



**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 walls managed with short and long cephalomedullary nails.

**Materials & Methodology:** 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 evaluated 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 a better functional outcome. HHS for the LCMN group was  $89.15 \pm 9.53$ , and for the SCMN group it was  $81.53 \pm 13.21$  ( $p = 0.021$ ). PPMS for LCMN group was  $8.85 \pm 0.67$  and for the SCMN group was  $7.53 \pm 1.807$  ( $p = 0.005$ ). There were four implant failures in the LCMN group compared to none in the SCMN group ( $p = 0.036$ ).

**Conclusion:** Both SCMN and LCMN are effective treatment modalities for unstable intertrochanteric fractures with vulnerable/broken lateral walls. In the absence of more extensive study and long-term follow-up, the superiority of one implant over the other cannot be recommended.

**KEYWORDS :** Unstable intertrochanteric fractures, Long cephalomedullary nail, Short cephalomedullary nail.

**INTRODUCTION:**

Cephalomedullary nail has gained popularity for the last few decades, but there has been worry regarding the use of long and short cephalomedullary nails in intramedullary fixation for intertrochanteric fracture.<sup>1</sup> There is a lack 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)<sup>2</sup>. Furthermore, there was no pre-established treatment protocol for choosing long or short nails for these femoral intertrochanteric fractures. Therefore, the present study evaluates intraoperative variables and postoperative outcomes of intertrochanteric fractures with vulnerable/ broken lateral wall managed with SCMN and LCMN.

**MATERIALS AND METHODS:**

Twenty prospective cases of patients treated with LCMN and twenty retrospective cases treated with SCMN following institutional ethical clearance were included in the study. This study was performed from Jan 2019 to December 2020 in Department of orthopedics, IGIMS Patna-14 Bihar. 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 three weeks of injury. The exclusion criteria were: open intertrochanteric fractures, pathological fractures, pure subtrochanteric fractures, and intertrochanteric fractures 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<sup>3</sup>. In addition, the American Society of anaesthesiologists (ASA)<sup>4</sup> grade and Parker Palmer mobility score<sup>5</sup>(PPMS) were determined pre-operatively. The documented Intraoperative parameters were; Duration of surgery, blood loss during surgery, and surgeon's perception of surgery. At the end of one year, functional outcomes were

assessed by; Harris Hip score<sup>6</sup> (HHS), Parker Palmer mobility score<sup>7</sup> (pre-surgery and at one year), and SF-12<sup>8</sup>. Radiological assessments 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. The 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 the ability to bear total weight on the extremity. Implant failure was defined as varus collapse, screw cutout, implant breakage, and screw back out, ununited fracture.

**RESULTS:**

**Following results were obtained.**

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

**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)

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

**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 <sup>†</sup>	
Harris Hip score	81.53 ± 13.21	89.15 ± 9.53	0.021 <sup>†</sup>	
SF-12 <sup>‡</sup>	PCS <sup>§</sup>	41.89 ± 9.99	41.83 ± 12.28	0.81 <sup>†</sup>
	MCS <sup>§</sup>	57.74 ± 3.87	57.52 ± 3.99	0.64 <sup>†</sup>
Fracture union	All cases united	One case not united at six month follow up	.71 <sup>#</sup>	
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)

Only 19 patients of LCMN group (fig no.1) and 17 patients of SCMN (fig no.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 failed due to technical reasons for revision surgery. In the LCMN group, one patient had not shown union by six months, and the patient was offered revision surgery as rescue treatment. (Table 2)

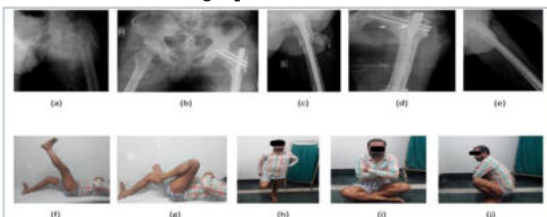


Fig 1.a- Radiograph of left hip showing AO31A3.1 fracture.  
Fig 1.b,c- immediate post-operative radiographs showing LCMN in both AP and lateral views.  
Fig 1.d,e- six month follow up showing radiological union in both AP and lateral views.  
Fig 1(f-i) clinical photographs showing straight leg raising, hip flexion, single leg stance, squatting and sitting cross legged at six month follow up.

**Fig-1**

Fig-2



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

In SCMN group, all the 17 available patients had a radiological union. Therefore, no implant failures were observed in SCMN group, but there were 4 implant failures in LCMN group, i.e., 3 varus collapses and one ununited fracture (Table 2). In addition, the neck-shaft angle was observed to see for varus collapse at the 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).

**DISCUSSION:**

In the current study, the duration of surgery and 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) were 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. We hypothesize that longer nails in the medullary canal offered 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 degrees for LCMN group. However, if the 3 cases collapse 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 fracture in one patient did not unite till six months follow-up in LCMN group in our series and are 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.

In all 3 cases of varus collapse (LCMN group), fracture united despite varus, and 2 patients had good functional outcomes. However, in one case, the fracture did not unite by six months. Therefore, the case was not included in the final statistical analysis for a functional outcome (Table 2).

**CONCLUSION:**

Comparing 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 different 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. Hence, we conclude that both short and long cephalo medullary nails are effective treatment modalities for unstable intertrochanteric fractures with vulnerable/broken lateral walls. However, in the absence of more extensive study and long-term follow-up, the superiority of one implant over the other cannot be recommended.

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