

Valgus Impacted Femoral Neck Fractures: Surgery or Non-Operative Approach?

Arvin Najafi¹, Mohsen Tavakoli², Danoosh Zargar³, Dorsa Hadavi⁴, Ehsan Seif³, Salman Azarsina^{1,*}

¹ Associate Professor, Department of Orthopedic, Shahid Madani Hospital, School of Medicine, Alborz University of Medical Sciences, Karaj, Iran

² Orthopedic Surgeon, Department of Orthopedic, Shahid Madani Hospital, School of Medicine, Alborz University of Medical Sciences, Karaj, Iran

³ General Practitioner and Researcher, Research Committee, School of Medicine, Alborz University of Medical Sciences, Karaj, Iran

⁴ General Practitioner and Researcher, Department of Orthopedic, Shahid Madani Hospital, School of Medicine, Alborz University of Medical Sciences, Karaj, Iran

*Corresponding author: Salman Azarsina; Department of Orthopedic, Shahid Madani Hospital, School of Medicine, Alborz University of Medical Sciences, Karaj, Iran.
Tel: +98-9366794584, Email: azarsina.salman@gmail.com

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Abstract

Background: Non-operative management of valgus impacted femoral neck fracture leads to prolonged bed rest which may lead to deep vein thrombosis. The preferred method is the internal fixation because of pain control, enhanced mobilization, and better fracture healing but fails in older patients and individuals with medical comorbidities. The present study aims to assess the functional outcomes after the internal fixation or the non-operative management.

Methods: A retrospective cohort study was conducted at a Level I trauma center from January 2013 to December 2019 on all patients with valgus-impacted femoral neck fractures [Arbeitsgemeinschaft für Osteosynthesefragen/Orthopedic Trauma Association Classification (AO/OTA 31-B1)]. Overall, 81 patients were managed operatively with three partially threaded, cannulated screws in a parallel configuration and 21 patients were managed non operatively with instant mobilization, physical therapy, and partial weight-bearing protocol.

Results: 6 (28.0%) patients in the non-operative group and 3 (4.0%) cases in the operative group experienced fracture displacement ($P < 0.001$). 48 (59.2%) patients of the operative treatment group returned to baseline ambulatory function at 3 months, while this figure was 43.0% in the non-operative treatment group, not significantly different ($P = 0.100$). There was no significant difference in the mortality rates at one month and three months between the two groups (2 patients in each group, $P = 0.140$).

Conclusion: The ideal treatment of valgus-impacted femoral neck fractures is still controversial. The main purpose in the treatment of hip fractures is to return the patient to functional level equal to the level he or she was before the fracture. Surgically treated patients had lower failure rates in comparison with the other group.

Keywords: Femoral Neck Fractures; Femoral Fractures; Surgical Procedures

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Background

The number of femoral neck fractures is growing considerably as the mean age of the populations increase all over the world (1). The incidence of hip fractures in the United States has increased to more than 300,000 per year, while related healthcare costs have been reported to be about \$10 billion (2). By 2050, it is believed that the incidence of these fractures will approach 650,000, with nearly half of them being femoral neck fractures (1). Based on a meta-analysis, displaced femoral neck fractures are a major cause of widespread morbidity and/or mortality (3). The optimal treatment of valgus-impacted femoral neck fractures remains uncertain. Internal fixation may have considerable rates of re-operation as 8-22 percent (4-15). Multiple risk factors are related to fixation failure including medical comorbidities (7) and advanced age (16). On the other hand, non-operative approach can lead to prolonged bed rest and its related morbidities like fracture displacement and deep vein thrombosis (17). The probable advantages of surgical treatment compared to non-operative approach consist of pain control, enhanced mobilization (18), and better fracture healing (19). Revision surgery is necessary during the first two years in 20-36 percent of patients following internal fixation and in 6 to 18% of patients following joint arthroplasty (3).

A major question exists about the efficacy and cost-effectiveness of the operative management of displaced femoral neck fractures. Widespread outcome studies that

have merged different types of hip fractures would be unsuccessful to present comprehensible guidelines for the management of particular hip fractures (20-22). While internal fixation is the main approach in our center for these fractures, we found that some patients with valgus-impacted femoral neck fractures experienced acceptable outcomes after a non-operative approach. The current study prospectively followed up patients with non-displaced or impacted femoral neck fractures in order to assess the functional outcomes after either internal fixation or non-operative management.

Methods

In a retrospective cohort study from January 2013 to December 2019 at a single Level I trauma center, all patients with a valgus-impacted femoral neck fracture [Arbeitsgemeinschaft für Osteosynthesefragen/Orthopedic Trauma Association Classification (AO/OTA 31-B1)] (23) were included. The study exclusion criteria were displaced fractures, age younger than 18 years old, stress fractures, and less than three months of follow-up. 30 patients were managed non operatively, among who 9 patients were excluded (for inadequate follow-up and/ or documentation), yielding 21 patients. 124 patients were managed operatively with cancellous screws; though, 43 patients were excluded because of inadequate follow-up (< 3 months) or documentation. Operative fixation has been



performed by various surgeons with different degrees of experience. All patients who underwent non-operative treatment were instantly mobilized with physical therapy and partial weight-bearing protocol (Figure 1).



Figure 1. A. Valgus impacted femoral neck fracture, B. It's union after three months

The fixation protocol included percutaneous fixation with three partially threaded, cannulated screws in a parallel configuration and the patients were mobilized instantly after surgery with partial weight-bearing (Figure 2). The fractures were classified using the AO/OTA Classification for femoral neck fractures (23). For categorical variables, Fisher's exact test was conducted. For survival analysis, Kaplan-Meier survival analysis and a log rank test using the Mantel-Cox method were performed. Binominal logistic regression analysis was performed in R studio software (version 1.2.1335 for Mac OS). All other calculations were performed in Prism software (version 8.0.2 for macOS, GraphPad Software, La Jolla, CA, USA).



Figure 2. A. Valgus impacted femoral neck fracture, B. It's union via surgical fixation after three months

Results

No significant difference existed between the 2 groups of patients regarding baseline characteristics except sex dominancy. Age, body mass index (BMI, kg/m²), smoking, and preoperative ambulatory status were all similar between the groups (Table 1).

Table 1. Baseline characteristics of operative and non-operative groups			
Variable	Operative group (n=81)	Non-operative group (n=21)	P-value
Age (mean ± SD)	75.4 ± 6.4	77.2 ± 3.8	0.220
Sex (female/male ratio)	53/38	12/9	< 0.050
BMI	21.7 ± 2.6	20.9 ± 1.9	0.100
Follow up (months)	16.8 ± 11.6	12.4 ± 8.2	0.100
Smoking	20 (24.6%)	7 (33.3%)	0.400
Prior ambulatory w/o assist	66 (81%)	16 (76%)	0.500

SD: Standard deviation; BMI: Body mass index

The median follow-up time was 12.4 months in the non-surgical treated group (range 4.1-21.7 months), which was roughly the same as the follow-up period in the operatively managed group (median 16.8 months, range 4.7-28.3 months, P = 0.100). At the follow up of the non-operative group, 6 (28.0%) patients experienced fracture displacement, which led to bipolar hemi arthroplasty (Figure 3).



Figure 3. A. Valgus impacted femoral neck fracture managed non-operatively, B. It's secondary displacement after two months, C. Final bipolar hemiarthroplasty as a salvage procedure

The rate of fixation failure in the operative group was 3 (4.0%) cases, who were managed by bipolar hemi arthroplasty ($P < 0.001$). There was no significant difference in the mortality rates at 1 month and 3 months in the non-operative compared to the operative groups (2 patients in each group, $P = 0.140$). 1 (4.7%) case and 2 (2.4%) cases of deep vein thrombosis (DVT) were found in the non-operative group and in the fixation group, respectively ($P = 0.500$). Urinary tract infection was recorded in 4 (19.0%) cases of the non-operative group, while only 2 (2.4%) cases of the operative group recorded this pathology ($P < 0.050$). There were no significant differences in the proportion of patients ambulating without assistive device three months after injury between the two groups (57% in the non-operative group versus 64% in the fixation group, $P = 0.500$). 48 (59.2%) patients of the operative treatment patients returned to baseline ambulatory function at 3 months, while in the non-operative treatment group it was 43%, but this was not statistically significant ($P = 0.100$).

Discussion

The optimal management of the valgus-impacted femoral neck fractures remains uncertain. The main purpose of management of hip fractures is to return the patient to functional level as he or she was before fracture. We designed a retrospective cohort study in order to compare non-operative treatment with percutaneous cancellous screw fixation approach. We found that our overall failure rate was higher than most previous reports in the literature. Conventionally, non-operative management including bed rest reported failure rates ranging from 14 to 46% (24-26). Based on the first study comparing brief bed rest with operative treatment for non-displaced femoral neck fractures, the rate of operation in non-operatively managed patients was 20% versus 0% in the patients of the surgical fixation group (18). Given a systematic review, the rate of operation after non-operative treatment (22.6%) was higher than that of re-operation (10.6%) after surgical fixation group (19). Alternatively, surgical fixation can lead to notable rates of re-operation ranging from 8 to 22%; for instance in a recent large multicenter study, the rate of later arthroplasty among the patients with slightly displaced femoral neck fracture (age > 50 years) who were managed with surgery was 13.2% (4-11). While, the rate of treatment failure in patients who underwent non-operative treatment with immediate partial weight-bearing was low. However in the present study, non-operative treatment with immediate partial weight-bearing treatment did not result in diminished patient functional status and was not associated with an increase in patient mortality and complications except urinary tract infections. Although failure rates were high in non-operatively managed femoral neck fracture patient group rather than those surgically treated with cancellous screw fixation, the salvage for failed non-operative treatment was arthroplasty. Even though we did not evaluate outcomes after arthroplasty, this treatment approach had superior functional outcomes and few reoperation rates compared to screw fixation in a randomized trial (27).

Arthroplasty after failed non-operative treatment may lead to outcomes similar to those of the primary surgical screw fixation, particularly given the previous re-operation rates for cancellous screw fixation (4, 16, 27). This treatment strategy may be particularly reasonable if and when a patient would like to avoid surgery and takes the risk of subsequent arthroplasty. Further research is

necessary to assess outcomes after arthroplasty for failed screw fixation versus failed non-operative treatment. Gordon (28) showed the need for good cooperation between primary care physicians, internists, and orthopedic surgeons to ensure return to a high level of function. He emphasized the need for special precautions during the postoperative period. A large prospective study measured functional outcome during two years after fracture and also included all types of hip fractures and reported that at 1-year follow-up, the ambulatory condition of the patients was recovered to pre-injury levels in 67% of patients (20). Koval et al., who did not discriminate various hip fracture types, found that 73% of patients returned to their basic pre-injury at 1 year (29).

In the current study, an overall 3-month mortality of 4% was reported. This is in contrast to one-year mortality rates ranging from 10 to 20% of patients with different hip fractures (29-31). The majority of patients in the current study in the non-operative group stated a significant loss of function after non-displaced hip fractures. In the surgically treated group, about two thirds of the patients recovered to acceptable functional status regarding the pre-injury level. There was inadequate data on postoperative discharge complications in the current study groups. As a limitation of our study, admission to a hospital other than our institute was not recorded and complications could be missed. The inability to evaluate the impact of physical therapy is a fundamental variable not assessed in our study (32). A randomized trial of two programs of postoperative physical therapy showed no significant difference in the recovery as measured by activities of daily living (33).

However, the most advantageous form and quantity of physical therapy sessions after hip fracture are uncertain. The current authors centralized on non-displaced femoral neck fractures discretely from other types of hip fractures, which verify that the health of geriatrics deteriorates after hip fracture. Outcome studies of patients with hip fractures are critical to a better insight of quality of care for these patients, and will modify healthcare facilities in order to reduce the mortality, morbidity, and incidence of hip fractures. Our study had the limitations of a retrospective design and is mainly susceptible to selection bias in which the best candidates for fixation were treated in this manner. However, it was not as good as surgical candidates were managed non-operatively. Besides, 43 out of 124 patients in the operative management group were excluded due to inadequate follow-up and/or documentation, either of which could be a source of selection bias. The study was also conducted at a single academic trauma center, restraining generalizability. A single fixation technique of three partially threaded cancellous screws was assessed, and operative fixation via a sliding hip screw or other device may bring about different outcomes.

Conclusion

In conclusion, the optimal management for valgus-impacted femoral neck fracture remains controversial. Although non-operative approach was not an independent risk factor for treatment failure, the surgically treated patients had lower failure rates. The fairly high failure rates among the groups suggest that future research into alternative treatment methods as well as primary arthroplasty may be acceptable.

Conflict of Interest

The authors declare no conflict of interest in this study.

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References

- Rockwood PR, Horne JG, Cryer C. Hip fractures: A future epidemic? *J Orthop Trauma*. 1990;4(4):388-93. [PubMed: 2266443].
- Praemer A, Furner S, Rice DP. Musculoskeletal conditions in the United States. Rosemont, IL: American Academy of Orthopaedic Surgeons; 1999.
- Lu-Yao GL, Keller RB, Littenberg B, Wennberg JE. Outcomes after displaced fractures of the femoral neck. A meta-analysis of one hundred and six published reports. *J Bone Joint Surg Am*. 1994;76(1):15-25. doi: 10.2106/00004623-199401000-00003. [PubMed: 8288658].
- Nauth A, Creek AT, Zellar A, Lawendy AR, Dowrick A, Gupta A, et al. Fracture fixation in the operative management of hip fractures (FAITH): An international, multicentre, randomised controlled trial. *Lancet*. 2017;389(10078):1519-27. doi: 10.1016/S0140-6736(17)30066-1. [PubMed: 28262269]. [PubMed Central: PMC5597430].
- Kim YC, Lee JY, Song JH, Oh S. The result of in situ pinning for valgus impacted femoral neck fractures of patients over 70 years old. *Hip Pelvis*. 2014;26(4):263-8. doi: 10.5371/hp.2014.26.4.263. [PubMed: 27536591]. [PubMed Central: PMC4971403].
- Sikand M, Wenn R, Moran CG. Mortality following surgery for undisplaced intracapsular hip fractures. *Injury*. 2004;35(10):1015-9. doi: 10.1016/j.injury.2004.01.004. [PubMed: 15351669].
- Clement ND, Green K, Murray N, Duckworth AD, McQueen MM, Court-Brown CM. Undisplaced intracapsular hip fractures in the elderly: Predicting fixation failure and mortality. A prospective study of 162 patients. *J Orthop Sci*. 2013;18(4):578-85. doi: 10.1007/s00776-013-0400-7. [PubMed: 23686084].
- Lapidus IJ, Charalampidis A, Rundgren J, Enocon A. Internal fixation of garden I and II femoral neck fractures: Posterior tilt did not influence the reoperation rate in 382 consecutive hips followed for a minimum of 5 years. *J Orthop Trauma*. 2013;27(7):386-90. doi: 10.1097/BOT.0b013e318281da6e. [PubMed: 23287762].
- Palm H, Gosvig K, Krashenninikoff M, Jacobsen S, Gebuhr P. A new measurement for posterior tilt predicts reoperation in undisplaced femoral neck fractures: 113 consecutive patients treated by internal fixation and followed for 1 year. *Acta Orthop*. 2009;80(3):303-7. doi: 10.3109/17453670902967281. [PubMed: 19634021]. [PubMed Central: PMC2823202].
- Bjorgul K, Reikeras O. Outcome of undisplaced and moderately displaced femoral neck fractures. *Acta Orthop*. 2007;78(4):498-504. doi: 10.1080/17453670710014149. [PubMed: 17966004].
- Murphy DK, Randell T, Brennan KL, Probe RA, Brennan ML. Treatment and displacement affect the reoperation rate for femoral neck fracture. *Clin Orthop Relat Res*. 2013;471(8):2691-702. doi: 10.1007/s11999-013-3020-9. [PubMed: 23640205]. [PubMed Central: PMC3705035].
- Kain MS, Marcantonio AJ, Iorio R. Revision surgery occurs frequently after percutaneous fixation of stable femoral neck fractures in elderly patients. *Clin Orthop Relat Res*. 2014;472(12):4010-4. doi: 10.1007/s11999-014-3957-3. [PubMed: 25256623]. [PubMed Central: PMC4397802].
- Chen WC, Yu SW, Tseng IC, Su JY, Tu YK, Chen WJ. Treatment of undisplaced femoral neck fractures in the elderly. *J Trauma*. 2005;58(5):1035-9. doi: 10.1097/01.ta.0000169292.83048.17. [PubMed: 15920421].
- Conn KS, Parker MJ. Undisplaced intracapsular hip fractures: Results of internal fixation in 375 patients. *Clin Orthop Relat Res*. 2004;(421):249-54. [PubMed: 15123955].
- Garden RS. Low-angle fixation in fractures of the femoral neck. *J Bone Joint Surg*. 1961;43-B(4):647-63.
- Hui AC, Anderson GH, Choudhry R, Boyle J, Gregg PJ. Internal fixation or hemiarthroplasty for undisplaced fractures of the femoral neck in octogenarians. *J Bone Joint Surg Br*. 1994;76(6):891-4. [PubMed: 7983113].
- Buord JM, Flecher X, Parratte S, Boyer L, Aubaniac JM, Argenson JN. Garden I femoral neck fractures in patients 65 years old and older: Is conservative functional treatment a viable option? *Orthop Traumatol Surg Res*. 2010;96(3):228-34. doi: 10.1016/j.otsr.2009.11.012. [PubMed: 20488140].
- Cserhati P, Kazar G, Manninger J, Fekete K, Frenyo S. Non-operative or operative treatment for undisplaced femoral neck fractures: A comparative study of 122 non-operative and 125 operatively treated cases. *Injury*. 1996;27(8):583-8. doi: 10.1016/S0020-1383(96)00073-3. [PubMed: 8994566].
- Xu DF, Bi FG, Ma CY, Wen ZF, Cai XZ. A systematic review of undisplaced femoral neck fracture treatments for patients over 65 years of age, with a focus on union rates and avascular necrosis. *J Orthop Surg Res*. 2017;12(1):28. doi: 10.1186/s13018-017-0528-9. [PubMed: 28187745]. [PubMed Central: PMC5301374].
- Iorio R, Healy WL, Lemos DW, Appleby D, Lucchesi CA, Saleh KJ. Displaced femoral neck fractures in the elderly: Outcomes and cost effectiveness. *Clin Orthop Relat Res*. 2001;(383):229-42. doi: 10.1097/00003086-200102000-00027. [PubMed: 11210960].
- Lee BP, Berry DJ, Harmsen WS, Sim FH. Total hip arthroplasty for the treatment of an acute fracture of the femoral neck: Long-term results. *J Bone Joint Surg Am*. 1998;80(1):70-5. [PubMed: 9469311].
- March LM, Chamberlain AC, Cameron ID, Cumming RG, Brnabic AJ, Finnegan TP, et al. How best to fix a broken hip. Fractured neck of femur health outcomes project team. *Med J Aust*. 1999;170(10):489-94. [PubMed: 10376027].
- Meinberg EG, Agel J, Roberts CS, Karam MD, Kellam JF. Fracture and Dislocation Classification Compendium-2018. *J Orthop Trauma*. 2018;32(Suppl 1):S1-S170. doi: 10.1097/BOT.0000000000001063. [PubMed: 29256945].
- Raaymakers EL, Marti RK. Non-operative treatment of impacted femoral neck fractures. A prospective study of 170 cases. *J Bone Joint Surg Br*. 1991;73(6):950-4. doi: 10.1302/0301-620X.73B6.1955443. [PubMed: 1955443].
- Shuqiang M, Kunzheng W, Zhichao T, Mingyu Z, Wei W. Outcome of non-operative management in Garden I femoral neck fractures. *Injury*. 2006;37(10):974-8. doi: 10.1016/j.injury.2006.04.136. [PubMed: 16934263].
- Verheyen CC, Smulders TC, van Walsum AD. High secondary displacement rate in the conservative treatment of impacted femoral neck fractures in 105 patients. *Arch Orthop Trauma Surg*. 2005;125(3):166-8. doi: 10.1007/s00402-004-0791-1. [PubMed: 15645267].
- Dolatowski FC, Frihagen F, Bartels S, Opland V, Saltyte Benth J, Talsnes O, et al. Screw fixation versus hemiarthroplasty for nondisplaced femoral neck fractures in elderly patients: A multicenter randomized controlled trial. *J Bone Joint Surg Am*. 2019;101(2):136-44. doi: 10.2106/JBJS.18.00316. [PubMed: 30653043].
- Gordon M. Restoring functional independence in the older hip fracture patient. *Geriatrics*. 1989;44(12):48-53, 56, 59. [PubMed: 2687121].
- Koval KJ, Skovron ML, Aharonoff GB, Zuckerman JD. Predictors of functional recovery after hip fracture in the elderly. *Clin Orthop Relat Res*. 1998;(348):22-8. [PubMed: 9553529].
- Craik RL. Disability following hip fracture. *Phys Ther*. 1994;74(5):387-98. doi: 10.1093/ptj/74.5.387. [PubMed: 8171100].
- Michel JP, Hoffmeyer P, Klopfenstein C, Bruchez M, Grab B, d'Epinau CL. Prognosis of functional recovery 1 year after hip fracture: Typical patient profiles through cluster analysis. *J*

- Gerontol A Biol Sci Med Sci.* 2000;55(9):M508-M515. doi: [10.1093/gerona/55.9.m508](https://doi.org/10.1093/gerona/55.9.m508). [PubMed: [10995048](https://pubmed.ncbi.nlm.nih.gov/10995048/)].
32. Tinetti ME, Baker DI, Gottschalk M, Williams CS, Pollack D, Garrett P, et al. Home-based multicomponent rehabilitation program for older persons after hip fracture: A randomized trial. *Arch Phys Med Rehabil.* 1999;80(8):916-22. doi: [10.1016/S0003-9993\(99\)90083-7](https://doi.org/10.1016/S0003-9993(99)90083-7). [PubMed: [10453768](https://pubmed.ncbi.nlm.nih.gov/10453768/)].
33. Tolo ET, Bostrom MP, Simic PM, Lyden JP, Cornell CM, Thorngren KG. The short term outcome of elderly patients with hip fractures. *Int Orthop.* 1999;23(5):279-82. doi: [10.1007/s002640050371](https://doi.org/10.1007/s002640050371). [PubMed: [10653294](https://pubmed.ncbi.nlm.nih.gov/10653294/)]. [PubMed Central: [PMC3619765](https://pubmed.ncbi.nlm.nih.gov/PMC3619765/)].