fractures. J Bone Joint Surg [Br] 1997;79-B:273-9.