

Comparison of Cemented with Uncemented Bipolar Hemiarthroplasty in Femoral Neck Fracture in over 70 Years Old Patients in Short-Term

Abstract

Background: Hip hemiarthroplasty is a common method in treating femoral neck fractures in patients older than 70 years old. Depending on the severity of bone destruction, and bone stock, two methods either cemented or non-cement bipolar prosthesis may be used.

Methods: In a prospective study, 60 patients with femoral neck fractures who were referred to the university hospitals of Isfahan, Iran, were divided into two treatment groups: 30 patients were treated with cemented bipolar method and 30 with non-cement bipolar hip arthroplasty surgery. In a 6-month follow-up, the surgical outcomes were assessed using the VAS pain scale, SF36 general health instrument score, and Harris hip score (HHS).

Results: The pain scale (VAS), SF36 and Harris scores showed non-significant differences in the two groups: pain=3.63 out of 10 in 3 months and 2.6 out of 10 in 6 months; SF36= 69 and 86 in 3 and 6 months, respectively; HHS=78 in both in 3 and 6 month in the cemented group. In non-cemented group the pain scores were 3.91 and 3.12 in 3 and 6 months; SF36=67 and 83, and HHS=82 in 3 and 6 months respectively.

Conclusion: It seems that the two methods of cemented and non-cemented bipolar hemiarthroplasty, in elderly hip fractures, would have similar pain, quality of life, and hip function in short term follow-ups.

Keywords: Femoral neck fracture, Hemiarthroplasty, Bone Cements, Quality of Life, Pain

Received: 25 days before printing; Accepted: 5 days before printing

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Introduction

A femoral neck fracture is a debilitating injury, which usually occurs in the elderly, causes disorder in the patient's health, and imposes high costs on the community health system ⁽¹⁾. More than 250,000 femoral neck fractures occur in the United States each year, which is expected to double by 2050 as the population ages. High- and low-energy trauma causes these fractures in young and older adults respectively, and the lack of correct treatment leads to complications and surgeries ⁽²⁾. Type I fractures are incomplete and usually impacted valgus in Garden classification. The fracture in types II, III, and IV are complete and without displacement, briefly displaced, and completely displaced ⁽³⁾.

Bipolar Hemiarthroplasty is one of the approaches to femoral neck fractures in people over the age of 70, which uses the cemented or uncemented method depending on bone quality and osteoporosis severity. Cemented prostheses are used when the bone quality is poor, osteoporosis is high, the channel is dilated, and fixation with uncemented prostheses is not possible ⁽⁴⁾.

Undisplaced fracture treatment is performed by fixing the fracture with a screw or DHS at all ages, but there is much disagreement about displaced fracture treatment, especially in patients over 70 years old. Some surgeons treat these patients based on their activity level and life expectancy through joint replacement and bipolar surgery ^(5, 6). Choosing the proper treatment method is essential due to the high age of these patients to improve efficiency and reduce prosthesis dislocation, infection, bleeding, and the need for reoperation associated with multiple risks. Okike et al. (2020) conducted a Cohort retrospective study on 49112 patients with a mean age of 83 years who underwent the cemented and uncemented Hemiarthroplasty with a mean age of 83 years who underwent the cemented and uncemented Hemiarthroplasty with a

mean follow-up time of 8.3 years. There were no statistically significant differences between the groups, including in-hospital mortality and postoperative outcomes⁽⁷⁾.

Parker (2019) evaluated 400 patients with femoral neck fractures, of whom 115 patients died within a year of surgery. There was no significant difference in pain scores among the survivors at any time intervals. Patients treated with the cemented Hemiarthroplasty had better mobility improvement than those treated with the uncemented Hemiarthroplasty. Re-fractures were more common in the uncemented group, but the need for further surgery was similar in both groups⁽⁸⁾.

Liu et al. (2019) compared the cemented and uncemented Hemiarthroplasty on people aged 70 and over with a mean age of 70-85.3 years old. This meta-analysis revealed that the cemented Hemiarthroplasty had a longer duration, less pain, less than one year of mortality, and fewer implant-related complications than the uncemented Hemiarthroplasty. However, this study has some limitations, such as uniform management of surgery, rehabilitation plan, and small sample size⁽⁹⁾.

Christensen (2020) carried out a similar comparative study and showed that reoperation was needed after the uncemented Hemiarthroplasty compared to the cemented Hemiarthroplasty for any reason, and post reoperation risks were higher due to fractures around the prosthesis and infection. However, no significant difference was found in patients' pain and mortality rate after one year⁽¹⁰⁾.

Kumar et al. (2020) performed a meta-analysis on 18 studies with 2,819 intra-articular pelvic fractures and found that the cemented Hemiarthroplasty reduced the risk of peripheral, postoperative, and postoperative fractures. However, there was no significant difference in other complications, including function, pain, and quality of life. There were no significant differences in the intra-operative results except for the increase in the operation duration and cemented Hemiarthroplasty. The comparison results of the intra-operative mortality rate, after 30 days, and after one

year between the two methods were not significantly different⁽¹¹⁾.

In Moorine's study, both cemented and uncemented groups were similar in age, gender, and systemic diseases. The cemented group had longer operation duration and more blood loss significantly. Despite significant differences between the two groups, the cemented group was more associated with premature postoperative mortality. Intra-operative fractures occurred in two patients (2.5%) of the uncemented group. There was no significant difference between the groups regarding dislocation rate or peripheral fracture rate after surgery during a 2-year follow-up period. An improvement in postoperative performance was observed at six weeks for both groups, and the mean HHS HRS score was similar at the end of 2 years⁽¹²⁾.

Another systematic study, including 12 studies, and involving 1805 patients, compared the results of these surgeries. The meta-analysis presented longer operation duration in cemented Hemiarthroplasty than in the uncemented method, and no significant difference was observed between the two treatment groups regarding mortality, hospitalization, blood loss, pain severity, and other complications⁽¹³⁾.

Many clinical trial studies have found no difference between the cemented and uncemented prostheses in the pain severity and hip function, and the length of surgery in cemented prostheses was longer⁽¹⁴⁻¹⁷⁾.

Different results have been obtained from the study of these two methods, but there is no comprehensive study in this field in Iran. This study aimed to evaluate for this purpose.

Methods

This prospective study was conducted on people aged 70 and over who referred to Isfahan medical and educational centers in Iran due to a femoral neck fracture from 2019 to 2020 and treated under the cemented and uncemented bipolar method. Patients with post-surgery complications, such as infection, death, or who did not pursue the follow-up

were excluded from the study, and finally, two groups of 30 people were included.

The inclusion criteria were femoral neck fracture for any reason except pathological fractures between 2019 and 2020, using cemented and uncemented bipolar method depending on the degree of bone resorption, age over 70, lack of chronic debilitating diseases, activity, and ability to walk before fracture, and gaining informed consent. The exclusion criteria include dissatisfaction to participate or continue to participate in the study, people with illness or disabilities who cannot continue to study, and people addicted to opium.

Patients treated with the cemented (group 1) and uncemented (group 2) bipolar Hemiarthroplasty were studied in two groups of 30. All patients were evaluated for pain severity, quality of life, and hip function 3 and 6 months after surgery.

The VAS criterion was used to determine the pain severity criterion in 10 degrees, and the patient selected a number according to the pain severity. The SF-36 questionnaire was used to determine the quality of life, containing eight dimensions of physical function, physical limitation, vitality, general health, social relations, mental health disorders, and mental health. This questionnaire was normed in Iran⁽¹⁷⁾ with a score from 0 to 121, of which 121 is the best.

The Harris Hip Scale (HHS), which is the essential scale for hip scoring, and factors such as pain, claudication, ability to walk and get up from a chair and sit, as well as a range of motion, and difference in limb length were used to evaluate the function of the hip joint. This criterion is like the WOMAC and SF-36 criteria in terms of validity, whose reliability was 0.94⁽¹⁵⁾. The data related to 3- and 6-month follow-ups after surgery were measured and recorded in a checklist.

The data were analyzed by SPSS Software Version 21 and Repeated measure ANOVA, independent test T, and Chi-square statistical tests. The significance level is considered less than 0.05. This study was conducted based on the approved proposal with research code

399892 and ethics code
IR.MUI.MED.REC.1399.1012.

Results

Table 1 compares the mean pain severity score based on VAS criteria, the mean score of the SF-36 questionnaire, and the Harris hip score (HHS) at intervals of 3 and 6 months after surgery.

A total of 143 bipolar surgeries were performed in Kashani Hospital in Isfahan, Iran, in 2019-20, of which 57 were cemented and 86 were uncemented. The age range of patients was between 70 and 98 years with the mean age of patients as much as 78.3 ± 4.3 years, of whom 53% female ($n = 32$), and 47% male ($n = 28$). The mean operation duration was 67 minutes in the first group and 46 minutes in the second group. The average bleeding during the surgery was 730 ml in the first group and 520 ml in the second group.

Although the pain severity in the cemented bipolar group was lower than uncemented, this difference was not significant. There was no significant difference between the mean pain severity score based on each VAS, the mean score of the SF-36 questionnaire, and the Harris hip score (HHS) at intervals of 3 and 6 months after surgery. The results revealed that the cemented and uncemented surgeries are not significantly different in terms of pain severity, quality of life, and hip function. Both methods can have good results in femoral neck fracture surgery.

According to the comparison of mean pain intensity severity based on each VAS criteria, the mean score of the SF-36 questionnaire and Harris hip score (HHS) increased at intervals of 3 and 6 months after surgery in the cemented and uncemented surgery, which seems to be due to physiotherapy sessions.

	Average pain severity		Mean score of the SF-36 questionnaire		Mean score of the Harris hip score (HHS)	
	3 months	6 months	3 months	6 months	3 months	6 months
first group Cemented bipolar hemiarthroplasty	3.63	2.96	69.34	86.02	70.23	74.57
The second group Uncemented bipolar hemiarthroplasty	3.91	3.12	67.89	83.86	68.06	73.29
p-value	0/05<	0/05<	0/05<	0/05<	0/05<	0/05<



Figure 1: cemented bipolar

Discussion

A femoral neck fracture is a debilitating injury that most commonly affects the elderly, disturbing their health and straining the community's health care system. In the United States, more than 250,000 femoral neck fractures occur each year, which is expected to double by 2050 as the population ages. There is considerable disagreement about the treatment of displaced fractures, most of which are about patients over 70 years old. Choosing the proper treatment

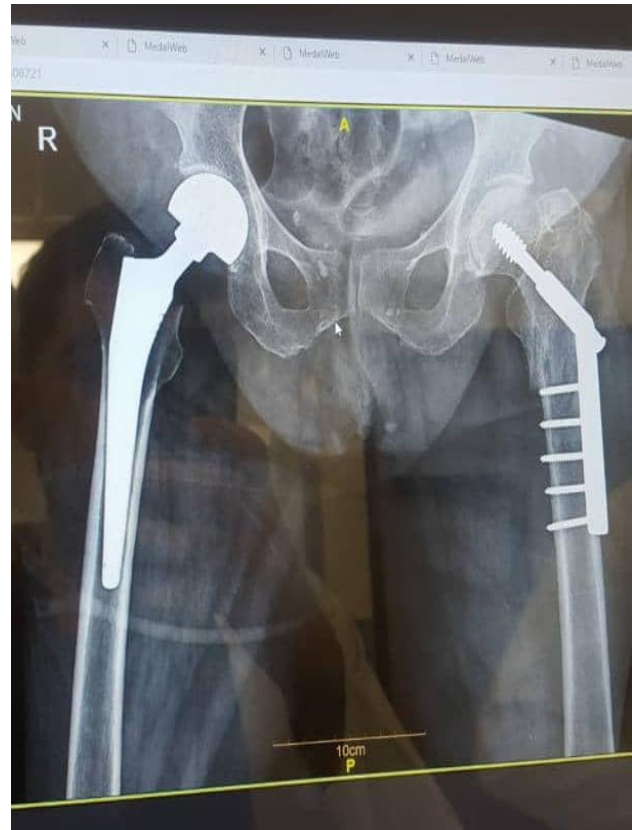


Figure 2: non cemented bipolar

method is essential due to the high age of these patients to improve efficiency and reduce complications and the need for reoperation associated with multiple risks. The results indicated that the cemented and uncemented surgery were not significantly different in terms of pain severity, quality of life, and hip function. Both methods can have good results in femoral neck fracture surgery. There is not much research comparing these methods, and disagreement about the use of the cemented and uncemented prostheses is high. Numerous studies have reported that patients who use cemented prostheses have

less thigh pain and better performance than uncemented ones⁽¹⁵⁾.

Many clinical trial studies have found no difference between the cemented and uncemented prostheses in the pain severity and hip function, and the length of surgery in cemented prostheses was longer⁽¹⁸⁾. A meta-analysis study was performed to compare the efficacy and safety of the cemented and uncemented Hemiarthroplasty for displaced femoral neck fractures. The post-surgery hip function in 12-month cemented Hemiarthroplasty was significantly better than the uncemented Hemiarthroplasty ($P = 0.01$). The post-operative fracture rate in the cemented Hemiarthroplasty was significantly lower than uncemented Hemiarthroplasty ($P = 0.001$). In addition, the inter-surgical fracture rate in cemented Hemiarthroplasty was significantly lower than in uncemented one ($P = 0.004$). The operation duration in the uncemented Hemiarthroplasty was shorter than in cemented ($P < 0.00001$). There was no significant difference between the two groups with HHS, mortality, wound infection, dislocation, general complications, reoperation rate, and intra-operative blood loss⁽¹⁹⁾. Contrary to this study, there was no significant difference between the cemented and uncemented Hemiarthroplasty in our study, like our study, HHS was not significantly different after 3 and 6 months.

A comparative study was performed between two stem design prostheses to investigate the results of two types of cemented and uncemented stem design implants after Hemiarthroplasty. There was no significant difference between the two groups with both 10A orthopaedic data evaluation panel rankings, mortality after one-year, total other complications, immobilization at discharge, and general prosthesis complications. Periprosthetic fractures and post-operative infections were significantly more common in the uncemented group with reoperation. Significant differences were observed in cardiovascular complications, blood loss, and operation duration in favour of the uncemented group⁽²⁰⁾. In this study, no significant difference was observed between

the cemented and uncemented implants, which are inconsistent with the results of our study.

A meta-analysis study was conducted on eight studies, including 1577 pelvis (782 uncemented and 795 cemented), to compare the efficacy and safety of the cemented and uncemented Hemiarthroplasty in elderly patients with femoral neck fractures. The meta-analysis showed that the operation duration of the cemented Hemiarthroplasty is longer than the uncemented one, with a statistically significant difference ($P = 0.01$). However, there was no significant difference between the stabilization methods in mortality at 12 months ($P = 0.14$), hospitalization ($P = 0.44$), blood loss ($P = 0.46$), and HHS score. There was a significant difference in the common complications of pulmonary embolism between the two groups, but there was no difference in the other five common complications. Based on the results, uncemented Hemiarthroplasty could reduce the incidence of pulmonary embolism after surgery. In addition, the results of prosthesis-related complications showed a significant difference between the two groups in pre-prosthetic fractures ($P < 0.00001$, $P < 0.00001$, $P = 0.0002$)⁽²¹⁾. In line with our study, HHS and complications in follow-up were not significantly different in this study.

A meta-analysis was carried out to compare cemented Thompson and uncemented Austin Moore Hemiarthroplasty for femoral neck fractures. A variety of articles were searched through PubMed, Cochrane Central, Scopus, Ovid, and the Web of Science through February 2019 on pelvic function, pelvic pain, implant complications, surgical complications, reoperation rates, and hospitalization. A total of 10 studies (four RCTs and six observational studies) with 4378 patients were included in the final analysis. The Thompson group was associated with lower pelvic pain after surgery, lower reoperation rate, fewer intra-operative fractures, and longer operation duration than the Austin Moore group. Estimating the effect of pelvic function, fractures around the prosthesis, prosthetic dislocations, wound infection, mortality, and hospitalization was not in favour of either

group⁽²²⁾. There was no significant difference between the cemented and uncemented prostheses, which was consistent with our study.

A systematic review of 13 studies, including 1561 bipolar Hemiarthroplasty (770 cemented and 791 uncemented), evaluated the differences between cemented and uncemented bipolar prostheses in the treatment of femoral neck fractures in patients aged 60 and over. The uncemented Hemiarthroplasty was associated with significantly less blood loss ($P < 0.0001$), shorter operation duration ($p < 0.0001$), less infection ($p = 0.03$), and lower risk of heterotypic ossification ($p = 0.007$). On the other hand, patients with the cemented Hemiarthroplasty suffered a significant less thigh pain after surgery than patients with the uncemented implants ($p < 0.00001$)⁽²³⁾.

A prospective controlled randomized trial was conducted to compare cemented (CHA) and uncemented (UCH) bipolar Hemiarthroplasty in patients with femoral neck fractures (FNF). This study was performed on 158 patients over 76 years old who underwent bipolar HA for displaced FNF, who were randomly divided into two groups. The cemented group (CHA, $n = 79$) was treated with the cemented and uncemented group (UCH, $n = 79$) used no cement, and the operation duration, blood loss, complication rate, and postoperative mortality were compared after surgery. Both CHA and UCH groups were not significantly different in age, gender, and co morbidities. The CHA group experienced a significantly longer operation duration and more intra-operative blood loss. Intra-operative fractures occurred in two patients from the UCH group, and there was no significant difference between the groups regarding dislocation and postoperative periprosthetic fracture. There was a tendency for better postoperative performance improvement at week 6 for the CHA group, although the mean HRS score (HHS) was comparable at two years⁽²⁴⁾. These results were consistent with those of our study. HHS was not significant in the present study at of 3- and 6- month intervals. Generally, both methods can have good results in femoral neck fracture surgery in short-term follow-up.

Conclusion

The results indicated that the cemented and uncemented methods were not significantly different in terms of pain severity, quality of life, and hip function. Studies in this field are limited in Iran, and different results have been obtained in different studies in other countries. Both methods can have good results in femoral neck fracture surgery.

Some of the limitations of our study were the small sample size, short follow-up period, and failure to evaluate complications in two methods. In addition, the choice of surgery was not random, and more community-based studies are recommended to examine these cases. According to investigations, no study has been reported so far in this field in Iran.

Conflict of interests

The authors declared there is no conflict of interest.

Funding

The project was supported financially by the Isfahan University of Medical Sciences for the design of the study and collection, analysis, and interpretation of data (Research project Number: IR.MUI.MED.REC.1399.1012)

Acknowledgements

We thank the hospital staff and all the patients who participated in this study.

Financial support: Isfahan University of Medical Sciences, Vice-Chancellor for research

References

1. Rogmark C, Carlsson Å, Johnell O, Sernbo I. Costs of internal fixation and arthroplasty for displaced femoral neck fractures. *Acta Orthopaedica Scandinavica*. 2003 Jan 1; 74(3):293-8.
2. Green DP. Rockwood and Green's fractures in adults. Lippincott Williams & Wilkins; 2010.
3. Bhandari M, Devereaux PJ, Swiontkowski MF, Tornetta III P, Obrebsky W, Koval KJ, et al. Internal fixation compared with arthroplasty for displaced fractures of the femoral neck: a meta-analysis. *JBJS*. 2003 Sep 1; 85(9):1673-81.
4. Azar FM, Canale ST, Beaty JH. *Campbell's Operative Orthopaedics*, E-Book. Elsevier Health Sciences; 2020 Dec 23.

5. Rogmark C, Johnell O. Orthopaedic treatment of displaced femoral neck fractures in elderly patients. *Disability and Rehabilitation*. 2005 Jan 1; 27(18-19):1143-9.
6. Ozturkmen Y, Karamehmetoglu M, Azboy I, Acikgoz İ, Canikoglu M. Comparison of primary arthroplasty with early salvage arthroplasty after failed internal fixation for displaced femoral neck fractures in elderly patients. *Acta orthopaedica et traumatologica turcica*. 2006 Jan 1; 40(4):291-300.
7. Okike K, Chan PH, Prentice HA, Paxton EW, Burri RA. Association between uncemented vs cemented hemiarthroplasty and revision surgery among patients with hip fracture. *Jama*. 2020 Mar 17; 323(11):1077-84.
8. Parker MJ, Cawley S. Cemented or uncemented Hemiarthroplasty for displaced intracapsular fractures of the hip: a randomized trial of 400 patients. *The bone & joint Journal*. 2020 Jan; 102(1):11-6
9. Liu B, Li A, Wang J, Wang H, Zhai G, Ma H, Lian X, Zhang B, Liu L, Gao Y. Cemented versus uncemented hemiarthroplasty for elderly patients with displaced fracture of the femoral neck: a PRISMA-compliant meta-analysis of randomized controlled trial. *Medicine*. 2020 Aug 14; 99(33).
10. Kristensen TB, Dybvik E, Kristoffersen M, Dale H, Engesæter LB, Furnes O, Gjertsen JE. Cemented or uncemented hemiarthroplasty for femoral neck fracture? Data from the Norwegian Hip Fracture Register. *Clinical orthopaedics and related research*. 2020 Jan; 478(1):90.
11. Nantha Kumar N, Kunutsor SK, Fernandez MA, Dominguez E, Parsons N, Costa ML, Whitehouse MR. Effectiveness and safety of cemented and uncemented hemiarthroplasty in the treatment of intracapsular hip fractures: a systematic review and meta-analysis of randomized controlled trials. *The bone & joint journal*. 2020 Sep 14; 102(9):1113-21.
12. Movrin I. Cemented versus uncemented hemiarthroplasty for displaced femoral neck fractures: A randomized controlled trial with two years follow-up. *Acta Orthop Traumatol Turc*. 2020 Jan; 54(1):83-88.
13. Ning GZ, Li YL, Wu Q, Feng SQ, Li Y, Wu QL. Cemented versus uncemented hemiarthroplasty for displaced femoral neck fractures: an updated meta-analysis. *European Journal of Orthopaedic Surgery & Traumatology*. 2014 Jan; 24(1):7-14.
14. Simon P, Gouin F, Veillard D, Laffargue P, Ehlinger M, Bel JC, Lopez R, Beaudet P, Luickx F, Molina V, Pidhorz LE. Femoral neck fractures in patients over 50 years old. *Revue de chirurgie orthopedique et repara-trice de l'appareil moteur*. 2008 Sep 19; 94(6):S108-32.
15. Fahad S, Khan MZ, Aqueel T, Hashmi P. Comparison of bipolar hemiarthroplasty and total hip arthroplasty with dual mobility cup in the treatment of old active patients with displaced neck of femur fracture: A retrospective cohort study. *Annals of Medicine and Surgery*. 2019 Sep 1; 45:62-5.
16. Yoo JI, Cha YH, and Kim JT, Park CH. Clinical outcomes of bipolar hemiarthroplasty versus total hip arthroplasty: assessing the potential impact of cement use and pre-injury activity levels in elderly patients with femoral neck fractures. *Hip & Pelvis*. 2019 Jun 1; 31(2):63-74.
17. Boukebous B, Boutroux P, Zahi R, Azmy C, Guillon P. Comparison of dual mobility total hip arthroplasty and bipolar arthroplasty for femoral neck fractures: A retrospective case-control study of 199 hips. *Orthop Traumatol Surg Res*. 2018 May; 104(3):369-375.
18. Montazeri A, Goshtasebi A, Vahdaninia M, Gandek B. The Short Form Health Survey (SF-36): translation and validation study of the Iranian version. *Qual Life Res*. 2005 Apr; 14(3):875-82.
19. Lin FF, Chen YF, Chen B, Lin CH, Zheng K. Cemented versus uncemented hemiarthroplasty for displaced femoral neck fractures: A meta-analysis of randomized controlled trials. *Medicine (Baltimore)*. 2019 Feb; 98(8):e14634.
20. Frenken MRM, Schotanus MGM, van Haaren EH, Hendrickx R. Cemented versus uncemented hemiarthroplasty of the hip in patients with a femoral neck fracture: a comparison of two modern stem design implants. *Eur J Orthop Surg Traumatol*. 2018 Oct; 28(7):1305-1312.
21. Li N, Zhong L, Wang C, Xu M, Li W. Cemented versus uncemented hemi-arthroplasty for femoral neck fractures in elderly patients: A systematic review and meta-analysis of randomized controlled trials. *Medicine (Baltimore)*. 2020 Feb; 99(8):e19039.
22. Shehata MSA, Abdelal A, Salahia S, Ahmed H, Shawqi M, Elsehili A, et al. Historically, did Cemented Thompson perform better than uncemented Austin Moore hemiarthroplasty for femoral neck fractures? A meta-analysis of available evidence. *SICOT J*. 2019; 5:33.
23. Elmenshawy AF, Salem KH. Cemented versus cementless bipolar hemiarthroplasty for femoral neck fractures in the elderly. *EFORT Open Reviews*. 2021 May 4; 6(5):380-6.
24. Movrin I. Cemented versus uncemented hemiarthroplasty for displaced femoral neck fractures: a randomized controlled trial with two years follow-up. *Acta orthopaedica et traumatologica turcica*. 2020 Jan; 54(1):83.