

Incidence and Characteristics of Scaphoid Fractures in the Adult Population of D.I.Khan, Pakistan

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Abstract:

Background: Scaphoid fractures pose significant challenges due to their unique anatomical characteristics and potential complications. This study aims to investigate the incidence and characteristics of scaphoid fractures in the adult population of D.I.Khan, Pakistan.

Objective: To determine the incidence and characteristics of scaphoid fractures in the adult population of D.I.Khan, Pakistan.

Material and Method: This cross-sectional study was conducted at Department of Orthopedics, DHQ Teaching Hospital, D.I.Khan, Pakistan from January 2022 to December 2023. Sample size was 63. All adult patients (17-50 years old) with scaphoid fractures were included, excluding old fractures (duration >1 year), open or associated with other injuries. Demographic variables were gender, age groups and presentation time. Research variables were mechanism of injury, laterality, site, treatment modalities, union time and presence of infection.

Results: Out of 63 scaphoid fractures, the prevalence was higher in males 54(85.7%), age group 17-30 years 39(61.9%), presentation time in ≤1 week 30(47.6%), mechanism of injury as fall on outstretched hand 42(66.7%), laterality as right hand 45(71.4%), site of fracture as waist 39(61.9%), treatment modalities as ORIF with dorsal approach 23(36.5%).

Conclusion: Early recognition, accurate diagnosis, and tailored management approaches are necessary for optimal care to prevent long-term complication of scaphoid fractures which are common in younger males, mostly caused by fall on outstretched hand, and mostly involve right and wrist. Significant number of cases requires open reduction and internal fixation. Union is achieved mostly in 3-6 months.

KEY WORDS: Scaphoid; Incidence; Characteristics; Mechanism.

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Introduction:

Scaphoid bone's unique anatomical position in proximal row of wrist carpal bones and function of movements make it particularly susceptible to injury, often resulting from falls onto an outstretched hand or direct trauma to the wrist.¹ Pain and swelling at the base of the thumb in the anatomic snuffbox being the most frequently reported symptoms of scaphoid fractures while complications, such as SSI, nonunion, avascular necrosis, post-traumatic arthritis, noted

in a minority

of cases.² Operative management of the scaphoid fracture is primarily determined by the fracture location and amount of displacement. Currently, first-line treatment for scaphoid nonunion with or without humpback deformity and cyst formation involves dual screws fixation without graft.³ United States National Trauma Data Bank (NTDB) reported 286 scaphoid fractures per 100,000 person-years for 2016.⁴

Suspected scaphoid fractures are challenging although advancements regarding these injuries. The risks and

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restrictions of routine immobilization as well as nonunion are associated with a missed fracture.⁵ A clinical suspected scaphoid fracture without signs of fracture on radiographs should have a supplementary MRI done within 5-7 days. Displaced fractures (≥ 1.5 mm) and majority of proximal scaphoid fractures should be treated surgically with internal fixation.⁶ Scaphoid waist fractures can occur with low-energy trauma and lead to mild symptoms. Non displaced fractures can heal with non-operative conservative treatment, but require prolonged immobilization.⁷ Arthroscopic bone grafting allows for restoration of the scaphoid alignment and accurate placement of implants into the scaphoid nonunion site regardless of the vascularity of the proximal pole fragment within a single-attempt using a robotic navigation system.⁸ Scaphoid fractures are more common than all other carpal bones.⁹ numerous studies have investigated scaphoid fractures in various populations where characteristics vary while limited research exists on their incidence and characteristics specifically in D.I.Khan, Pakistan. Understanding the features of scaphoid fractures in this region is crucial for optimizing patient care and implementing preventive measures. Keeping these in mind, the present study was designed with the objectives to determine the incidence and characteristics of scaphoid fractures in the adult population of D.I.Khan, Pakistan.

Material and Methods:

This cross-sectional study was conducted at Department of Orthopedics, DHQ Teaching Hospital, D.I.Khan, Pakistan from January 1st, 2022 to December 31st, 2023. Sample size was calculated as 63 using Raosoft taking 10.37% margin of error, 90% confidence level and 50% response distribution.¹⁰ Consecutive sampling technique was used. In bilateral cases, one hand was excluded with total 63 fractures selected to have same size for patients and hands.

Inclusion Criteria

All adult patients with scaphoid fractures

- Both genders
- Age 17-50 years

Exclusion Criteria

Patients having

- Old scaphoid fractures with duration more than 1 year
- Open fractures
- Fractures associated with other injuries

After initial workup of detailed history and examination, x-rays of anteroposterior, lateral & scaphoid views were taken. Treatment was planned and categorizations were done accordingly. Early active motion and early return to work were the aim in treatment regimens. Conservative management with casting for 2-3 months done in undisplaced and fresh non-dominant hand fractures. Routine protocol was undertaken for surgical cases. Percutaneous screw fixation was done for fresh fractures (<2 weeks). Fractures older than two weeks were operated through open reduction and internal fixation (ORIF) with either dorsal approach (Proximal pole fractures) or palmar approach with stable screw fixation and bone grafting (Late presenting & displaced waist fractures). Follow-up with radiograph was done weekly in 1st month, then fortnightly for next two months and monthly afterward till fracture union was achieved. Demographic variables (attributes) were; gender

(men & women), age groups (17-30 & 31-50 years) and presentation time in weeks (≤ 1 , >1-4, >4-12, >12-24 & >24). Research variables (attributes) were; mechanism of injury (fall on out-stretched hand & RTA), laterality (right, left & bilateral), site (waist, proximal pole & distal pole), treatment modalities (closed management with casting, percutaneous screw fixation, ORIF with palmar approach & ORIF with dorsal approach), union time in months (0-3, >3-4, >4-5, >5-6 & >6) and surgical site infection (yes & no). All categorical variables were analyzed by count & percentages for the sample and 90% CI for proportion for the population using Wilson score interval.¹¹ Comparisons were based on overlapping of results with CIs. All data was analyzed using SPSS version 29.

Results:

Out of 63 scaphoid fractures, the prevalence in male was 54(85.7%), female 9(14.3%), age group 17-30 years 39(61.9%), 31-50 years 24(38.1%), and prevalence of presentation time in ≤ 1 week was 30(47.6%), >1-4 weeks 20(31.7%), >4-12 weeks 7(11.1%), >12-24 weeks 4(6.4%) & >24 weeks 2(3.2%) as shown in table 3.1.

Table 3.1: Demographic profile of patients with scaphoid fractures in adult population of D.I.Khan, Pakistan (n=63)

Demographic variable	Attributes	Sample statistics		90 % CI of proportion	
		Frequency	Percentage	Lower	Upper
Gender	Male	54	85.7	76.99	92.34
	Female	09	14.3	08.50	23.01
Age groups (years)	17-30	39	61.9	51.55	71.28
	31-50	24	38.1	28.72	48.45
Presentation time	≤ 1 week	30	47.6	37.58	57.85
	>1-4 weeks	20	31.7	23.02	41.97
	>4-12 weeks	07	11.1	04.59	17.62
	>12-24 weeks	04	6.4	02.88	13.41
	>24 weeks	02	3.2	01.05	09.14
Total		63	100%	Population parameters	

The prevalence of mechanism of injury as fall on outstretched hand was 42(66.7%) and RTA 21(33.3%). The prevalence for laterality was right hand 45(71.4%), left hand 15(23.8%) and bilateral hands 3(4.8%). The prevalence for site of fracture was waist 39(61.9%), proximal pole

17(27.0%) and distal pole 7(11.1%). The prevalence for treatment modalities was casting 10(15.9%), percutaneous screw fixation 12(19.0%), ORIF with palmar approach 18(28.6%) and ORIF with dorsal approach 23(36.5%) as shown in table 3.2.

A study in Jordan by Almgidat, et al.¹² among 64 scaphoid fracture showed results for males 62(96.9%) higher than our study. A study similar to us in China by Shanlin, et al.¹³ among 363 scaphoid fracture patients showed results in males 332(91.4%), in England by Dias, et al.¹⁴ among 408 participants showed results in males 363(88.9%), in Texas

Table 3.2: Clinical profile of patients with scaphoid fractures in adult population of D.I.Khan, Pakistan (n=63)

Research variable	Attributes	Sample statistics		90 % CI of proportion	
		Frequency	Percentage	Lower	Upper
Mechanism of injury	Fall on out-stretched hand	42	66.7	56.39	75.57
	RTA	21	33.3	24.43	43.61
Laterality	Right hand	45	71.4	61.34	79.76
	Left hand	15	23.8	16.18	33.60
	Bilateral	03	4.8	01.91	11.33
Site of fracture	Waist	39	61.9	51.55	71.28
	Proximal pole	17	27.0	18.87	36.99
	Distal pole	07	11.1	06.13	19.29
Treatment modalities	Casting	10	15.9	09.73	24.83
	Percutaneous screw fixation	12	19.0	12.25	28.39
	ORIF through PA	18	28.6	20.24	38.66
	ORIF through DA	23	36.5	27.28	46.85
Union time	0-3 months	10	15.9	09.73	24.83
	> 3-4 months	20	31.7	23.02	41.97
	> 4-5 months	15	23.8	16.18	33.60
	> 5-6 months	12	19.1	12.25	28.39
	> 6 months	06	9.5	05.01	17.38
SSI	Yes	02	3.2	01.05	09.14
	No	61	96.8	90.85	98.94
Total		63	100%	Population parameters	

RTA = road traffic accident, ORIF= open reduction and internal fixation, PA= palmar approach, DA= dorsal approach, SSI= surgical site infection. The prevalence for union time in 0-3 months was 10(15.9%), >3-4 months 20(31.7%), >4-5 months 15(23.8%), >5-6 months 12(19.1%) and >6 months was 6(9.5%). The frequency of surgical site infection (SSI) was 2(3.2%) as shown in table 3.2.

Discussion:

Scaphoid fractures by gender: Our study showed that the prevalence of scaphoid fractures in male 54(85.7%, 90% CI 76.99-92.34) was higher than female 9(14.3%, 90% CI 8.50-23.01).

by Prabhakar, et al.¹⁵ among 48 patients showed results in males 42(87.5%) and by Khan, et al.¹⁶ in D.I.Khan, Pakistan among 40 patients showed results in males 34 (85%) similar to our study. A study in United States (NTDB) by Wells, et al.⁴ among 903 reported scaphoid fractures showed results in males 672(74.4%), in Brazil by Nogueira, et al.¹⁷ among 23 patients showed males 17(73.9%) and in United Kingdom by Stirling, et al.¹⁸ among 221 patients showed males 99(45%) lower than our study. Scaphoid fractures by age groups: Our study showed that the prevalence of scaphoid fractures is similar in age group 17-30 years 39(61.9%, 90% CI 51.55-71.28) and 31-50 years 24(38.1%, 90% CI 28.72-

48.45). A study by Almgid, et al. (n=64) showed higher results for age group 25-40 years 47(73.4%) than our study. A study similar to us by Khan, et al. (n=4) showed 24(60%) in 17-30 years age group similar to our study. A study by Wells, et al. (n=903) showed results in age group 18-30 years 335(37.1%) lower than our study. Scaphoid fractures by presentation time: In our study, the prevalence of time to presentation was similar in groups ≤ 1 week 30(47.6%, 90% CI 37.58-57.85) and $>1-4$ weeks 20(31.7%, 90% CI 23.02-41.97). It was also similar in the other three groups i.e. $>4-12$ weeks 7(11.1%, 90% CI 4.59-17.62), $>12-24$ weeks 4(6.4%,

90% CI 2.88-13.41) and >24 weeks 2(3.2%, 90% CI 1.05-9.14). However, it was higher for the first two groups individually than the last three groups and highest in group ≤ 1 week.

A study similar to us by Khan, et al. (n=40) showed time to presentation ≤ 1 week in 19(47.5%) similar to our study.

In comparison to our study, a study by Shanlin, et al. (n=363) showed 194(53.4%) patients not seek medical treatment within 1 month and 121(33.3%) patients presented for medical treatment more than 6 months after the injury.

Scaphoid fractures by mechanism of injury: In our study, the prevalence for mechanism of injury as fall on out-stretched hand 42(66.7%, 90% CI 56.39-75.57) was higher than RTA 21(33.3%, 90% CI 24.43-43.61).

A study similar to us by Khan, et al. (n=40) showed results for fall on out-stretched hand in 27 (67.5%) patients similar to our study.

In comparison to our study, a study by Wells, et al. (n=903) showed results for fall 306(33.8%) and Shanlin, et al. (n=363) showed results for fall 154(42.4%) lower than our study.

Scaphoid fractures by laterality: In our study, the prevalence was highest for right hand 45(71.4%, 90% CI 61.34-79.76) than left hand 15(23.8%, 90% CI 16.18-33.60) and bilateral hands 3(4.8%, 90% CI 1.91-11.33).

A study similar to us by Khan, et al. among 40 patients showed results for right hand 29(72.5%) similar to our study.

In comparison to our study, a study by Nogueira, et al. among 23 patients showed 13(56.5%) fractures occurred on the right side which are lower than our study.

Scaphoid fractures by site of fracture: In our study, the prevalence for site of fracture was higher for waist 39(61.9%, 90% CI 51.55-71.28) than proximal pole 17(27.0%, 90% CI 18.87-36.99) and distal pole 7(11.1%, 90% CI 6.13-19.29).

A study by Prabhakar, et al. among 48 patients showed waist fracture in 41(85%) higher than our study.

A study similar to us by Almgid, et al. among 64 patients showed scaphoid waist fracture 40(52.5%) was the most common location, by Shanlin, et al. among 363 patients showed waist fractures 280(76.5%) and distal pole fractures 41(11.2%), and by Khan, et al. among 40 patients showed results for site of fracture as waist in 24(60%), proximal pole 11(27.5%) and distal pole 5(12.5%) cases similar to our study.

Scaphoid fractures by treatment modalities: Open reduction and internal fixation (ORIF) through dorsal approach in 23(36.5%, 90% CI 27.28-46.85) cases was the most common treatment option employed. The other three procedures ORIF through palmar approach 18(28.6%, 90% CI 20.24-38.66), close management with casting 10(15.9%, 90% CI 9.73-24.83) and percutaneous screw fixation 12(19.0%, 90% CI 12.25-28.39) had similar prevalence.

A study similar to us by Khan, et al. (n= 40) showed conservative treatment in 7 (17.50%) patients, percutaneous screw fixation 7 (17.50%), open reduction and internal

fixation through palmar in 11 (27.50%) and through dorsal 15 (37.50%) cases.

In comparison to our study, a study by Almgid, et al. (n=64) showed 47(73.4%) patients received conservative treatment, by Dias, et al. (n=408) showed 205(50.2%) received cast immobilization, by Zhao, et al. 19 among 132 patients with scaphoid fracture reported surgical management in 67(50.8%) & conservative treatment in 65(49.2%) and by Nogueira, et al. (n=23) showed locked volar plate 13(56%) as mostly used treatment option.

Scaphoid fractures by union time: The prevalence for union time in $>3-4$ months category 20(31.7%, 90% CI 23.02-41.97) was highest than 0-3 months 10(15.9%, 90% CI 9.73-24.83), $>4-5$ months 15(23.8%, 90% CI 16.18-33.60), $>5-6$ months 12(19.1%, 90% CI 12.25-28.39) and >6 months 6(9.5%, 90% CI 5.01-17.38)

A study similar to us by Khan, et al among 40 patients showed time to union ≤ 3 months 7(17.50%), $>3-4$ months 11(27.5%), $>4-5$ months 10(25%) while $>5-6$ months 8(20%) patients. Non or minimally displaced waist scaphoid fractures were given six week cast by Clementson, et al. and he reported screw fixation compared with cast treatment does not reduce time to fracture union.

Scaphoid fractures by SSI: In our study, the frequency of surgical site infection (SSI) was 2(3.2%, 90% CI 1.05-9.14). A study similar to us by Khan, et al. (n=40) showed presence of infection in 1(2.38%) similar to our study. In comparison to our study, a study by Shanlin, et al. (n=363) showed 2(0.05%) complicated cases, by Almgid, et al. (n=64) showed nonunion complications in 53(82.8%), by Prabhakar, et al. (n=48) showed 16 nonunion, and by Dias, et al. (n=408) showed surgical and cast-related complications in 74(18.3%).

Conclusion:

Fracture characteristics and patient compliance are important factors of scaphoid fractures influencing outcomes. Early recognition, accurate diagnosis, and tailored management approaches are necessary for optimal care to prevent long-term complications. Scaphoid fractures are mostly caused by fall on outstretched hand presenting within a week of injury, mostly involve right hand and waist. Common in younger males. Significant number of cases requires open reduction and internal fixation. Union is achieved mostly in 3-6 months.

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Conflicts of Interest: No

References:

1. Scaphoid Bone. Structure, function and clinical significance. Available at: <https://www.wikipedia.org/wiki/Scaphoid-bone>
2. Hayat Z, Varacallo M. Scaphoid Wrist Fracture. Treasure Island (FL): StatPearls Publishing; 2024. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK536907>.
3. Gray RRL, Halpern AL, King SR, Anderson JE. Scaphoid fracture and nonunion: new directions. *J Hand Surg Eur.* 2023 Sep;48(2):4S10S. doi:10.1177/17531934231165419.
4. Wells ME, Nicholson TC, Macias RA, Nesti LJ, Dunn JC. Incidence of Scaphoid Fractures and Associated Injuries at US Trauma Centers. *J Wrist Surg.* 2021 Apr;10(2):123-128. doi: 10.1055/s-0040-1720963.
5. Stirling, Paul HC, Strelzow, Jason A, Doornberg, Job N, Timothy O, Margaret M, Andrew D. Diagnosis of

- Suspected Scaphoid Fractures. *JBJS Reviews*. 2021 Dec;9(12):e20.00247 doi:10.2106/JBJS.RVW.20.00247.
6. Clementson M, Bjorkman A, Thomsen NOB. Acute scaphoid fractures: guidelines for diagnosis and treatment. *EFORT open reviews*. 2020;5(2):96–103. doi:10.1302/2058-5241.5.190025.
 7. Hughes TB. Acute Scaphoid Waist Fracture in the Athlete. *Clin Sports Med*. 2020 Apr;39(2):339-351. doi:10.1016/j.csm.2019.12.007.
 8. Chen S, Yi Z, Lim RQR, Chen W, Zhu J, Liu B. Arthroscopic Bone Grafting and Robot-assisted Fixation for Scaphoid Nonunion. *Orthopedic Surgery*. 2024 Jan;16(1):254-262. doi:10.1111/os.13930.
 9. Sabbagh T, Morsy M, Moran SL. Diagnosis and management of acute scaphoid fractures. *Hand Clinics* 2019; 35 (3):259-69. <https://doi.org/10.1016/j.hcl.2019.03.002>.
 11. Raosoft® online sample size calculator. Raosoft Inc., Seattle, Washington 2004. [accessed 2024 Mar 16]. Available at: www.raosoft.com/samplesize.html
 12. Statistics Kingdom. Proportion confidence interval calculator. Statistics Kingdom; Melbourne, Australia 2007. [accessed 2024 Mar 16]. Available at: https://www.statskingdom.com/41proportion_confidenceinterval.html.
 13. Almqdad A, Al-Zoubi A, Mustafa A, Al-Qasaimeh M, Azzam E, Mestarihi S, Khair Y, Almanasier G. A review of scaphoid fracture, treatment outcomes, and consequences. *IntOrthop*. 2024 Feb;48(2):529-536. doi:10.1007/s00264-023-06014-2.
 14. Shanlin C, Yin Y, Xu K, Zhang N, Yi Z, Liu B. Clinical and Epidemiological Features of Scaphoid Fracture Nonunion: A Hospital-Based Study in Beijing, China. *Orthopaedic Surgery*. 2022 Aug;14(10):2455–2461. doi:10.1111/os.13478.
 15. Dias JJ, Brealey SD, Fairhurst C, Amirfeyz R, Bhowal B, Blewitt N, et al. Surgery versus cast immobilization for adults with a bicortical fracture of the scaphoid waist (SWIFFT): a pragmatic, multicentre, open-label, randomised superiority trial. *Lancet*. 2020 Aug;396(10248):390401. doi:10.1016/S01406736(20)30931-4.
 16. Prabhakar P, Wessel L, Nguyen J, Stepan J, Carlson M, Fufa D. Factors Associated with Scaphoid Nonunion following Early Open Reduction and Internal Fixation. *J Wrist Surg*. 2020 Apr;9(2):141-149. doi:10.1055/s-0039-3402769.
 17. Khan MS, Rasheed N, Hussain K, Farooq MZ. Demographic and clinical profile of adult patients with scaphoid fractures in population of district D.I.Khan, Pakistan. *Gomal Journal of Medical Sciences*, 2021;18(2):75-80. doi:10.46903/gjms/18.02.847.
 18. Nogueira CKG, Moraes VY, Sarmento LP, Nakachima LR, Santos JBGD, Belloti JC. Distal Radial Fractures with Scaphoid Fractures. *Rev Bras Ortop (Sao Paulo)*. 2024 Apr;59(2):e247-e253. doi:10.1055/s-0044-1785464.
 19. Stirling PHC, Simpson CJ, Ring D, Duckworth AD, McEachan JE. Virtual management of clinically suspected scaphoid fractures. *Bone Joint J*. 2022 Jun;104-B(6):709-714. doi:10.1302/0301-620X.104B6.BJJ-2021-1464.R2.
 20. Zhao H, Tian S, Kong L, Bai J, Lu J, Zhang B, et al. Factors associated with union time of acute middle third scaphoid fractures; an observational study. *Ther Clin Risk Manag*. 2018 Jun;14:1127-31. <https://doi.org/10.2147/TCRM.S16931>