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ORIGINAL ARTICLE

ASSESSMENT OF RADIOLOGICAL HEALING IN ELDERLY HIP FRACTURES FIXED WITH INTRAMEDULLARY VERSUS EXTRAMEDULLARY IMPLANTS AT THREE MONTHS

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ABSTRACT

OBJECTIVE: To compare the radiological healing in elderly patients with hip fractures fixed with intramedullary versus extramedullary implants at 3 months by using Radiological Union Score for Hip (RUSH score).

METHODS: This quasi-experimental study was conducted at Lady Reading Hospital, Peshawar from September 2020 to March 2021, in elderly patients (50-80 years) with hip fractures. Out of 238 patients, 119 were non-randomly assigned to Group-A undergoing intra- medullary implants and 119 to Group-B undergoing fixation with an extra-medullary implant. After the surgery, the patients were followed up periodically at 2nd week, 6th week and 12th week after surgery and assessed for radiological healing through RUSH score. The data was analyzed using SPSS version 23.

RESULTS: Out of 238 patients, 96 were males and 142 were females. In Group-A, 51 (42.9%) were males and 68 (57.1%) were females. In Group-B, 45 (37.8%) were males and 74 (62.2%) were females. Majority (n=135/238: 56.72%) were aging from 50-60 years. Mean±SD of age was 63.1±8.8 years and 61.7±8.1 years in Group-A and Group-B respectively. Mean±SD of RUSH score in Group-A and Group-B was 19.50±6.92 and 22.51±5.60 respectively. Mean RUSH score for males in Group-A and Group-B was 21.52±6.39 and 22.33±6.99 (p=0.354) and for females in Group-A and Group-B was 19.36±7.33 and 22.18±5.75 (p=0.025) respectively. Median and IQR of RUSH score in Group-A and Group-B was 21±10 and 23±8 respectively (p=0.069).

CONCLUSION: There was statistically insignificant difference in median RUSH score with use of either intramedullary or extramedullary implants in the management of hip fractures.

Clinical Trial Registration Number: ACTRN12623000103662

KEYWORDS: RUSH score (Non-MeSH); Hip Joint (MeSH); Hip Fractures (MeSH); Intramedullary (Non-MeSH); Extramedullary (Non-MeSH); Geriatric hip fractures (Non-MeSH); Femoral Fracture (MeSH); Femoral Neck Fractures (MeSH)

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INTRODUCTION

Patients sustaining proximal femur fractures pose a major challenge to the health care team due to the old age group that majority of such patients belong to, related risk factors, prolonged period of recovery and high mortality rate.[1,2] Ninety-five percent of proximal femur fractures in elderly patients are due to fall.[3] There is a high risk of mortality after proximal femur fractures particularly in elderly patients 60 years of age or above. According to one study, overall 1-year mortality in patients ≥60 years of age treated after proximal femur fractures was 21%. In another research overall 1-year postoperative mortality was 27%.[4,5]

Various scores have been introduced to assess radiological healing of hip fractures after surgery. One of these scores is the Radiological Union Score for Hip (RUSH score). This score uses a checklist-based approach. It improves agreement of fracture healing assessment among healthcare personnel, offers a systematic approach to evaluate hip fracture radiographs and provides prognostic information that can predict healing outcomes.[6] It is a validated outcome instrument designed to improve intra and inter-observer reliability in describing healing of hip fracture.[7]

Depending on the fracture type and clinicians' preference, different surgical procedures are chosen to manage these fractures, in order to achieve the best outcomes considering the fracture and patient characteristics. The commonest procedures use intramedullary and extra medullary implants for the management of hip fractures.[8] There is lack of evidence regarding comparison of these procedures in terms of radiological healing outcome using validated outcome assessment tool. FAITH trial investigators reported that for every 1 unit decrease in RUSH, there was a 2% increase in odds of reoperation within 24 months of the fracture; for every 2 units decrease in RUSH, 5% increase in risk of reoperation and for every 5 units decrease in RUSH, 14% increase in odds of reoperation.[9]

Recently a cohort study conducted by Ahmed T, et al., showed that there was no significant difference in terms of radiological healing between intramedullary and extramedullary

implants group at 6 months on the basis of RUSH score, however the number of patients in the intramedullary group was very small.[10]

The rationale of this study was to address the question (knowledge gap) which is still unanswered in that how radiological healing, assessed via RUSH score (validated outcome assessment instrument), will be affected by intramedullary or extramedullary implants at 3 months in patients with hip fracture. We planned this quasi-experimental study to assess which method of surgical fixation (intramedullary or extramedullary) gives better outcomes at 3 months using RUSH score. The results of this study will help orthopaedic surgeons in deciding which of these two methods is better suited for management of elderly patients with hip fracture.

METHODS

This Quasi-experimental study was conducted at Orthopedics department of Lady Reading Hospital, Peshawar, Pakistan. Our hypothesis was that there is a difference in radiological healing of hip fracture at 3 months fixed with either intramedullary or extramedullary implants. Previous literature on RUSH score has used mean values for assessment. For sample size calculation, we used mean values but we will report median values as well as RUSH is an ordinal scale. We assumed that at 3 months, mean RUSH score will be 22±5.5 for extramedullary implants and 20±5.5 for intramedullary implants.[10] With probability of type I error at 0.05, type 2 error at 0.2, power of 0.8, our calculated sample size was 238 (119 in each group).

Inclusion criteria was patients of both genders with age group 50-80 years, having hip fracture (Transcervical, Intertrochanteric and Subtrochanteric) as per standard definitions. Patients with following characteristics were excluded; refusal of informed consent, unwilling/unable to comply with follow up, polytrauma, history of steroids use, history of use of immunosuppressants/ disease modifying anti-rheumatic drugs (DMARDs), pathological fracture and unfit for surgery (ASA III and above).

The study was conducted after getting approval from hospital ethical and research committee. Study duration was six months (September 2020 to March 2021). The patients meeting the inclusion criteria in the orthopaedics ward of Lady Reading Hospital, Peshawar, were recruited in the study after taking written informed consent. The diagnosis of hip fracture was made based upon the criteria mentioned in the inclusion criteria. Sampling technique was non-probability, consecutive sampling. The purpose of the study and what this study entails were explained to all the recruited patients at the start of the study before enrolling them. Demographic data including age and gender of the patient was noted. History was taken from the patient to find out the duration of the injury. Routine baseline investigations were performed and these patients were prepared for surgery.

The surgery involved extramedullary (dynamic hip screw, dynamic condylar screw, cannulated screws, proximal femoral locking plate) implants in half of the patients and fixation with an intramedullary (proximal femoral nail, gamma nail) implant in the other half via non-randomized protocol (Figure 1 & 2). After the surgery, the patients were followed up periodically at 2nd week, 6th week and 12th week after surgery to look for radiological healing. X-rays of the hip were performed at the time of follow up and RUSH score was used to assess for

Figure 1: Extramedullary implant

Figure 2: Intramedullary implant

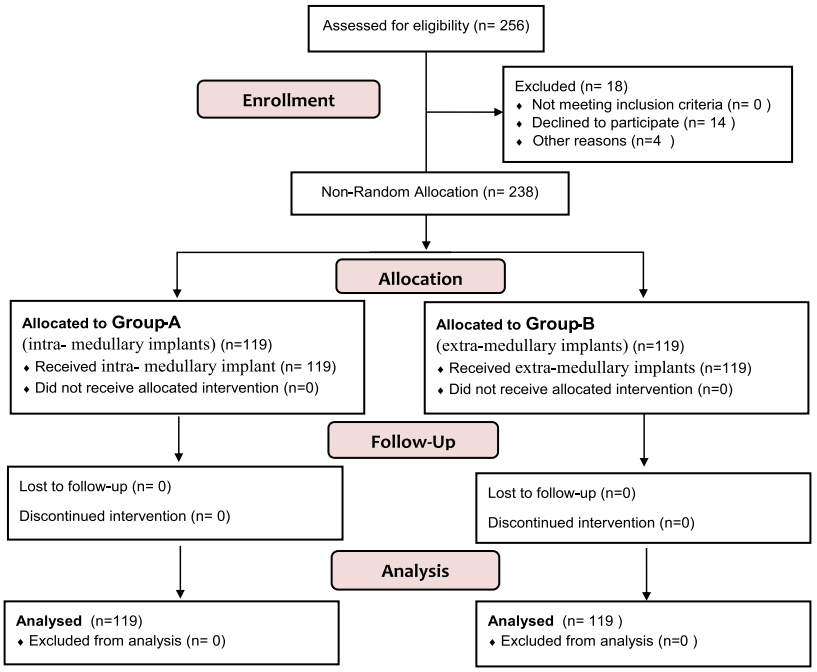

Figure 3: Methodology flow diagram of the study

TABLE I:DESCRIPTIVE STATISTICS OF THE STUDY SUBJECTS

Variables		Minimum	Maximum	Mean	S.D	95% CI
Age (years)	**Group A** (Intramedullary Implants) (n=119)	50	80	63.1	8.8	61.50-64.69
	Group B (Extramedullary Implants) (n=119)	50	80	61.7	8.1	60.22-63.17
RUSH Score	**Group A** (Intramedullary Implants) (n=119)	3	30	20.3	7.0	19.02-21.57
	Group B (Extramedullary Implants) (n=119)	3	30	22.2	6.2	21.07-23.32

TABLE II:STRATIFICATION OF AGE GROUP, GENDER AND DURATION OF FRACTURE WITH RUSH SCORE BETWEEN GROUPS

Variables			RUSH SCORE				P-VALUE
			Mean	SD	Mean Rank	Mann Whitney U	
Age Group (years)	**50 - 60**	Intramedullary Implants (n=65)	19.80	7.34	60.36	1778.500	0.028
		Extramedullary Implants (n=70)	22.34	6.66	75.09		
	>60	Intramedullary Implants (n=54)	20.89	6.58	50.03	1216.500	0.480
		Extramedullary Implants (n=49)	22.10	5.60	54.17		
Gender	**Male** (n=96)	Intramedullary Implants (n=51)	21.52	6.39	46.03	1021.500	0.354
		Extramedullary Implants (n=45)	22.33	6.99	51.30		
	Female (n=142)	Intramedullary Implants (n=68)	19.36	7.33	63.47	1970.000	0.025
		Extramedullary Implants (n=74)	22.18	5.75	78.88		
Duration (days)	**2 -12**	Intramedullary Implants (n=55)	19.92	7.55	55.06	1488.500	0.187
		Extramedullary Implants (n=63)	21.79	6.57	63.37		
	>12	Intramedullary Implants (n=64)	20.60	6.53	55.12	1447.500	0.069
		Extramedullary Implants (n=56)	22.75	5.83	66.65		

Applied Mann Whitney test

radiological healing. All the data was recorded on a predesigned proforma for analysis. Figure 3: Methodology flow diagram of the study is given in Figure 3.

The data was analyzed using SPSS version 23. Frequencies and percentages were used to describe categorical variables such as gender. Mean and standard deviation were calculated for the numerical variables for age. Mann-Whitney test was used to compare the means of RUSH scores in two groups and a p-value of less than 0.05 was taken as significant. Median and IQR was calculated for both groups and Wilcoxon rank sum test was used compare the medians with p value of < 0.05 as significant.

The trial has been registered with anzctr.org.au **(Trial ID-ACTRN12623 000103662).**

RESULTS

A total of 238 patients with 96 (40.36%) males and 142 females (59.64%) were included in the study. Each group (Group A: intramedullary implant and Group B: extramedullary implant) included 119 patients to compare the radiological healing in elderly patients with hip fractures at 3 months using RUSH score. Mean±SD of age in intramedullary implants group was 63.1±8.7 with 95% confidence interval (CI) (61.5-64.7) and extramedullary implants group was 61.7±8.1 with CI (60.23-63.18) years. Mean±SD of RUSH score in intramedullary (Group-A) and extramedullary implants (Group-B) was 19.50±6.92 (CI,18.25-20.76) and 22.51±5.6 (CI,21.49-23.53), respectively (Table I).

Mean RUSH score for males in Group-A and Group-B was 21.52±6.39 and 22.33±6.99 (p=0.354) and for females in Group-A and Group-B was 19.36±7.33 and 22.18±5.75 (p=0.025) respectively. Stratification of age group, gender and duration of fracture with rush score between groups is presented in Table II. Median and IQR of RUSH score in intramedullary (Group A) and extramedullary implants (Group-B) was 21±10 and 23±8 (p value <0.069).

DISCUSSION

This study shows that the median RUSH score was not significantly different at 3 months in intramedullary group compared to the extramedullary group with p value of 0.069.

An estimated fifty million musculoskeletal injuries occur annually in the United States with six million of those being fractures.[11] Approximately 10% of those fractures result in non-union.[12] Clinicians and researchers have often failed to agree on relevant and reproducible measures of fracture healing.[11] Although most surgeons believe fracture healing should be determined using clinical and radiographic information, there is significant variability in the methods for assessing fracture healing in practice.[12] Given the myriad criteria and lack of consensus, generalizability of results is lacking. The assessment of femoral neck fracture healing remains highly subjective and causes disagreements among treating physicians.[13]

The decision of whether to use intramedullary or extramedullary implants for the management of hip fractures is dependent on multiple factors, including bone quality, fracture pattern, surgeon expertise and available resources. There is a general trend towards intramedullary fixation of late, but the question whether intramedullary implants work as well as extramedullary implants is unanswered, using validated criteria.

The Radiographic Union Score for Hip (RUSH) is a validated tool that improves fracture healing agreement between radiologists and orthopaedic surgeons by using a checklist-based scoring approach with improved intra- and interobserver reliability.[14,15] The utilization of this tool to assess femoral neck fracture healing has led to better agreement with respect to radiographic healing as well as improved interobserver and intraobserver reliability.[6] Two reviewers in previous study assessed 250 hip fractures 6 months post operatively by assigning RUSH scores and demonstrated substantial interobserver reliability with an ICC of 0.81 . Their study also found that a threshold of RUSH < 18 was associated with 100% specificity and a positive predictive value of 100% for radiographic nonunion.[7]

In this study, mean age in intramedullary implants group was 63.1±8.8 and in extramedullary implants group was 61.7±8.1 years. The study of Frank T, et al., reported mean age to be 71±12.[7] This is generally in line with average life expectancy in this region notwithstanding ten years difference in the mean age group.

In their study, Frank T, et al., noted RUSH score as 22.9±4.2 versus 24.8±3.0, with a significant p-value of 0.002.[7] Present study noted mean radiological union scale for hip (RUSH) score as 19.50±6.9 and 22.51±5.60 in intramedullary and extramedullary implants group with significant p-value, 0.029. The determination of bony union is essential for clinical care as well as research purposes to evaluate various treatment methods. Our study uses validated fracture assessment method. Traditionally, extramedullary implants have given good results. Shifting to use of intramedullary techniques to address these fractures entails training and expertise and good instrumentation. In absolute terms, RUSH is an ordinal scale and it is just reasonable to report median values for the groups, and the difference is insignificant (0.069) in this study. The strength of this study is that we have reported both mean and median values for the groups.

Limitations of this study are inherent in the study design. We could not go for randomized controlled trial (RCT) because of equipoise with use of intramedullary implants in the management of hip fractures. In future, well designed RCT will help address our limitation.

CONCLUSION

There was statistically insignificant difference in median RUSH score with use of either intramedullary or extramedullary implants in the management of hip fractures.

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AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

IuH, MB, NA: Acquisition of data, drafting the manuscript, approval of the final version to be published.

IuR: Analysis and interpretation of data, drafting the manuscript, approval of the final version to be published.

SIB: Concept and study design, drafting the manuscript, critical review, approval of the final version to be published

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

CONFLICT OF INTEREST

Authors declared no conflict of interest

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DATA SHARING STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request

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