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Evaluate Intraoperative Variables and Postoperative Outcomes of Intertrochanteric Fractures with Vulnerable/Broken Lateral Wall Managed with Short and Long Cephalomedullary Nail

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ABSTRACT

Purpose: To evaluate intraoperative variables and postoperative outcomes of intertrochanteric fractures with vulnerable/broken lateral wall managed with short and long cephalomedullary nail. **Materials and Methods:** Twenty prospective cases of patients treated with LCMN and twenty retrospective cases treated with SCMN were included in the study. Intraoperative variables compared were duration of surgery, blood loss during surgery, and surgeon's perception of surgery. Functional outcome was assessed by Parker Palmer mobility score (PPMS), Harris hip score (HHS), and Short Form-12 at one year. Radiological assessment were done at six months/one year to look for progress of fracture union, change in neck shaft angle and any signs of implant failure. **Results:** Duration of surgery (p<0.001), blood loss during surgery (p=0.002) and surgeon's perception of surgery (p=0.002) were significantly more in the LCMN group. The LCMN group had better functional outcome. HHS for the LCMN group was 89.15±9.53 and for the SCMN group it was 81.53±13.21 (p=0.021). PPMS for LCMN group was 8.85± 0.67 and for the SCMN group was 7.53±1.807 (p=0.005). There were four implant failures in the LCMN group as compared to none in the SCMN group (p=0.036). **Conclusion:** Both SCMN and LCMN are effective treatment modality for unstable intertrochanteric fractures with vulnerable/broken lateral wall and in the absence of larger study and long term follow up the superiority of one implant over the other cannot be recommended.

Key words: Unstable intertrochanteric fractures, Long cephalomedullary nail, Short cephalomedullary nail, Harris Hip score, Parker palmer mobility score, short form-12.

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INTRODUCTION

Cephalomedullary nail has gained popularity since last few decades but there have been concerns regarding the use of long and short cephalomedullary nails in intramedullary fixation for intertrochanteric fracture.[1] There is paucity of literature comparing short cephalomedullary nail (SCMN) and long cephalomedullary nail (LCMN) in intertrochanteric fractures with vulnerable/broken lateral wall (AO31A2.2 to AO 31A3.3).[2] There was no pre-established treatment protocol in choosing long nail or short nail for these femoral intertrochanteric fractures. The present study is designed to evaluate intraoperative variables and postoperative outcomes of intertrochanteric fractures with vulnerable/broken lateral wall managed with SCMN and LCMN.

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MATERIALS AND METHODS

Twenty prospective cases of patients treated with LCMN and twenty retrospective cases treated with SCMN following institutional ethcal clearance were included in the study.

Inclusion Criteria of the study included Adults (>18yrs) of either sex, AO: 31A2.2 to 31A3.3 intertrochanteric fractures, isolated fractures, and patients operated within 3 weeks of injury. The exclusion criteria were: open intertrochanteric fractures, pathological fracture, pure sub trochanteric fractures and intertrochanteric fracture with significant distal extension (>3 cm).

Methodology

Standard Radiographs in the anteroposterior (AP) view of the pelvis with both hips and lateral view were obtained, and all fractures were categorized according to the AO/ASIF classification (Table 1).[3] American Society of anaesthesiologists (ASA)[4] grade and Parker Palmer mobility score[5] (PPMS) were determined pre-operatively. Patient were operated with LCMN (Green Surgicals, Gujarat, India). The Intraoperative parameters that were documented were; Duration of surgery, blood loss during surgery and surgeon's perception of surgery. At the end of one year functional outcome were assessed by; Harris Hip score[6] (HHS), Parker Palmer mobility score[5] (pre-surgery and at one year) and SF-12.[7] Radiological assessment were done at six months/one year to look for progress of fracture union, change in neck shaft angle and any signs of implant failure. Reoperation rate was seen at the end of six months/ one year. Union was defined as bridging callus in three or more cortices on AP and lateral radiographs with ability to bear full weight on the extremity. Implant failure was defined as varus collapse, screw cutout, implant breakage, screw back out, un-united fracture. This group was compared with a group of patients with the same inclusion and exclusion criteria operated by SCMN (Green Surgicals, Gujarat, India) previously in the same department.[8]

Statistical analysis

Keeping HHS as the primary variable, 80%as power of study, 10% as loss to follow up and 10% anticipated mortality rate, we got 40 as the sample size for our study. Mann-Whitney U test was used to compare parametric variables between two groups. Chi-square test was used for categorical variables. A p value of less than 0.05 was taken as significant.

RESULTS

Following results were obtained.

Forty patients (20 in either group) were included in study population.

The difference for mean duration of surgery, mean blood loss and surgeon's perception of surgery was found to be statistically significant.

Only 19 patients of LCMN group (Figure 1) and 17 patients of SCMN (Figure 2) were available for evaluation of functional outcome at one year follow-up. In the SCMN group two cases were lost to follow up, and one patient had failure due to technical reasons for which revision surgery was done. In the LCMN group one patient (Figure 1) had not shown union by six months and patient was offered revision surgery as rescue treatment. (Table 2)

In SCMN group all the 17 available patients had radiological union. No implant failures were observed in SCMN group, but there were 4 implant failures in LCMN group i.e. 3 varus collapse and one ununited fracture (Table 2).

Table 1: Demographic profile of the patients.

Study group		SCMN (*n*=20)	LCMN (*n*=20)	Total (*n*=40)	*p* value
Age (mean) in years		55.55 ± 17.09	55.25±20.40	55.40	0.525*
Sex	Male	10	15	25	0.185#
	Female	10	5	15	
Fracture classification (AO type)	A2.2/A2.3	8	9	17	0.749#
	A3	12	11	23	
ASA Grade	I	8	20	28	<0.0001#
	II	12	0	12	
	III	0	0	0	

**P* value as calculated by Mann-Whitney U test
#*P* value as calculated by chi square test
SCMN (short cephalomedullary nail)
LCMN (long cephalomedullary nail)

Table 2: Intra-operative Variables, functional outcome and Radiological outcomes in both groups.

Intra-operative Variables		SCMN	LCMN	*P* value
Duration of surgery (minutes)		64.30 ± 21.40	119.00 ± 37.64	<0.001*
Amount of blood loss during surgery(ml)		316 ± 143.98	350± 139.21	0.002*
Surgeon's perception of surgery		12 easy 8 moderately difficult	3 easy 14 moderately difficult 3 difficult	0.002#
Parker palmer mobility score		7.53±1.807	8.85±0.67	0.005*
Harris Hip score		81.53±13.21	89.15±9.53	0.021*
SF-12¥	PCS§	41.83±12.28	41.89±9.99	0.81*
	MCS§	57.52±3.99	57.74±3.87	0.64*
Fracture union		All cases united	One case not united at six month follow up	.71#
Implant failure		0	4	.036*
Loss of neck shaft angle (degrees)		0.22	4.70	.047*

*P value as calculated by Mann-Whitney U test
#P value as calculated by chi square test
SCMN (shortcephalomedullary nail)
LCMN (long cephalomedullary nail)
¥ SF-12 Short form 12
§ PCS (physical component summary),
§MCS (mental component summary)

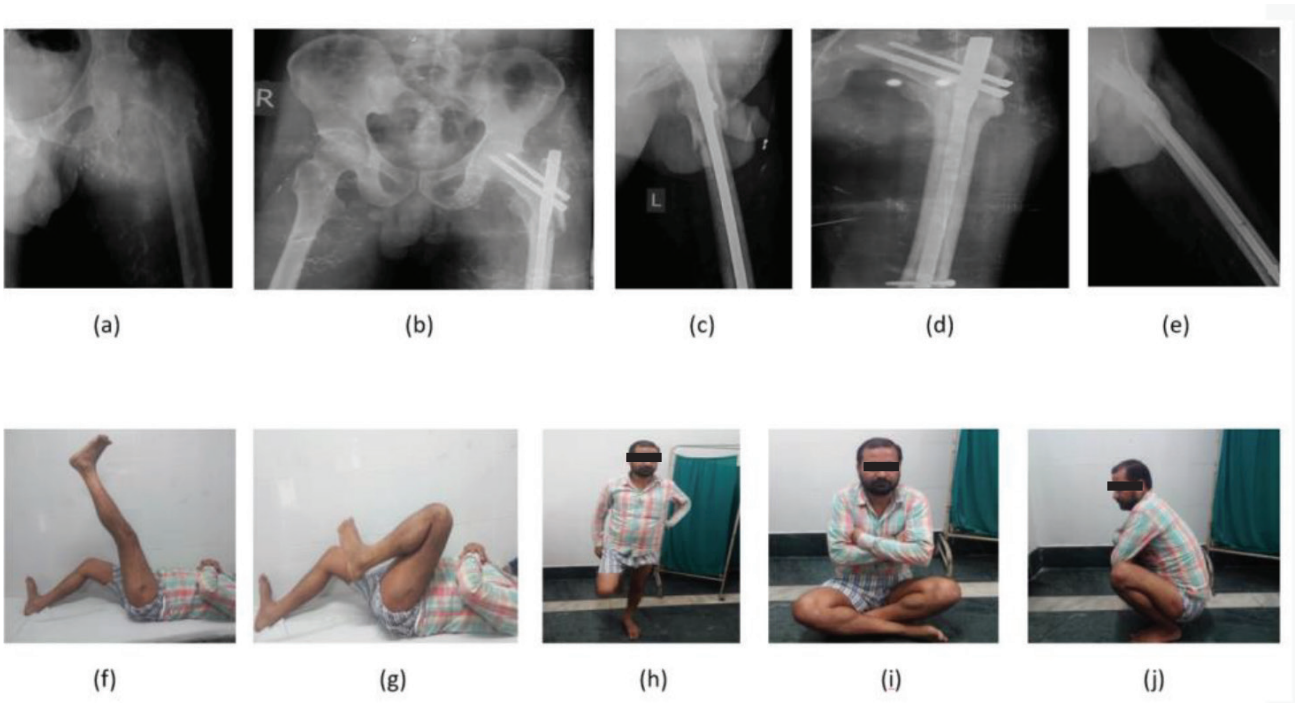

Figure 1 a: Radiograph of left hip showing AO31A3.1 fracture.
Figure 1 b,c: Immediate post-operative radiographs showing LCMN in both AP and lateral views.
Figure 1 d,e: Six month follow up showing radiological union in both AP and lateral views.
Figure 1 f-j: Clinical photographs showing straight leg raising, hip flexion, single leg stance, squatting and sitting cross legged at six month follow up.

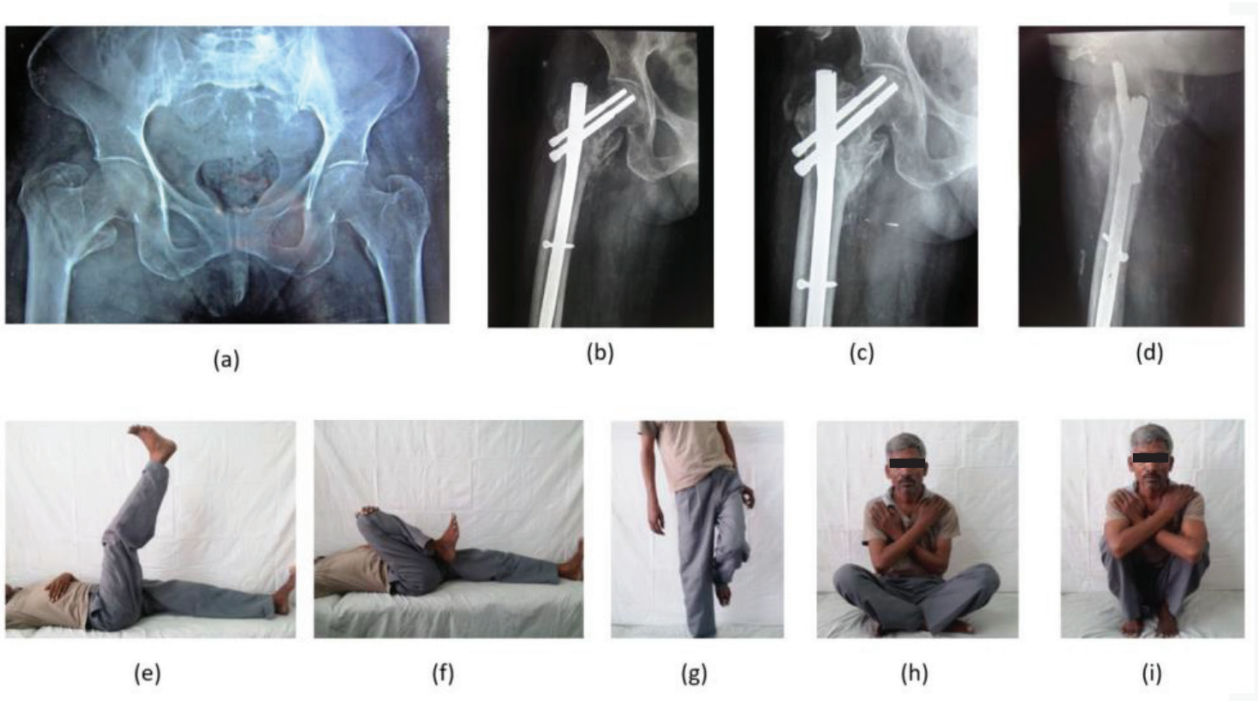

Figure 2 a: Radiograph of right hip showing AO31A2.3 fracture.
Figure 2 b: Immediate post-operative radiograph showing SCMN in AP view.
Figure 2 c,d: Six month follow up showing radiological union in both AP and lateral views.
Figure 2 e-i: Clinical photographs showing straight leg raising, hip flexion, single leg stance, and sitting cross legged and squatting at six month follow up.

Neck shaft angle was observed to see for varus collapse at fracture site in both study groups. However when the three patients of LCMN group who had varus collapse were excluded from this analysis there was no statistically significant difference (p=0.087).

Comparison of variables with other studies was found statistically significant as shown in Table 3.

DISCUSSION

In the current study the duration of surgery and amount of blood loss was higher for the LCMN group. The surgeon's perception of surgery was more difficult for LCMN group. The functional outcomes at one-year follow- up (HHS, PPMS) was better in LCMN group. The radiological outcome at one-year follow- up (implant failure and loss of neck shaft angle) was better in SCMN group.

In the current series the patients were relatively younger in contrast to previous published studies.[1,9-12] Only AO31A2.2 to AO31A3.3 were included in the current study. However some authors only considered AO31A1.1 to AO31A2.3.[1,9,10]

The duration of surgery of current study were comparable to other series[1,9-11] (Table 3). The statistically significant longer duration of surgery in LCMN group as compared to the SCMN is probably due to the use of free hand distal locking in LCMN vs jig hand distal lock in SCMN and more cannal reaming in LCMN as compared to SCMN.

The current study had greater amount of blood loss for both groups when compared to literature[1,9-11] (Table 3). The longer duration of surgery, free hand distal locking, and more reaming of intramedullary canal were probably the reasons for increased blood loss in LCMN group compared to SCMN group in our study. The quantification of amount of blood loss during surgery also has an element of subjectivity.[9]

To the best of our knowledge the surgeon's perception of difficulty in surgery has not been analysed in previously published literature except one.[8] Significant difference between the groups were found. The probable reason behind this may be free hand distal locking in LCMN group vs jig hand distal lock in SCMN group.

There were no previous published studies comparing PPMS and SF-12 between two groups and only two studies by Li *et al.*[11] and Paramar *et al.*[12] compared HHS between two groups of patient treated by long and short cephalomedullary nail. The reason of mean PPMS of LCMN(8.85) is better than SCMN(7.53) is

Table 3: Comparison of variables with other studies.

Variables		Series	Boone *et al.*[9]	Paramar *et al.*[12]	Hou *et al.*[1]	Guo *et al.*[10]	Li *et al.*[11]	Current study
Duration of surgery		SCMN (min.)	44	70	41	43.5	69	64.3
LCMN (min.)			56.8	69	61	58.5	77	119
p value			<0.001	-	< 0.05	0.002	0.063	<0.001*
Blood loss during surgery		SCMN(ml)	92.6	250	100	90.7	69.95	316
LCMN(ml)			135.5	250	135	127.8	77.97	350
p value			0.002	-	0.031	0.004	0.063	0.002*
Harris hip score		SCMN	NR	>60, 43/52	NR	NR	76.16	81.53
LCMN			NR	>60, 67/72	NR	NR	79.98	89.15
p value			–	–	–	-	0.28	0.021*
PPMS	Pre injury	SCMN	NR	NR	NR	NR	NR	8.55
		LCMN	NR	NR	NR	NR	NR	8.70
		p value	-	-	-	-	-	0.15*
	One year follow-up	SCMN	NR	NR	NR	NR	NR	7.33
		LCMN	NR	NR	NR	NR	NR	8.85
		p value	-		-	-	-	0.005*
SF-12	SCMN	PCS	NR	NR	NR	NR	NR	41.83
		MCS	NR	NR	NR	NR	NR	57.52
		p value	-	-	-		-	0.81*
	LCMN	PCS	NR	NR	NR	NR	NR	41.89
		MCS	NR	NR	NR	NR	NR	57.74
		p value	-	-	-	-	-	0.64*
Number of implant failures		SCMN	1/82	5/52	7/100	1/102	3//97	0/17
LCMN			1/119	1/72	13/183	0/76	0/59	4/20
p value			–	–	0.518	>0.05	<0.05	0.021*
Delayed union		SCMN	-	5	1	-	NR	-
LCMN			-	3	2	-	NR	-
Non-union		SCMN	1	3	NR	1	NR	-
LCMN			-	1	NR	-	NR	1 ununited fracture

**P* value as calculated by Mann-Whitney U test
SCMN (shortcephalomedullary nail)
LCMN (long cephalomedullary nail)
NR Not reported
SF-12 Short form 12
PCS (physical component summary),
MCS (mental component summary)

because pre injury PPMS score of LCMN (8.70) is better than SCMN group (8.55) (Table 3).

The HHS was better in LCMN group (current study, Li *et al.*[11] Paramar *et al.*[12]). We hypothesize that longer nail in medullary canal offered a better initial stability. An interesting finding in our study was that HHS and PPMS score was better for LCMN group and it was statistically significant despite the mean loss of neck shaft angle was 4.70 degree for LCMN group. However if the 3 cases of varus collapse (Figure 3) in the LCMN group were taken out, the remaining 16 cases in the LCMN group did not show a statistically significant loss of neck shaft angle.

The various studies comparing long and short cephalomedullary nail have shown different rates of union (Table 3). The fracture in one patient did not unite (Figure 4) till six month follow- up in LCMN group in our series and was offered a revision surgery as rescue treatment. The probable cause of the fracture not uniting could be that the patient was suffering from diabetes mellitus which was initially uncontrolled. The patient did not accept any further surgery.

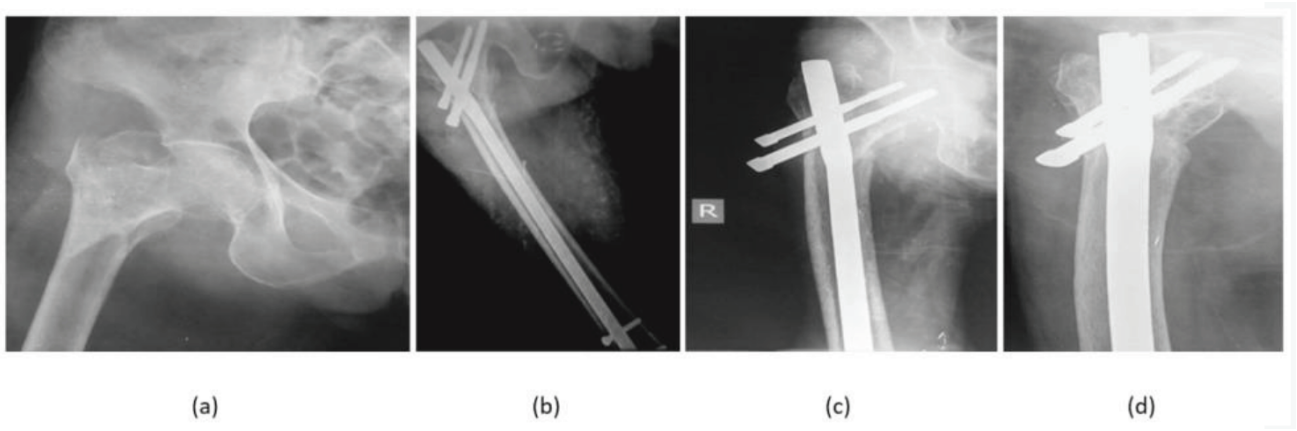

Figure 3 a: Radiograph of left hip showing AO31A2.2 fracture.
Figure 3 b: Immediate post-operative radiograph showing LCMN in AP view.
Figure 3 c,d: Six month follow up showing varus collapse in both AP and lateral views.

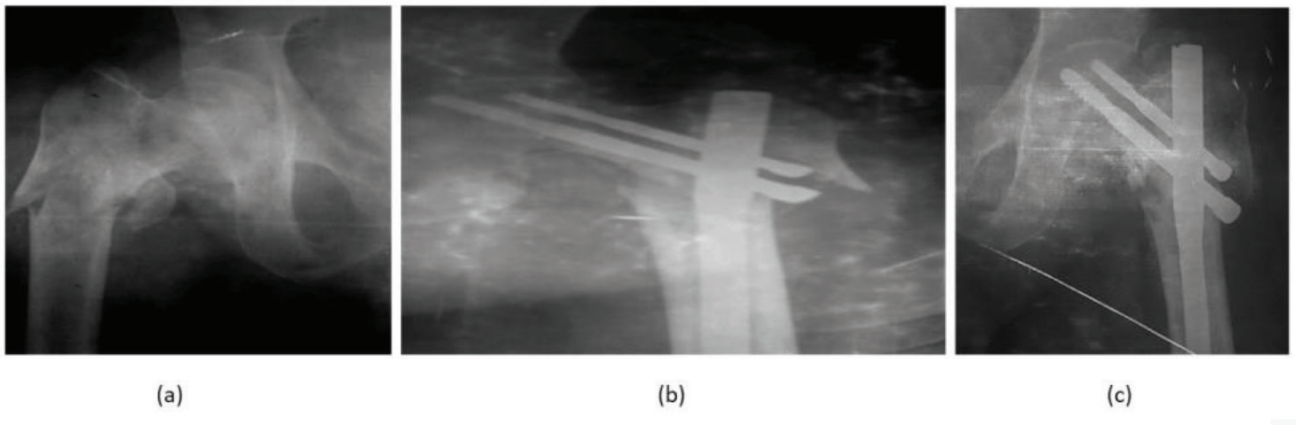

Figure 4 a: Radiograph of left hip showing AO31A3.2 fracture.
Figure 4 b: Immediate post-operative radiograph showing LCMN in AP view.
Figure 4 c: Six month follow up showing un united fracture in AP view.

In all 3 cases of varus collapse (LCMN group), fracture united inspite of varus (Figure 3) and 2 patients were having good functional outcome. In one case the fracture did not united by six month (Figure 4). The case had not been included in final statistical analysis for functional outcome (Table 2).

The current study has few limitations. The study groups were non-randomized because one of the study group was retrospectively analysed.[8] The sample size and duration of follow-up is limited. However the strength of this study is that it also dwells on the functional outcomes (PPMS, HHS, and SF-12) of both long and short cephalomedullary nail in unstable intertrochanteric fracture.

CONCLUSION

On comparison between the outcomes of LCMN vs SCMN for unstable intertrochanteric fracture femur (AO31A2.2 to AO31A3.3) the duration of surgery and blood loss during surgery was significantly higher in the LCMN group. However the functional outcome of the patients (HHS, PPMS) was significantly better in the LCMN group at one year follow up. In view of the small number of cases and small follow up no significant specific advantage of one implant over the other can be made. Hence we conclude that both short and long cephalomedullary nail are effective treatment modality for unstable intertrochanteric fractures with vulnerable/broken lateral wall and in the absence of larger study and long term follow up the superiority of

one implant over the other cannot be recommended. On behalf of all authors, the corresponding author states that there is no conflict of interest.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

REFERENCES

1. Hou Z, Bowen TR, Irgit KS, Matzko ME, Andreychik CM, Horwitz DS, Smith WR. Treatment of pertrochanteric fractures (OTA 31-A1 and A2): long versus shortcephalomedullary nailing. J Orthop Trauma. 2013;27(6):318-24. doi: 10.1097/BOT.0b013e31826fc11f, PMID 22955331.
2. Palm H, Jacobsen S, Sonne-Holm S, Gebuhr P, Hip Fracture Study Group. Integrity of the lateral femoral wall in intertrochanteric hip fractures: an important predictor of a reoperation. J Bone Joint Surg Am. 2007;89(3):470-5. doi: 10.2106/JBJS.F.00679, PMID 17332094.
3. Muller ME, Allgower M, Schneider R. The comprehensive classification of fractures of long bones. 3rd ed. New York: Springer-Verlag; 1990. p. 118.
4. Daabiss M. American Society of Anaesthesiologists physical status classification. Indian J Anaesth. 2011;55(2):111-5. doi: 10.4103/0019-5049.79879, PMID 21712864.
5. Parker MJ, Palmer CR. A new mobility score for predicting mortality after hip fracture. J Bone Joint Surg Br. 1993;75(5):797-8. doi: 10.1302/0301-620X.75B5.8376443, PMID 8376443.
6. Nilsdotter A, Bremander A. Measures of hip function and symptoms: Harris Hip Score (HHS), Hip Disability and Osteoarthritis Outcome Score (HOOS), Oxford Hip Score (OHS), Lequesne Index of Severity for Osteoarthritis of the Hip (LISOH), and American Academy of Orthopedic Surgeons (AAOS) Hip and Knee Questionnaire. Arthritis Care Res (Hoboken). 2011;63;Suppl 11:S200-7. doi: 10.1002/acr.20549, PMID 22588745.
7. Larson CO. Use of the SF-12 instrument for measuring the health of homeless persons. Health Serv Res. 2002;37(3):733-50. doi: 10.1111/1475-6773.00046, PMID 12132603.
8. Haq RU, Manhas V, Pankaj A, Srivastava A, Dhammi IK, Jain AK. Proximal femoral nails compared with reverse distal femoral locking plates in intertrochanteric fractures with a compromised lateral wall; a randomised controlled trial. Int Orthop. 2014;38(7):1443-9. doi: 10.1007/s00264-014-2306-1, PMID 24652419.
9. Boone C, Carlberg KN, Koueiter DM, Baker KC, Sadowski J, Wiater PJ, Nowinski GP, Grant KD. Short versus long intramedullary nails for treatment of intertrochanteric femur fractures (OTA 31-A1 and A2). J Orthop Trauma. 2014;28(5):e96-e100. doi: 10.1097/BOT.0b013e3182a7131c, PMID 24751609.
10. Guo XF, Zhang KM, Fu HB, Cao W, Dong Q. A comparative study of the therapeuticeffect between long and short intramedullary nails in the treatment ofintertrochanteric femur fractures in the elderly. Chin J Traumatol. 2015;18(6):332-5. doi: 10.1016/j.cjtee.2015.12.001, PMID 26917023.
11. Li Z, Liu Y, Liang Y, Zhao C, Zhang Y. Short versus long intramedullary nails for the treatment of intertrochanteric hip fractures in patients older than 65 years. Int J Clin Exp Med. 2015;8(4):6299-302. PMID 26131244.
12. Parmar DS, Porecha MM, Chudasama SL. Long proximal femoral nails versus short proximal femoral nails for the management of proximal femoral fractures: A retrospective study of 124 patients. Eur J Orthop Surg Traumatol. 2011;21(3):159-64. doi: 10.1007/s00590-010-0683-8.

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