

Original research article

Comparative assessment of the outcome of the two different treatment approaches in the management of acute scaphoid fractures

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Abstract

Aim: The aim of the present study was to evaluate the role of conservative vs operative treatment for acute scaphoid fractures.

Material and methods: This prospective observational study was carried out in the Department of Orthopaedics, Institute of Medical Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India from September 2015 to August 2016. Total 50 acute scaphoid fractures (<3 weeks) irrespective of the location and All scaphoid fractures as a part of other acute injuries like peri-lunate instabilities were included in this study. The clinical examinations consisted of three diagnostic tests: A. tenderness in the anatomical snuffbox (ASB); B. scaphoid tubercle tenderness (STT); and C. pain on longitudinal compression of the thumb (LTC). If any of these tests were positive, the patients were referred for a radiographic investigation of the wrist).

Results: A total of 50 cases of acute scaphoid fracture (≤ 3 weeks) were seen in during study period. The average age of presentation in our study was 37.5 years. Most common mode of injury was Road traffic accident. Other causes of injuries were sports injury, work place injuries, house hold injuries, assault injury. Most common location of fracture was waist fracture (19 cases-3 incomplete & 16 complete) followed by distal oblique fracture (7 cases). 34 patients were managed conservatively & 16 patients were treated with operative procedure (CRIF/ORIF WITHN K-Wire / Herbert screw). Mayo wrist score was calculated for all patients in follow up.

Conclusion: the choice of operative or nonoperative treatment must be individualized based on the discussion of pros and cons of treatment with the patient. Non-operative treatment has good results in case of acute, non-displaced stable fractures through the scaphoid waist and in distal pole without other bony or ligamentous injury and for scaphoid fractures in children.

Keywords: Acute scaphoid fracture, Treatment options

Introduction

Traditionally, undisplaced, stable scaphoid fractures are treated by casting in short- or long arm casts. Cast immobilization always involves prolonged immobilization of at least 12 weeks¹, but it has been demonstrated that union can be achieved in greater than 90% of

affected individuals with this method.² However, prolonged immobilization disrupts collagen homeostasis resulting in loss of normal connective tissue characteristics, which normally allow tendons to glide and the joint capsule to stretch.³ Clearly this management option can result in complications that may delay rehabilitation, as indicated by some studies in the literature that suggest poorer outcomes after prolonged immobilization.^{1,4} In theory, early internal fixation has the benefits of early return of wrist movement, a higher rate of union, an early return to work and sport, and avoidance of the need for a plaster cast.³ Although reports have shown that operative treatment is safe, effective and produces satisfactory results^{5,6}, the optimal management of undisplaced or minimally-displaced scaphoid fractures has been the focus of much debate.^{3,7} Recently, a few randomized controlled trials (RCTs) regarding operative versus non-operative treatment in the management of acute undisplaced or minimally-displaced scaphoid fractures have been published. However, the relatively small sample size (n = 25–88) in each published study rendered the results inconclusive and controversial. Recently, a meta-analysis of RCTs compared the effectiveness of surgical versus non-surgical treatment of acute undisplaced or minimally-displaced scaphoid fractures.⁸ Regrettably, a prospective controlled study⁹, which was confirmed by its corresponding author, was non-randomized, but was included and analyzed in the meta-analysis.⁸ Furthermore, sub-group analyses rather than independent analyses were used in the management of the data concerning complications, thereby making the conclusions questionable. Another pairwise and network meta-analysis of RCTs¹⁰, which only included data of complications, range of motion and grip strength, produced conclusions which were not comprehensive. In order to make a more precise estimation, we performed a meta-analysis based on RCTs. The aim of the present study was to evaluate the role of conservative vs operative treatment for acute scaphoid fractures.

Material and methods

This prospective observational study was carried out in the Department of Orthopaedics, Institute of Medical Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India from September 2015 to August 2016., after taking the approval of the protocol review committee and institutional ethics committee. Total 50 acute scaphoid fractures (<3 weeks) irrespective of the location and All scaphoid fractures as a part of other acute injuries like peri-lunate instabilities were included in this study.

Methodology

The clinical examinations consisted of three diagnostic tests: A. tenderness in the anatomical snuffbox (ASB); B. scaphoid tubercle tenderness (STT); and C. pain on longitudinal compression of the thumb (LTC). If any of these tests were positive, the patients were referred for a radiographic investigation of the wrist). The initial radiologic examination of the wrist included poster anterior, lateral view, scaphoid view, oblique (45 deg. Pronation) view of the wrist. If the radiology reveals no fracture, wrist was immobilized with below elbow slab & was instructed to review after 15 days. The same series of x-ray was repeated after 2 weeks. All patients were thoroughly counselled & instructed regarding participation in the study. If the patient accepted the invitation, they were enrolled in a prospective database, that included a patient questionnaire that sought information on sex, age, activity when the injury occurred (sport, traffic, work, or other), type of injury (fall, blow, or other), patho-mechanism (extension, flexion, or other), and high-energy trauma (defined as a fall from > 1 m of height), nature of previous treatment received & past medical history etc. The pre-operative radiograph, range of motion, intra operative photographs, immediate post-operative radiographs, range of motion & X-Ray in subsequent follow up were collected.

In case of a clinically suspected scaphoid fracture without radiological signs of a fracture, early functional treatment was started using a below elbow slab. Patients with persistent clinical suspicion of a scaphoid fracture are repeated radiological evaluation after 2 weeks of the trauma to evaluate the current treatment strategy and to potentially adjust the treatment strategy as a result based on the radiographic findings. Displaced fracture is the one with >2 mm gap at fracture site. Several authors have reported that scaphoid fractures not visible on initial x-ray films are “incomplete” or otherwise minor and will heal regardless of treatment. We advised for primary rigid fixation for all acute scaphoid fractures with consent of the patient. Those patients who were not agreed for operative procedure were managed with scaphoid cast (below elbow POP thumb- spica cast in glass holding manner sparing the IP joint of thumb with thumb in palmar abduction and the wrist in neutral or slight extension). Post operatively, a posterior POP cast was used to support the wrist for the first two weeks and then, after the removal of sutures, limb was immobilized for 4 weeks in case of fresh fractures & for 6 weeks in case of non-unions. After 6 weeks removable splint was applied for 6 weeks & supervised physiotherapy was started gradually. Up to 12 weeks after surgery, patients were advised to avoid fullloading of the wrist and to refrain from contact sports. All patients were asked to attend for routine review at two and six weeks, three months, 6 month and one-year, additional visits being scheduled as required. Standard Scaphoid series radiographs were taken at each visit and a full clinical assessment was recorded. Modified MAYO Wrist score was used to assess functional out-come of individual patient after treatment. Radiological results were more rigorously defined: fractures were recorded as united, only if cross- trabeculation was present and the fracture line was no longer visible on any of the four standard views.

Results

A total of 50 cases of acute scaphoid fracture (≤ 3 weeks) were seen in during study period. The average age of presentation in our study was 37.5 years. The average delay in presentation was 1 week. This may be due to the fact that Scaphoid fracture is usually missed in initial standard AP & Lateral X-Ray following an acute wrist injury or may be due to negligence of Patients in seeking medical consultation or both. Most common mode of injury was Road traffic accident. Other causes of injuries were sports injury, work place injuries, house hold injuries, assault injury.

Most common location of fracture was waist fracture (19 cases-3 incomplete & 16 complete) followed by distal oblique fracture (7 cases). 34 patients were managed conservatively & 16 patients were treated with operative procedure (CRIF/ORIF WITHN K-Wire / Herbert screw). Mayo wrist score was calculated for all patients in follow up. Mean follow up period was 12 months. Out of 34 patients managed conservatively 9 patients had poor results (<65), 3 patient had fair results (65-79), 14 patients had good results (80-89), 8 patients had excellent results (≥ 90). In patients managed operatively poor results was obtained in 2 patient, fair result was obtained in 3 patients, good result was there in 5 cases & excellent result was obtained in 6 cases.

All fractures managed by operative procedure (ORIF/per cut. Screw or k-wire fixation) united eventually. But there were 8 cases of non-union with conservative management.

Table 1: Gender distribution of patients

	Right	Left	Total
Male	17(34%)	19(38%)	36(72%)
Female	9(18%)	5(10%)	14(28%)
Total	26(52%)	24(48%)	50

Table 2: Distribution of patients with Herbert classification

Herbert Classification	Male=36	Female=14	Total
A1	6	0	6
A2	4	3	7
B1	5	6	11
B2	12	2	14
B3	5	3	8
B4	4	0	4

Table 3: Distribution of patients in conservative and Operative methods

	Poor	Fair	Good	Excellent	Total
Conservative	9	3	14	8	34
Operative	2	3	5	6	16
Total	11	6	19	14	50

Table 4: Union and non-union distribution

	Conservative	Operative	Total
Union	26	16	42
Non-union	8	0	8
Total	34	16	50
% Age of non-union	23.53%	0%	



Patient presenting with displaced waist fracture managed conservatively

Discussion

Scaphoid fracture is a dilemma in orthopaedics owing to its delay in diagnosis (as in first presentation of pain in wrist joint, most often X-Ray of wrist in AP & Lateral position are prescribed in which the fracture is often not seen), the controversial classification system and never-ending debate on appropriate treatment protocol.

The incidence of scaphoid fractures quoted in different literatures ranges from 1.47 to 121 per 100,000 of the population per year and is one of the key areas of discrepancy in the scaphoid fracture literature. This is likely due to the retrospective nature of many studies, low capture rates, small population sample sizes, the lack of a defined captive population, and the limitation of many databases in their ability to distinguish between a true and suspected

fracture. The average age of presentation in our study was 37.5 years (17-71yrs). Most common age group involved was 30-40 years (32%). The trend tends to be decreased with extremities of age distribution. In a review study conducted by Duckworth et al,¹¹ Low-energy falls from a standing height were most common (40.4%) cause of scaphoid fracture. Contact sports comprised the next largest group (n=35, 23.5%), with football injuries being the most common (n=24, 68.5%).

The classical clinical tests described for patients with post traumatic radial wrist pain anatomical snuffbox tenderness, scaphoid tubercle tenderness and pain at longitudinal compression of the thumb & combinely, they have better specificity & sensitivity (97,98). Singh & Dias¹² described ASB tenderness, Effusion in USG, Scaphoid tubercle tenderness & Scaphoid compression test for diagnosing scaphoid fracture. Chen¹³ has described the Scaphoid Compression Test, which is intended to discriminate scaphoid fracture from other causes of snuffbox tenderness. In his series of 52 traumatized wrists with snuffbox tenderness, he reports very high sensitivity and specificity of this test for scaphoid fracture. Others have not found such high specificity. The test is, at least, sensitive for fracture on the radial side of the wrist and thus provides an aid to diagnosis. The absence of scaphoid tubercle tenderness makes a diagnosis of scaphoid fracture unlikely. The absence of snuffbox and scaphoid tubercle tenderness virtually excludes a diagnosis of scaphoid fracture. We too allocated the patients depending on these initial three clinical tests at the time when the patient attended the Emergency Department/OPD. Most common location of fracture reported by us was waist followed by distal oblique. Leslie & Dickson¹⁴ also reported similar results. First-line of radiologic investigation in patients with a suspected scaphoid fracture is wrist radiographs which are described to be good at ruling out a fracture (high specificity).^{15,16} All our patients had four scaphoid views {PA, Lateral, Scaphoid view & Oblique (45 deg. Pronation) view} In addition to the standard PA and lateral radiographs used in the diagnosis of a scaphoid fracture, the additional views described in different literatures are the radial oblique view (proximal pole fractures), the ulnar oblique view (waist and tubercle fractures), and Ziter's view (waist fractures). Duckworth et al¹¹ acknowledged that there is an intra- and interobserver error associated with interpreting the radiographs for the presence of a fracture, and classifying according to the Herbert classification, although this unavoidable.

Bohler et al.¹⁸ & Clay et al.¹⁷ demonstrated that leaving the thumb free clearly allows patients greater hand function. Thus, we used a below elbow POP thumb-spica cast in glass holding manner sparing the IP joint of thumb with thumb in palmar abduction and the wrist in neutral or slight extension for patients managed conservatively.

Schubert opined that immobilization in the cast should continue until there are clinical and radiographic signs of bony union. These signs are absence of tenderness, appearance on x-ray films of bony trabeculae crossing the fracture line, a sclerotic band at the fracture site, or cortical continuity. The time varies directly with patients' age.

It is a common belief that the majority of scaphoid fractures will unite when treated in a cast for sufficient time.¹⁸⁻²² The average age of presentation in our study was 37.5 years. As most of the patients were active persons, the traditional treatment in a cast for several months may have inherent compliance problems, a substantial impact on daily living and a socioeconomic burden for society. Mink van der Molen et al. reported the time off work in carpal injuries to be 155 days in a cohort of 447 patients treated conservatively (98%). Most patients were young men with manual work.²³ The development of minimal invasive techniques in combination with an increasing demand from professional athletes of a quick functional recovery has evolved wrist surgeons globally toward offering percutaneous screw fixation of even un-displaced waist fractures to avoid plaster immobilization.^{24,25}

Operative treatment for scaphoid fracture ensures two advantages.²⁶⁻²⁸ Firstly, patients will have an immediate fracture stabilization which is beneficial for healing and which allows for early return to normal activity. Secondly, preoperative assessment is insufficient for diagnosing the true nature of the fracture. Displacement and instability that are strongly associated with poor outcome are most safely diagnosed in the operating theatre.

S. L. Filan, T. J. Herbert²⁹ in 1996 stated in his review that apart from the one case of screw protrusion, they do not attribute any late non-unions to failure of fixation. Several of our patients sustained further injuries to their wrist within three months of surgery, but in none of these was outcome affected adversely. They therefore questioned the relevance of recent work which has compared the mechanical properties of different fixation devices in cadaver or foam model scaphoids. Their review has shown that a correctly inserted Herbert screw provides adequate fixation to allow early movement. While the same may be true for other devices, they believed that the challenge for the future is to secure adequate fixation with the least possible trauma to the bone and the surrounding joints and soft tissues.

Davis et al.³⁰ calculated that open reduction and internal fixation would be cost saving compared to casting from a societal perspective. They also found that the late consequences in the form of secondary arthritis were actually less in the operated group than in the conservatively treated group. In this study 34 patients were managed conservatively & 16 patients were treated with operative procedure (CRIF/ORIF WITH K-Wire / Herbert screw). Mayo wrist score was calculated for all patients in follow up. Mean follow up period was 12 months. Out of 34 patients managed conservatively 9 patients had poor results (<65), 3 patient had fair results (65-79), 14 patients had good results (80-89), 8 patients had excellent results (>=90). In patients managed operatively poor results was obtained in 2 patient, fair result was obtained in 3 patients, good result was there in 5 cases & excellent result was obtained in 6 cases. In a Swiss study Fusseti et al.³¹ reported that 34% of the individuals treated conservatively could resume work with the wrist immobilized in a cast. Furthermore, Papaloizos et al.³² reported that operative treatment using a minimally invasive technique was initially more expensive than conservative treatment, but markedly decreased the work compensation cost and was less expensive overall compared to treatment in plaster.

In randomized clinical trials comparing the conservatively and surgically treated patients Bond and Sadden with co-workers found a significantly shorter period of sick leave in patients treated by percutaneous osteosynthesis. Differences in grip strength compared to the uninjured wrist between both groups were statistically insignificant with a better outcome in the surgically treated patients. Adolfson³³ reported 13% mean loss of range of wrist motion in the conservatively treated group and 6% in the operated group.

Our results confirm that internal fixation leads to better functional results & union of fracture than conservative treatment. We found more complain-free patients in the surgically treated group and less patients with resting pain and pain during sports and physical activities at the time of check-up which signifies a marked improvement in functional status with operative management.

The only disadvantage of Herbert screw fixation encountered by us was its technical difficulty. The operation requires skill and practice, poor surgery leads to poor results. While doing per-cutaneous fixation, with the wrist in neutral position, the trapezium blocks the scaphoid bone. Thus, we prefer to give a small longitudinal incision (\approx 1 cm, or just long enough to accommodate the drill bit / guide wire) just distal to the scaphoid tubercle. The wrist is hyperextended and ulnarly deviated over a bump. This moves the trapezium dorsally away from the entrance point on the scaphoid bone. Another disadvantage was un-availability of different size of screw specially for proximal 3rd fracture for which 3.8 mm screw is larger. It would have been good to use a 2.7 mm screw. The average delay in presentation in this study was 1 week. Delay in seeking medical treatment is one of the risk factors for non-

union. Also, patient compliance with cast immobilization is one of the important determinants of success of treatment procedure. We did not compare the time to union in the conservatively and surgically treated patients because, we did not perform CT examination routinely for all patients at the time of follow up evaluation. This was, along with a small sample, the main limitation of our study.

Conclusion

We conclude that the choice of operative or nonoperative treatment must be individualized based on the discussion of pros and cons of treatment with the patient. Non-operative treatment has good results in case of acute, non-displaced stable fractures through the scaphoid waist and in distal pole without other bony or ligamentous injury and for scaphoid fractures in children. We recommend below elbow POP thumb-spica cast in glass holding manner sparing the IP joint of thumb with thumb in palmar abduction and the wrist in neutral or slight extension.

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