ORIGINAL ARTICLE

Evaluation of the effect of proximal femur geometry on results of geriatric intertrochanteric fracture surgery

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ABSTRACT

BACKGROUND: This study aimed to explore the relationship between the complications and clinical outcomes after intertrochanteric femoral fracture surgery, and the Singh index (SI), canal-calcar ratio (CCR), cortical thickness index (CTI), and canal flare index (CFI) – the radiological indices defining proximal femoral morphology in the literature – among patients over 60 years of age.

METHODS: The data of 350 patients who were operated between 2015 and 2019 were evaluated retrospectively. The study included patients who underwent dual lag screw proximal femoral nailing and had good intraoperative reduction quality according to Fogagnolo's criteria. The relationships among radiological indices measured on radiographs acquired after trauma, and post-operative complications, Barthel activity index, and Harris hip score (HHS) were assessed statistically.

RESULTS: Among 121 patients who met the study criteria, there were 63 (52.07%) female and 58 (47.93%) male patients. The mean length of follow-up was 37.09 (36–60) months. The patients had a mean age of 79.78 (60–97) years. At least one mechanical complication developed in 32 (26.4%) patients in the study group. No significant relationship could be established between radiological indices and post-operative complications ($p>0.05$). The relationship between SI and HHS was statistically significant ($p<0.05$). CCR, CTI, and CFI did not have a statistically significant relationship with and HHS ($p>0.05$).

CONCLUSION: No statistically significant relationship could be established between radiological indices and post-operative complications. It should be considered that SI may be a parameter that affects clinical outcomes.

Keywords: Femur; fracture; hip; index; radiological; singh.

INTRODUCTION

Hip fracture is a significant public health problem because of its destructible effect on the geriatric population.[1] One of the reasons for this situation is that 1 year mortality rate after hip fracture can access to 36%.[2] In addition, complications such as implant-related complications, delirium, cardiac problems, vascular thromboembolism, and wound infection can be seen at rates of up to 26%.[3] Most patients experience functional losses in their quality of life and deterioration in activities of daily living.[4] The difficult part of hip fracture management in elderly population is that, in addition to fracture management, it includes perioperative and post-operative care, functional rehabilitation, prevention of secondary falls, and management of comorbidities.[5]

Intertrochanteric fractures are a subgroup of hip fractures, accounting for 42% of all hip fractures.[6] Although low-energy traumas such as simple falls are the prominent etiological factor for elderly population, osteoporotic fracture is a significant predisposing risk factor.[7]

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Treatment options for fractures are conservative or surgical, but the main goal of treatment should be to mobilize the patient as soon as possible and to reduce morbidity and mortality.[8] The choice of implant in surgical processes may vary. Among these options, proximal femoral nailing (PFN) is an effective method that enables early mobilization and weight-bearing.[9] Besides surgical option and operation, post-operative complications should be managed well.

Literature studies show that the head-neck angle, neck length, and cortical thickness values, which constitute the femoral proximal geometry, are directly related to the occurrence of hip fractures.[10] In addition, proximal morphology of the femur is associated with the risk of post-fracture mortality.[11] Singh index (SI), canal-calcar ratio (CCR), cortical thickness index (CTI), and canal flare index (CFI) are radiological indices that describe proximal femur morphology.[12,13] These indices have been shown to be directly related to osteoporosis and fracture risk. In the literature, radiological parameters that are directly related to complications after hip fractures such as head-neck angle and tip-apex distance, which define the relationship of the implant with the center of the femoral head, have been described.[14,15] Tip-apex distance and head-neck angle are measurements that can be evaluated intraoperatively. Radiological measurements defining the proximal femur morphology are a pre-operative evaluation and predictive factors are very important in terms of complications in orthopedic surgery.

Table 1. Patients and groups evaluated within the scope of the study

		n	%
Evans-Jensen fracture subtype	1	65	18.5
	2	120	34.28
	3	30	8.6
	4	95	27.22
	5	30	8.6
	Reverse	10	2.8
Fracture pattern	Stable	215	61.42
	Unstable	135	38.57

We did not find any study on the existence of a relationship between complications and radiological indices. In this study, our aim is to examine the relationship between the post-operative complications, and the SI, CCR, CTI, and CFI among patients aged ≥60 years, who underwent PFN after intertrochanteric fracture of femur due to simple falls.

MATERIALS AND METHODS

Within the scope of the study, the data of 350 patients who were operated for intertrochanteric fractures of femur between 2015 and 2019 were analyzed retrospectively (Table 1). Our research was conducted in accordance with the Declaration of Helsinki, and approval was obtained from the Ethics Committee. Among the patients who were operated using a dual lag screw trochanteric proximal femoral nail and had good intraoperative fracture reduction according to the Fogagnolo's criteria[16] were included in the study. The study exclusion criteria were determined as having a type of trauma other than simple fall, receiving an implant other than dual lag screw PFN, having pathological fractures, having a body mass index of ≥35, being <60 years of age, having poor fracture reduction according to Fogagnolo's criteria, having no clinical scoring assessment due to neurological deficits, having no follow-up data, and having unavailable data of follow-up for more than 36 months (Table 2).

Outpatient follow-up and control examination data of 121 study patients were reviewed. Of these patients with at least 36 months of follow-up; age, sex, side of trauma, pre-operative and post-operative length of hospital stay, type of trauma, comorbidities, type of fracture according to the Evans-Jensen classification, quality of reduction, subchondral distance of the screws, post-operative complications, and collodiaphyseal angle (CDA) at pre-operative and post-operative follow-up visits were measured. The Evans-Jensen fracture pattern types 1, 2, and 3 were evaluated as stable, types 4 and 5 and also reverse oblique fractures as unstable.[17] In addition, clinical outcomes were assessed by the Barthel activity index (BI)

Table 2. Inclusion and exclusion criteria

Inclusion	Exclusion
Operating with dual lag screw trochanteric proximal femoral nail	Operating with a different type of proximal femoral nail
Good fracture reduction to fogagnolo's crtieria	Having pathological fractures
	Body mass index ≥35
	Age <60
	Poor fracture reduction according to Fogagnolo's criteria
	Patient with neurological deficit
	Patients without 36-month follow-up data

and Harris hip scoring system (HHS) measured before the trauma and at 6-month follow-up visit. BI is an ordinal scale that assesses the actual performance in 10 basic activities of daily life such as dressing, grooming, and mobility.[18] HHS is a clinical scoring system that basically measures pain, function, deformity, and range of motion.[19]

In addition, the radiological indices SI, CCR, CTI, and CFI were measured and recorded by two independent orthopedic surgeons based on the pre-operative AP radiographs of the intact hip. SI is a scale that shows trabecular bone loss on plain radiographs and is graded from 1 to 6 by looking at the trabecular patterns in the proximal femur.[20] The trabecular lines in the proximal femur are evaluated with the help of radiography, and the scale is graded and the level of osteoporosis is determined (Fig. 1).[21] For CCR, lines are drawn 10 cm and 3 cm distal to the mid-lesser trochanter line followed by drawing secondary lines intersecting proximally at the distal. The ratio of the distance in the middle in the lesser trochanter to the distal medulla gives the CCR (Fig. 2a).[22] CTI is calculated by dividing the cortical and medullary measurement differences 10 cm distal to the mid-lesser trochanter line by the medulla (Fig. 2b).[22] CFI is the ratios of the medulla at a distance 2 cm proximal and 10 cm distal to the mid-lesser trochanter line (Fig. 2c).[23]

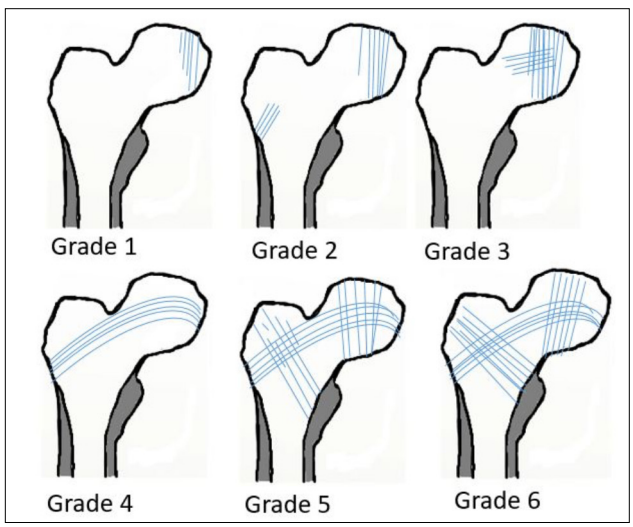

Figure 1. Singh index.

The distance to the subchondral distance was measured according to the inferior lag screw and recorded. The head-neck angle was measured by evaluating the angles between the femoral diaphysis and the axes parallel to the femoral neck. Of the patients with fractures, the contralateral intact hip angle and the head-and-neck angles of the fractured hip in the immediate post-operative period and at month 6 were measured and recorded. These measurements were made by two different observers. During the post-operative assessment of varus, a change of ≤5 degrees in the head-and-neck angle was considered good, 5–10 degrees acceptable, and a change of ≥10 degrees was considered poor outcome, as a varus complication.[24]

Surgical Technique

All patients were intravenously administered 1 g prophylactic first-generation cephalosporin at least 30 min before the operation. The patients were draped in the lateral decubitus position with the fractured side on top. The reduction was checked with AP and lateral views under fluoroscopy, and a nail suitable for the proximal medullary diameter of the femur of each patient was placed. The procedure was completed on placing two 6.5 mm thick nails into the femoral head and two 4.5 mm distal locking screws distal to the nail. The patients were mobilized using a walker on post-operative day 1, and full weight-bearing mobilization was initiated after week 6. The use of prophylactic low-molecular-weight heparin was recommended for 1 month. The same design femoral proximal nail was used in all patients and all surgeries were performed by two orthopedic surgeons affiliated with our department.

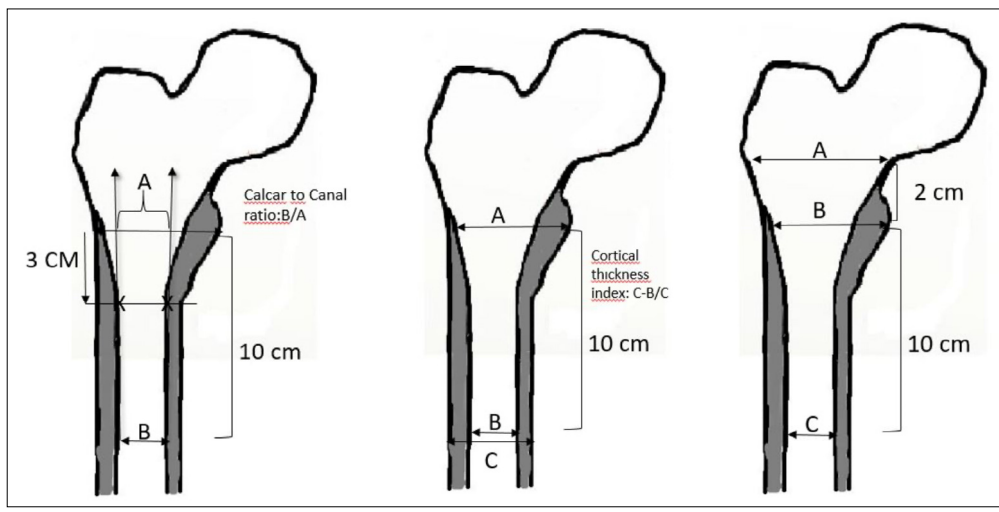

Figure 2. (a) Canal-calcar ratio. **(b)** Cortical thickness index. **(c)** Canal flare index, CFI=A/C.

Statistical Analysis

Descriptive statistics of the study data were presented as mean and standard deviation for continuous variables, and frequency and percentage for categorical variables. Independent samples t-test was used to compare numerical variables according to categorical variables with two groups, while the paired samples t-test was used to compare the pre-operative and post-operative values of the same numerical variable. In addition, the Chi-square test was used to analyze the relationships among categorical variables. Moreover, the Pearson's correlation analysis was used to assess the relationships among numerical variables. All analyses were conducted using SPSS 22.0 software package. A significance level of $p<0.05$ was chosen.

RESULTS

According to the demographic evaluation of 121 study patients, there were 63 (52.07%) female and 58 (47.93) male patients. The mean length of follow-up was 37.09 (36–60) months. The mean age of the patients was 79.78 years. Regarding the side of fracture, 54 (44.63) patients had a fracture on the right and 67 (55.37) patients on the left side. When the length of hospital stay of the patients was examined, the mean total length of hospital stay was 6.39 (2–19) days. The evaluation of comorbidities showed no comorbidity in 31 (25.6%) patients and at least 1 comorbidity in 90 (74.4%) patients. When evaluated according to the Evans-Jensen fracture classification, there were 22 (18.2%) cases with type 1, 45 (37.2) cases with type 2, 7 (5.8%) cases with type 3, 35 (28.9%) cases with type 4, 8 (6.6) cases with type 5, and 4 (3.3%) cases with type R fractures. In addition, according to the Evans-Jensen classification, 74 (61.2%) patients had a stable fracture pattern and 47 (38.8) patients had an unstable fracture pattern. The distribution of complications revealed non-union in 2 (1.65%) patients, rotational union in 8 (6.61%) patients, cutout in 6 (4.96%) patients, unacceptable reduction loss in three patients at the 1st month post-operative control, and other complications are given in Table 3. Thirty-four patients died within 1 year and the 1-year mortality rate was 28%. In addition, complication rates and 1-year mortality rates according to whether the fracture patterns are stable or unstable are given in Table 3. In the follow-up of the patients in the study group, it was seen that 87 patients continued to live at the end of the 1st year. Sixteen patients died during follow-up and the 2-year mortality rate was 41.32%. In the follow-up of 87 patients who survived at the end of the 1st year, chronic renal failure developed in 2 patients (2.29%), 4 patients (4.59%) received treatment for recurrent urinary tract infections, cardiac pathologies were detected in 5 patients (5.74%), and there were no implant-related complications. Looking at the patient data, it was seen that 15 more patients died in the 3rd year follow-up, and the 3-year mortality rate was 53.71%.

Within the scope of the study, the mean tip-apex distance was 15.95 (8–30) mm. When evaluated according to SI, 12 (9.9%) patients were Grade 1, 19 (15.7%) patients Grade 2, 21 (17.4%) patients Grade 3, 26 (21.5%) patients Grade 4, 26 (21.5%) patients Grade 5, and 17 (14%) patients were Grade 6. The mean CCR value was 0.67 (0.46–0.88), the mean CTI value was 0.45 (0.20–0.65), and the mean CFI value was 2.81 (1.71–3.78). In addition, the mean pre-operative BI was 18 (14–20), the mean BI at post-operative month 6 was 15.41 (10–20), and the mean HHS was 73.80 (55–90). When we examined the CDA values, the mean CDA of the intact hip was 130.89° (122°–138°) on the post-traumatic radiographs, the mean CDA of the operated hip was 131.35° (120°–140°)

Table 3. Complications and mortality ratio

Complications	n	%	Fracture pattern stable (n=74)	%	Fracture pattern unstable (n=47)	%
Fissure in distal femur	2	1.65	2	2.7	0	0
Nonunion	2	1.65	1	1.3	1	2.12
Rotational union	8	6.61	5	6.75	3	6.38
Deep vein thrombosis	5	4.13	3	4.05	2	4.25
Cut-out	6	4.96	4	5.40	2	4.25
Lateral migration	5	4.13	2	2.7	3	6.38
Z-effect	7	5.79	4	5.40	3	6.38
Unacceptable reduction	3	2.48	2	2.7	1	2.12
Varus	15	12.4	9	12.16	6	12.7
Infection	4	3.31	3	4.05	1	2.12
Implant failure	1	0.8	1	1.3	0	0
1 year mortality	34	28	21	28.37	13	27.65
2 year mortality	50	41.32	30	40.54	20	42.55
3 year mortality	65	53.71	42	56.75	23	48.93

Table 4. Mean values of radiologic indices, BI, HHS and CDA

	Mean values		
	Study group (n=121)	**Stable fracture pattern group (n=74)**	**Unstable fracture pattern group (n=47)**
SI	3.71 (1–6)	3.68 (1–6)	3.74 (1–6)
CCR	0.67 (0.46–0.88)	0.68 (0.46–0.88)	0.65 (0.50–0.86)
CTI	0.45 (0.20–0.65)	0.44 (0.2–0.61)	0.46 (0.26–0.65)
CFI	2.81 (1.71–3.78)	2.81 (1.71–3.78)	2.81 (2–3.5)
BI	15.41 (10–20)	16.14 (10–20)	14.25 (10–18)
HHS	73.80 (55–90)	75.97 (55–95)	70.65 (57–85)
Postoperative CDA	130.89 (125–135)	131.02 (125–135)	130.68 (125–135)
Postoperative 6. month CDA	128.38 (110–136)	128.78 (115–136)	127.74 (110–135)

SI: Singh Index; CCR: Canal-Calcar Ratio; CTI: Cortical Thickness Index; CFI: Canal Flare Index; BI: Barthel Activity Index; HHS: Harris Hip Score; CDA: Collo-diaphyseal angle.

on the post-operative radiographs, and the mean CDA of the operated hip was 128.38° (110°–136°) at the post-operative 6-month follow-up (Table 4).

When we examined the relationship between the development of at least one complication among the study group patients and the radiological indices, no statistically significant correlation was established between SI, CCR, CTI, CFI, and the development of complications ($p>0.05$) (Table 5).

If we look at the relationship between SI, CCR, CTI, CFI, and clinical scores, there was a positive and significant correlation between SI and HHS ($p<0.05$). No statistically significant correlation was established between other radiological indices and clinical scores (Table 6). Regarding the relationship between radiological indices and post-operative 1-year mortality, no statistically significant relationship could be established ($p>0.05$).

There was no statistically significant relationship between the occurrence of mechanical complications, the type of fracture, the pattern of the fracture (stable or unstable), and the tip-apex distance ($p>0.05$). The pre-operative and post-operative 6-month values of BI were compared, revealing a statistically significant decrease in the index values at post-operative month 6 ($p<0.05$). When the relationship between CDA change and sex was evaluated, no statistically significant relationship was established. The mean fracture healing in the study group was 15.86 (12–20) weeks. It was 14.79 (12–17) weeks in the stable fracture pattern group and 17.55 (15–23) weeks in the unstable fracture pattern group. There was early reduction loss in two patients in the stable fracture pattern group and one patient in the unstable fracture pattern group, and these patients underwent revision surgery with the same system PFN system. Fracture union was delayed in two patients in total and it was accepted as non-union. These patients were operated with a bipolar partial hip prosthesis system. One patient who developed implant failure underwent revision surgery and the intraoperative surgeon's choice was bipolar system partial hip replacement. In six patients with cutout, the problem was the superior screw and the screw length was revised to remain within the femoral head. The Z-effect was detected in seven patients and it was observed that it did not interfere with osteosynthesis. Screw revision

Table 5. Relationship between mechanical complications and indices

	Mechanical complication	**N**	**Mean±SD**	**p-value**
SI	No	89	3.71±1.54	0.973
	Yes	32	3.72±1.61	
CCR	No	89	0.66±0.09	0.22
	Yes	32	0.69±0.08	
CTI	No	89	0.46±0.08	0.429
	Yes	32	0.45±0.09	
CFI	No	89	2.82±0.42	0.678
	Yes	32	2.79±0.37	

SI: Singh Index; CCR: Canal-Calcar Ratio; CTI: Cortical Thickness Index; CFI: Canal Flare Index; SD: Standard deviation.

Table 6. Relationship between radiological indices and scoring systems

Radiological indices		**Postop BI**	**HHS**
SI	p-value	0.148	0.016
CCR	p-value	0.661	0.92
CTI	p-value	0.461	0.226
CFI	p-value	0.165	0.503

SI: Singh Index; CCR: Canal-Calcar Ratio; CTI: Cortical Thickness Index; CFI: Canal Flare Index; BI: Barthel Activity Index; HHS: Harris Hip Score.

was performed in patients with hip pain in these cases with radiological union. Asymptomatic cases were followed only.

DISCUSSION

In this study, we examined the relationship between post-operative complications following intertrochanteric fractures, and SI, CCR, CTI, and CFI in the geriatric patient group. We evaluated the patients with good intraoperative reduction quality on the use of dual lag screw implants and assessed their clinical outcomes together with post-operative follow-up, complications, BI, and HPS. Our results showed that radiological indices did not have a statistically significant relationship with complications and clinical scores.

In our study, the cause was simple fall in all patients, and the number of women was higher in the patient population. According to the literature, simple fall is the cause in 90% of cases with intertrochanteric fracture of femur.[25] In addition, studies draw attention to the increased rate of female patients in the fracture population due to the increased incidence of postmenopausal osteoporosis.[26]

The quality of reduction according to the Fogagnolo's criteria was found to be good in all our study patients. Since the quality of reduction is a parameter that directly affects the outcomes, only patients who underwent dual lag screw PFN and had well-reduced fractures were included in the assessment for the homogeneity of the study. An unstable fracture pattern makes it difficult to achieve anatomical reduction. Therefore, the number of patients with a stable fracture pattern was higher (n=74, 61%) compared to 47 (38%) patients with an unstable fracture pattern. The choice of implant may vary, especially in Evans-Jensen Type 5 and Type R fractures, and long system implants may be required. Therefore, the number of patients in this group was lower.

Studies have demonstrated the relationship between intertrochanteric fractures of femur and osteoporosis.[27] As well, osteoporosis has been considered a parameter that directly affects the outcome of intertrochanteric fractures.[28] SI was described by Singh in 1970 and is determined by evaluating the trabecular lines proximal to the femur.[29] There are studies in the literature reporting that SI is closely associated with osteoporosis and bone mineral density.[29,30] CCR and CTI were described by Dorr et al.[31] and although these indices were initially associated with the choice of prosthesis in arthroplasty applications, studies have been conducted later in the literature on the relationship of these indices with osteoporosis and bone quality.[32] CFI is an index described by Noble et al.[33] and has been used in assessments on component selection in arthroplasty, but literature data have demonstrated its relationship with osteoporosis, aging, and bone mineral balance. When we examined the relationship between post-operative complications and radiological indices, we could not establish any statistically significant relationship of SI, CCR, CTI, and CFI with distal femoral fissure, non-union, rotational union, varus union, development of pulmonary embolism, cutout, lateral migration of screws, Z-effect, loss of reduction in an unacceptable position, development of infection, and implant failure. When we examined the radiological index assessments of 15 patients who developed varus, eight patients with rotational union, and two patients with non-union, we found the four indices of the patients with complications to be proportioned in parallel with each other compared to the group without complications. We believe that the correlation between these complications and the indices should be taken into consideration.

When we examined the relationship of radiological indices with SI and HSS at post-operative month 6, we found a significant relationship ($p=0.016$) between SI and HSS. We did not establish any relationship between the other indices and clinical scores. We believe that the trabecular bone morphology of the proximal femur had a positive effect on the clinical scoring results. In addition, our study data showed that the correlation between the BI and HSS was significant ($p<0.05$).

Our study data further showed that SI, CCR, CTI, and CFI had no statistically significant relationship with 1-year mortality. In addition, the post-operative 1st year mortality rate was 28% and the 2nd year mortality rate was 41.32% in our study. Results were similar in stable and unstable fracture pattern groups. Despite the studies in the literature reporting a mortality rate up to 39%, Tierney et al.[34] reported that the 1-year mortality could be 15–40%.[35] We observed that our results were consistent with the literature. Besides, we believe that there are different factors that influence mortality.

When we evaluated mechanical complications, the rate of developing at least one mechanical complication was found to be 26.44% in our study. Literature data have shown that the PFN complication rates and the need for revision can range from 3% to 28%.[16,36]

When we examined the relationship between fracture patterns and mechanical complications, mechanical complications were observed in 24% of patients with stable fractures and 29% of those with unstable fractures in our study. This difference was statistically insignificant. However, our study only included the patient group undergoing anatomical reduction. Therefore, even if the fracture is unstable, we can say that the risk of complications decreases with anatomical reduction.

Unstable intertrochanteric fracture management is a complex process.[37] Although the debate continues on treatment options for unstable intertrochanteric fractures, the biomechanical advantages of PFN have been demonstrated in many studies.[38] In addition, Kovalak et al.[39] suggested that although proximal femoral locking plates are not the first choice in the treatment of unstable intertrochanteric fractures, they can be an alternative to PFN and other conventional plates.

A statistically significant decrease was observed in the BI values of our study patients between pre-traumatic and post-operative 6-month values. The data in the literature indicate that BI decreases significantly after surgery in a large portion of patients.[40] This situation in intertrochanteric fractures shows how important it is to prepare patients for mobilization after treatment. Otherwise, it is likely to predict a serious reduction in the quality of life.

The statistically significant change in CDA values between post-operative and month 6 indicates the varus tendency in intertrochanteric fractures. This result was determined in accordance with the literature.[41,42] Regardless of the implant type, varus can develop in intertrochanteric fractures of femur. Thus, we believe that fixing intertrochanteric fractures of femur as much as the CDA of the contralateral hip or at a low degree of valgus in the fixation phase may prevent the development of varus. Open fractures were not included in our study, and the literature also reported the difficulties of treatment in open fractures involving different extremities.[43]

The retrospective nature of the study is one of the limitations. Another limiting factor is the number of patients and the radiological measurement techniques used. On the other hand, there is no study in the literature on the relationship between radiological indices and complications. In this regard, this research has been a study trying to provide a different perspective.

Conclusion

No relationship could be established between SI, CCR, CTI, CFI, and complications after intertrochanteric fractures of femur. There is a significant relationship between SI and HSS, which affects clinical outcomes. Relationships with radiological indices and post-operative processes are worthy of consideration.

Ethics Committee Approval: This study was approved by the Gaziantep University Clinical Research Ethics Committee (Date: 06.01.2021, Decision No: 2021/02).

Peer-review: Externally peer-reviewed.

Authorship Contributions: Concept: B.B.; Design: B.K., S.G., O.B.; Supervision: B.B., O.B., S.G.; Resource: B.B., V.K., B.K; Materials: B.B., S.G.; Data: B.B., S.G.; Analysis: B.B.; Literature search: B.B., V.K.; Writing: B.B.; Critical revision: B.B., O.B.

Conflict of Interest: None declared.

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ORİJİNAL ÇALIŞMA - *ÖZ*

Proksimal femur geometrisinin geriatrik intertrokanterik kırık cerrahisi sonuçlarına etkisinin değerlendirilmesi

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AMAÇ: Bu çalışmada amacımız 60 yaş üstü hastalarda femur intertrokanterik kırık cerrahisi sonrası yaşanan komplikasyonlar ve klinik sonuçlar ile literatürde femur proksimal morfolojisini tanımlayan radyolojik indeksler olan Singh Index (SI), Canal Calcar Ratio (CCR), Cortical Thickness İndex (CTI), Canal Flare İndex (CFI) arasındaki ilişkiyi incelemektir.

GEREÇ VE YÖNTEM: 2015–2019 yılları arasında ameliyat edilen 350 hastanın çalışma verileri geriye dönük olarak değerlendirildi. Çiftlag vidalı proksimal femoral çivileme yapılan ve intraop redüksiyon kalitesi fogagnolo kriterlerine göre iyi olan hastalar çalışma kapsamına alındı. Travma sonrası çekilen xrayler üzerinden ölçümleri yapılan radyolojik indeksler ile ameliyat sonrası komplikasyonlar, Barthel Aktivite İndeksi ve Harris Kalça Skorlaması arasındaki ilişki istatistiksel olarak değerlendirildi.

BULGULAR: Çalışma kriterlerine uyan 121 hastanın 63'ü kadın (%52.07) ve 58'i (%47.93) erkekti. Ortalama takip süresi 37.09 ay (36–60) olarak değerlendirildi. Hastaların yaşlarına baktığımızda ise; ortalama yaş 79.78 (60–97) idi. Çalışma grubundan 32 hastada (%26.4) en az bir mekanik komplikasyon gelişti. Radyolojik indeksler ve ameliyat sonrası komplikasyonlar arasında anlamlı ilişki kurulamadı (p>0.05). SI ile Harris kalça skorlaması arasındaki ilişki istatistiksel olarak anlamlıydı (p<0.05). CCR, CTI VE CFI ile Barthel Aktivite İndeksi ve Harris Kalça Skorlaması arasındaki ilişki istatistiksel olarak anlamlı değildi (p>0.05).

TARTIŞMA: Radyolojik indeksler ile ameliyat sonrası komplikasyonlar arasında istatistiksel olarak anlamlı ilişki kurulamamıştır. SI'nin klinik sonuçları etkileyen bir parametre olabileceği göz önünde bulundurulmalıdır.

Anahtar sözcükler: Femur; indeks; kalça; kırık; radyolojik; singh.

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