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Total hip arthroplasty for arthritis following acetabular fractures—evaluation of radiological, functional and quality of life parameters

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ABSTRACT

Introduction: Total hip arthroplasty (THA) has been termed as 'operation of the century' as it provides a stable and mobile hip to patients who are debilitated by pathologies affecting the hip. Acetabular fractures pose a challenge for their initial management as well for the management of secondary osteoarthritis which is often the outcome of these fractures. The study attempts to evaluate the short term radiological, functional and quality of life outcomes of THA done in patients with prior acetabular fractures and to find a correlation between various factors.

Materials and methods: 47 patients who provided consent for this retrospective study were clinically and radiologically evaluated at their latest follow up. Ratios of horizontal offset, vertical offset, body lever arm and cup inclination were calculated with respect to the opposite normal hip on a radiograph. Questionnaires were filled up for Harris Hip Score (HHS), Short form -12, Short Musculoskeletal functional assessment (SMFA) and WHO-quality of life (WHO-QoL).

Results: HHS and quality of life scores had a tendency to improve over time. A statistically significant difference ($p < 0.05$) was noted between scores of patients having less than 2 years follow up and more than 4 years follow-up. The HHS, radiological and quality of life parameters were not statistically significantly different when analysed based on acetabular fracture pattern, their primary management and aetiology necessitating the THA.

Conclusion: The short term radiological, functional and quality of life parameters are dependent on the accuracy of the THA performed and are not significantly affected by the fracture type, initial management and outcomes of that management. However, longer follow up is necessary to evaluate these parameters even more accurately.

1. Introduction

Acetabular fractures are complex orthopaedic injuries and require a fair amount of expertise for management. Although undisplaced acetabular fractures can be managed by non-operative means, displaced acetabular fractures need operative intervention for reduction and stabilization.[1,2] As these fractures involve one of the important joints of the body, anatomic reduction and internal fixation is the primary aim[1] of operative management. Incidence of acetabular fractures has seen an increase in the elderly population as osteoporosis contributes in fractures caused by low-energy falls.[3,4] The acetabulum has a complex anatomy and the described surgical approaches do not provide complete visualization of the entire acetabulum, thereby making anatomical reduction difficult in many cases. Even after a reasonable reduction, outcome may not be good in every case. The outcome of acetabular fracture may be compromised by secondary osteoarthritis, femoral head avascular necrosis and/or heterotopic ossification, even when anatomic reconstruction of the joint had been achieved.[5] In developing countries where adequate health-care facilities are often lacking, many acetabular fractures requiring operative management are managed non-operatively and these have a greater chance of developing complications. Total hip replacement (THA) is helpful in such cases. Investigators have

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reported good results of primary THA in appropriately selected patients.[5–7] Primary THA is a good option for complex fractures in elderly patients but should ideally be performed in centres which have necessary expertise and facilities for such a procedure.

Performing THA in patients who have had a prior acetabular fracture is challenging for the operating surgeon. The presence of surgical site soft tissue scars, non-availability of proper planes for dissection, heterotopic ossification and indolent infection are problems which a surgeon must tackle in patients who have had an open reduction and internal fixation (ORIF).[6,8] The other important issues which need to be addressed are poorly reduced fractures, insufficient bone stock and retained implants from the previous surgery.[6–9] While both cemented and un-cemented THA can be performed in these cases, the basic principle of reconstruction of bone stock for stable fixation of the acetabular cup and restoration of normal hip biomechanics needs to be followed in every case.[7–9] The adequacy of bone stock is likely to affect the placement of acetabular cup.[10] Restoration of correct offset and limb length are other expected problems resulting from acetabular defects; with inappropriate offset increasing the chances of post-operative dislocation and cup wear.[10,11] Restoration of the offset and centre of rotation tends to improve the abductor muscle function.[12] A limb length discrepancy after THA has adverse effects on the gait, back and hip biomechanics and can lead to early wear and patient dissatisfaction after the surgery.[13,14]

Previous studies[6–9] have reported the difficulties faced during surgery, especially in reconstruction of the acetabular bone stock and have also made note of the failures of THA in such patients and survivorship of the implant. But the impact which a THA has on quality of life of patients has not been evaluated. Also, while literature is available on the effect of limb length discrepancy (LLD) in patients undergoing THA for other aetiologies, such a data is lacking for patients with a prior acetabular fracture and who have undergone a THA.

This study was designed to follow up cases of THA performed by a single surgeon (RS) in patients with prior acetabular fracture and evaluate their function and quality of life following THA using objective scores and correlate them with the adequacy of hip reconstruction as inferred from radiological parameters measured on post-operative radiographs.An assessment of the impact of limb length discrepancy on the quality of life in such patients was also performed.

2. Materials and methods

The study was performed as a retrospective analysis of patients who had prior acetabular fracture and were operated by the senior surgeon (RS) between January 2007 and June 2014 at the Post Graduate Institute of Medical Education and Research (PGIMER), Chandigarh, India. All the surgeries were performed by the posterior approach with the patient positioned in lateral position. Prior to surgery, radiographs of the affected hip and pelvis as well as CT scans were obtained for planning the surgery and for ordering specific implants to be kept in the inventory. Pre-operative ESR and CRP were obtained in patients who had previously been treated operatively to rule out any active infection. The duration of hospital stay and the rehabilitation program was decided based on intra-operative findings and hence varied from patient to patient.

Patients with no debilitating medical or surgical condition, without any injury to knee, ankle and foot on either limb, any psychiatric or neurosurgical problems were offered to be included in this study. Patients providing consent were enrolled. Patients who didn't provide consent or had injuries of both the lower limbs and associated injuries along with the initial acetabulum fracture were excluded from the study. Data regarding the primary injury (acetabular fracture) including its mechanism, fracture pattern and method of management (operative or non-operative) was obtained from hospital records. The records of subsequent THAs were retrieved. During the most recent follow up visit of patients, measurements of the limb length and the range of motion were obtained, Questionnaires for Harris Hip Score (HHS), Short musculoskeletal function assessment score (SMFA), Short Form-12 (SF-12), and World Health Organization Quality of Life (WHOQOL) were filled by an investigator other than the operating surgeon. Antero-posterior radiographs (Fig. 1) obtained at the most recent follow-up visit were evaluated by an independent observer. Four radiological parameters were evaluated – horizontal offset, vertical offset, body lever arm and cup inclination. To eliminate the discrepancy from positioning of the x-ray tube, the contra lateral normal hip was used as a control for each case. A measurement on the affected side within 20% of the unaffected side was taken as acceptable; thus, when expressed as a ratio of affected with unaffected side, a ratio between 0.8-1.2 was considered as "**acceptable**" while any value more than 1.2 or less than 0.8 was considered "**non-acceptable**".It was also examined whether the acetabular cup was placed within the safe range of 30°- 50° or not. The results of the radiological parameters were expressed as **acceptable** or **non-acceptable.** All the collected data were statistically evaluated using SPSS version 20 (IBM). The radiological findings were evaluated against mean values of HHS, LLD, SF-1 and WHOQOL parameters. The WHOQOL-BREF (Field Trial Version) produces four domain scores. There were two questions which were examined separately: question about an individual's overall perception of quality of life and second about an individual's overall perception of his or her health. Non-parametric statistical tests were primarily used. Pearson's correlation coefficients were calculated. A 'p' value of <0.05 was considered at the cut off value for statistical significance.

3. Results

A total of 47 patients satisfying the inclusion criteria and who provided consent were included in the study. The mean age of the patients was 48.6 years (25–83 years). Young adults in the age group of 35–48 years (n = 19) formed the largest group. 41 of the 47 patients were males and 6 were females. Out of the 47 patients, 8 patients had isolated posterior wall fracture, 6 had posterior column fracture with or without posterior wall involvement, 5 had transverse fracture. 9 patients had bi-columnar fracture and 19 had posterior wall fracture with posterior dislocation. The largest number of patients had posterior wall fracture with an associated posterior dislocation of the hip. A total of 18 of the 47 patients were initially managed non-operatively and rest 29 patients had initial management by operative means.

The indications for total hip arthroplasty irrespective of the initial treatment received were post traumatic secondary osteoarthritis, post traumatic avascular necrosis (AVN) of femoral head or acetabular defects. 14 patients underwent a THA secondary to post traumatic AVN, 17 patients had acetabular defects and the remaining 16 had post traumatic secondary osteoarthritis.Out of the 47 patients who underwent THA, un-cemented THA (cup and stem were both un-cemented) was performed in 32 patients, cemented THA (cup and stem were both cemented) in 3 patients and 3 patients had hybrid THA (un-cemented cup and cemented stem). All these patients had a THA with a Metal on Poly bearing. Metal on metal implant was used in 3 patients. Burch Schneider Cage (Zimmer Inc.) and Muller's ring was used in 3 patients each for acetabular reconstruction. There were 4 cases where reconstruction plates were used to fix the fractures after reduction of previously unreduced fracture. Acetabular cup placement was done after the initial fracture fixation. Acetabular reconstruction of some sort was needed to be done in 17 patients using auto graft,

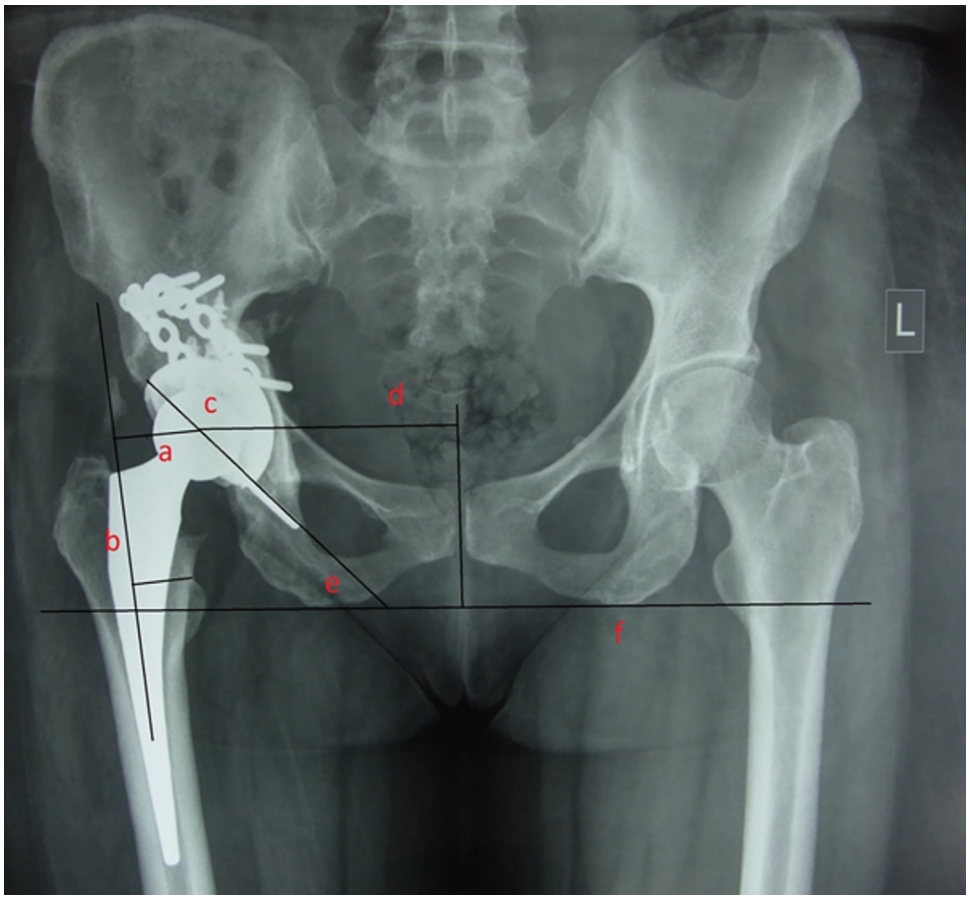

Fig. 1. Sample radiograph showing lines drawn for estimation of radiological parameters. **a** –Horizontal offset, **b** –Vertical offset, **c** –Centre of rotation, **d** –Body lever arm, **e** –Angle of inclination, **f** –Trans-ischial line.

allograft, reconstruction plates, and cage or ring either alone or in combination. Of all the cases, the minimum follow-up was less than 2 years for 24 patients, 2–4 years for 15 patients and more than 4 years for 8 patients. Thus, most of the patients have a relatively short duration of follow up.

The limb length discrepancy in the form of shortening was found to be within 0–10 mm in 42 patients and between 10 and 20 mm in 5 patients. Notably, none of the patients had a discrepancy of more than 20 mm.

3.1. Radiological outcomes after THA

Vertical offset was found to be within the acceptable range in 31 patients while it was non-acceptable in 16 patients. The horizontal offset was within the acceptable range in 22 patients and in the non-acceptable range in 25 patients. 40 patients had an acceptable range body lever arm and 7 had the body lever arm in non-acceptable range. The inclination of the acetabular cup was within acceptable range in 34 patients and non-acceptable in 13 patients. In 28 out of 47 patients the cup placement was within the safe range. A summary of the radiological outcomes for each type of fracture is presented in the Table 1.An evaluation was done to look whether the previous modality of management for the acetabular fracture i.e. non-operative or operative had any impact on the radiological outcomes. The result of this analysis is presented in the Table 2. One can infer that more number of patients had radiological parameters in the acceptable range when they were initially managed surgically for the acetabular fractures.

A comparison was done to see if the indication for surgery had effect on the radiological outcomes. The summary of the total number of patients with acceptable or non-acceptable range for the radiological parameters for each indication for surgery has been presented in Table 3.

Table 1
Table summarizing the number of patients with THA secondary to specific acetabular fracture patterns with acceptable and non-acceptable ranges of the radiological parameters. PW – Posterior wall, PC – Posterior column, PW with D/L – posterior wall with posterior dislocation.

		PW	PC	Transverse	Bi-columnar	PW with D/L	Total
Vertical offset	Acceptable	6	5	3	5	12	31
	Non-acceptable	2	1	2	6	5	16
Horizontal offset	Acceptable	3	2	1	6	10	22
	Non-acceptable	5	4	4	5	7	25
Body lever arm	Acceptable	6	6	5	7	16	40
	Non-acceptable	1	0	1	4	1	7
Cup inclination	Acceptable	5	3	3	7	11	29
	Non-acceptable	3	3	2	4	6	18

Table 2
Table summarizing the number of patients in acceptable or non-acceptable range for the radiological parameters with respect to the initial management received for the acetabular fractures.

		Non-Operative management	Operative management	Total
Vertical offset	Acceptable	9	22	31
	Non-acceptable	9	7	16
Horizontal offset	Acceptable	7	15	22
	Non-acceptable	11	14	25
Body lever arm	Acceptable	15	25	40
	Non-acceptable	3	4	7
Cup inclination	Acceptable	8	21	29
	Non-acceptable	10	8	18

Table 3
Summary of radiological parameters with respect to the indication for surgery. AVN-Avascular Necrosis of femoral head, OA – Osteoarthritis.

		AVN	Acetabular defects	Post traumatic secondary OA	Total
Vertical offset	Acceptable	9	12	10	31
	Non-acceptable	6	5	5	16
Horizontal offset	Acceptable	9	8	5	22
	Non-acceptable	6	9	10	25
Body lever arm	Acceptable	14	13	13	40
	Non-acceptable	2	4	1	7
Cup inclination	Acceptable	10	12	7	29
	Non-acceptable	5	5	8	18

3.2. Harris hip score (HHS) after THA

A total of 29 patients had HHS between 90 and 100 and were considered as having excellent scores. 6 patients had good, 7 had fair and 4 had poor HHS. 2 patients had HHS less than 69 and were considered as having failed result. Patients who were less than 60 years of age had better HHS than those who were older than 60 years. However, the mean HHS was not significantly different ($p = 0.775$) between these two age groups. On analysing the mean HHS for patients with different acetabular fracture pattern, we found no statistically significant difference between the mean scores ($p = 0.427$). When the mean HHS was compared between the patients based on the primary indication for the THA, we found no statistically significant difference ($p = 0.849$) between the groups. A comparison of the HHS between patients with a LLD of <10 mm and 10–20 mm showed no statistically significant difference ($p = 0.915$).

3.3. Quality of life assessment after THA

Short form – 12(SF-12) was calculated for patients of different age groups and it was found that patients with age between 35 and 60 years had the highest SF-12 scores. The physical health composite score (PCS) and mental health composite score (MCS) were not significantly different between patients with age less than 35 years, age between 35 and 60 years and more than 60 years. A comparison of means of PCS and MCS was done based on radiological parameters(acceptable and non-acceptable range) to evaluate if the quality of life was affected by restoration of the radiological parameters of the hip after THA. No statistically significant difference was found using non-parametric Mann Whitney test. This has been summarized in the Table 4.

Out of the 47 patients, limb length discrepancy (LLD) of <10 mm was achieved in 42 patients and LLD between 10 and 20 mm was found in 5 patients. The quality of life scores was better in the patients where limb length discrepancy was within 10 mm; but the scores had no statistically significant difference. Table 5 summarizes the quality of life scores based on the LLD.

3.4. Short musculo-skelatal function assessment score and WHO-QoL after THA

An evaluation of the SMFA scores in patients based on the initial fracture pattern showed no statistically significant difference (based on Kruskal Wallis test); patients with an initial transverse fracture had the best SMFA scores while those with an initial bi-columnar fracture had the worst scores. The SMFA scores based on initial fracture pattern are summarized in Table 6.The mean SMFA score in patients who had initially been treated non-operatively was 11.57 while it was 10.97 in patients who had initially been operated. However, this difference was not significant statistically. The SMFA scores in patients of THA based on the primary indication for THA too had no statistically significant difference ($p = 0.702$). Patients with post traumatic osteoarthritis had the

Table 4
Mean PCS and MCS values for patients with acceptable or non-acceptable range of radiological parameters.

		PCS	MCS
Vertical offset	Acceptable	47.45	56.86
	Non-acceptable	48.52	54.32
	'p'	0.213	0.609
Horizontal offset	Acceptable	49.47	56.60
	Non-acceptable	46.36	55.46
	'p'	0.302	0.382
Body lever arm	Acceptable	48.89	56.01
	Non-acceptable	43.20	55.58
	'p'	0.223	0.668
Cup inclination	Acceptable	47.62	56.65
	Non-acceptable	48.13	54.95
	'p'	0.691	0.493

Table 5
Mean PCS and MCS scores with respect to the LLD in the patients.

LLD	PCS	MCS
<10 mm	48.17	56.26
10–20 mm	44.84	53.82
'p' value	0.454	0.203

Table 6
SMFA scores after THA based on the initial type of fracture sustained by the patient.

Fracture type	N	Mean	Std. Deviation	p-value
Posterior wall	8	14.15	15.096	0.721
Posterior column	6	11.15	11.986	
Transverse	5	6.94	7.353	
Bi-columnar	9	17.52	16.187	
Posterior wall with posterior dislocation	19	7.41	8.123	

worst SMFA scores while those who had AVN had relatively good scores (12.48 vs. 9.61). Patients with a LLD of less than 10 mm had a SMFA score of 10.63, while those with LLD between 10 and 20 mm had a score of 17.23.

The best mean WHOQOL scores were found in patients with an initial transverse fracture (90.3). Those with an initial bi-columnar fracture had the worst scores (74.0). Patients with other fracture patterns had scores which were in between these scores. The mean WHOQOL score for patients who had been initially managed non-operatively was 78.48 and for those with an initial operative management it was 82.07. The mean WHOQOL scores for patients with post traumatic AVN, Acetabular defects and posttraumatic osteoarthritis were 82.3, 81.9 and 77.8 respectively. There was no statistically significant difference between the mean scores though. In terms of LLD, patients with $<$10 mm LLD had a WHOQOL score of 81.48 and those with LLD of 10–20 mm had a score of 74.7.correlation between the HHS and the scores for quality of life was analysed. A strong positive correlation of the HHS with the predictors of quality of life was noted, except for SMFA scores where there was a negative correlation. A low SMFA score implies a better quality of life. Hence, the negative co-relation is a good thing. The scatter plot (Fig. 2) shows the positive correlation between HHS and SF-12 and WHOQOL. Fig. 3 shows the negative co-relation of HHS with SMFA.

Table 7 summarizes the Pearson correlation coefficients of the quality of life scores in comparison with HHS and a statistically significant correlation can be seen between them.

We analysed whether the time since surgery and hence, the duration of follow up had any bearing on the HHS and the quality of life scores. The results of this analysis are presented in Table 8.

From the above table, the HHS and the quality of life scores have a tendency of gradual and sustained improvement over time and with increasing duration of surgery they tend to improve. We further statistically evaluated the HHS and quality of life assessment scores of patients with $<$2 years follow up and $>$4 years follow up. A statistically significant difference between the HHS ($p = 0.013$), SMFA (0.043) and WHOQOL (0.012) scores was obtained between these two groups.

4. Discussion

Anatomical reduction and stable fixation of displaced fractures improves the mobility and the quality of life of patients with acetabulum fractures. Available literature[15–17] suggests that accurate reduction and acceptable radiological parameters after surgery (as per Matta classification) lead to good outcomes in terms of quality of life.

Learmonth et al.[18] have termed total hip replacement as the operation of the century and note that patients present for hip-replacement surgery hoping to improve their quality of life. This Lancet publication of 2007 conveys the importance of total hip arthroplasty in orthopaedics. For patients who have suffered an acetabulum fracture and who have had a poor outcome, it offers a means to improve their quality of life.THA for an acetabular

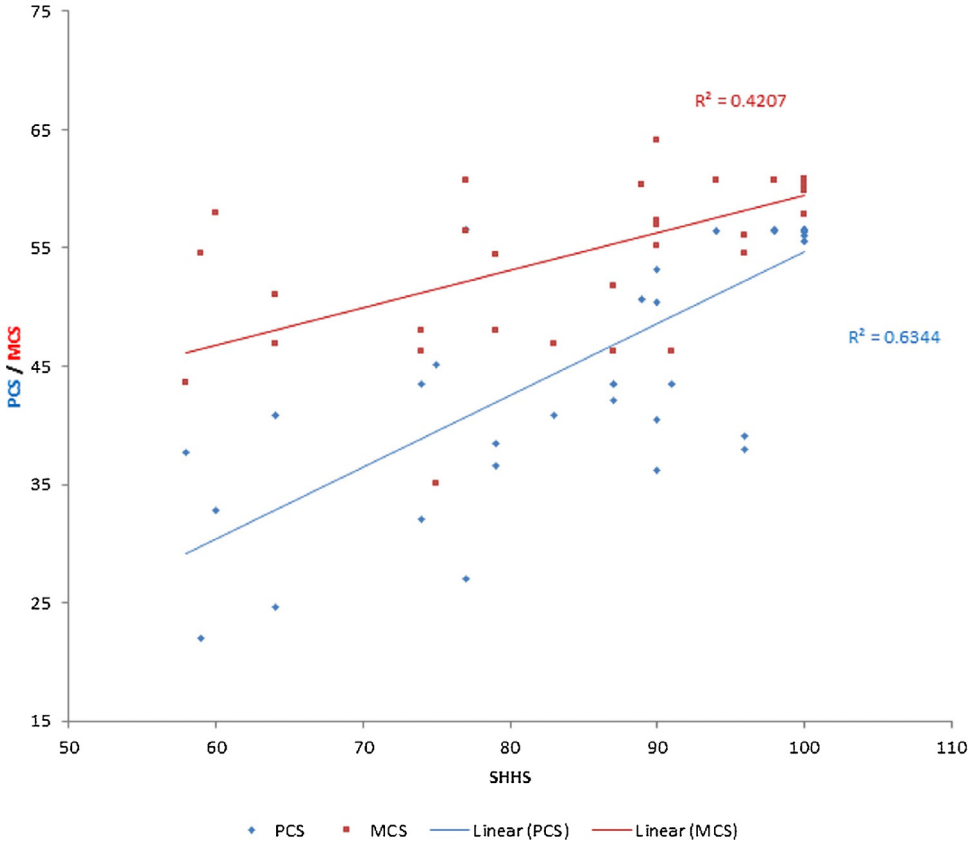

Fig. 2. Scatter plot of HHS and SF-12 (PCS and MCS) showing a positive correlation between the two implying that an improvement in HHS tends to improve the quality of life also.

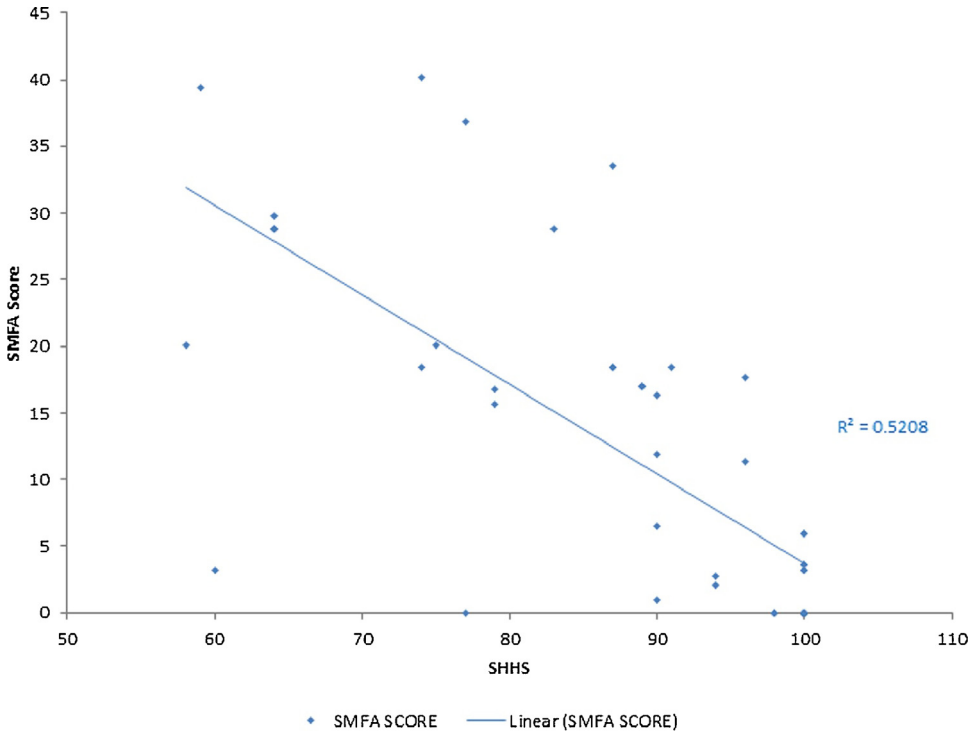

Fig. 3. Scatter plot showing the negative correlation of HHS with SMFA.

Table 7
Summary of the correlation coefficients of HHS with quality of life scores.

		HHS
PCS	Pearson Correlation	.797(**)
	Sig. (2-tailed)	0.000
	N	49
MCS	Pearson Correlation	.649(**)
	Sig. (2-tailed)	0.000
	N	49
SMFA SCORE	Pearson Correlation	−0.722(**)
	Sig. (2-tailed)	0.000
	N	49
WHOQOLBREF	Pearson Correlation	.814(**)
	Sig. (2-tailed)	0.000
	N	49

**Correlation is significant at the 0.01 level (2-tailed).

Table 8
Table summarizing the HHS and quality of life scores divided into groups based on the duration of follow up.

		N	Mean	Std. Deviation
SHHS	upto 2 yrs	26	84.3846	15.02818
	2–4 yrs	15	92.0000	8.83984
	>4 yrs	8	97.1250	7.35697
PCS	upto 2 yrs	26	44.32	11.400
	2–4 yrs	15	50.86	6.389
	>4 yrs	8	54.01	6.285
MCS	upto 2 yrs	26	56.02	5.588
	2–4 yrs	15	54.33	8.345
	>4 yrs	8	58.40	4.405
SMFA SCORE	upto 2 yrs	26	14.15	13.590
	2–4 yrs	15	10.24	10.802
	>4 yrs	8	3.35	5.681
WHO QOL BREF	upto 2 yrs	26	74.3462	18.70549
	2–4 yrs	15	84.5000	16.15632
	>4 yrs	8	94.5625	9.76578

fracture is a relatively complex surgery considering that the preparation of the acetabulum for cup placement may not be straight forward. Many of these cases have hardware from previous surgeries or may have a defect in the acetabulum. These issues need to be addressed for preparing an acceptable bed for cup placement. Moreover, restoration of the centre of rotation of hip is essential for proper functioning of the abductors and hence for good walking ability of the patient. A pre-operative blood workup in the form of ESR and CRP can aid in picking up any occult infection and in such a case staged surgery may have to be considered. Pre-operative radiographs of the pelvis, the involved hip and CT scans should be obtained for planning out the surgery. The sagittal, axial and coronal CT images aid in identifying acetabular defects. Moreover, CT can help in predicting the requirement of implant removal during surgery. A full set of implants for acetabular reconstruction should always be kept ready. The cancellous bone from the femoral head can be used for filling up any voids and use of reverse reaming can help in preparing a uniform and smooth bed for cup placement.

Based on the data obtained the following inferences could be drawn–

- THA was performed commonly in younger patients, which may be reflective of the fact that young patients tend to have acetabular fractures more often and that their demands of a more active lifestyle than the elderly, makes them opt for THA as a treatment option.
- Greater number of males is reflective of the fact that they have a greater possibility of being exposed to acetabular trauma considering that in developing countries, males are the primary bread-earners for their families.
- Restoration of radiological parameters was better in patients who had an initial operative management of acetabulam fracture than in those who had non operative management.

- HHS was good to excellent in 35 of the 47 patients. While not being statistically significant, the HHS was better in patients who were less than 60 years of age.
- SF-12 scores were better in the younger population. The scores were better in patients with LLD of less than 10 mm as compared to those with LLD between 10–20 mm
- The HHS has a strong positive correlation with the predictors of quality of life.
- HHS and quality of life scores tend to improve with increasing duration of follow up, which indicates that patients tend to adapt to their new-found mobility after the initial period of pain and restriction over a period and in doing so become more active.

The absence of a statistically significant difference in radiological parameters in cases where they were within acceptable and non-acceptable range is suggestive that the accuracy with which arthroplasty was performed is probably of prime importance. The type of fracture initially suffered, the management received for it and the aetiology which necessitated the THA may not affect the radiological outcomes after THA on their own. Rather these factors may affect the ease or difficulty of the THA for the operating surgeon. The adequacy of acetabular reconstruction (whenever required) and the accuracy of the acetabular component placement during the surgery are the determining factors for restoration of the radiological parameters.

Weber et al.[19] reported their experience of THAs in acetabular fractures and noted that both the cemented and un-cemented THAs had good results. von Roth et al.[20] reported the results of follow up at a mean of 21 years and noted that the twenty-year survivorship of the acetabular component was 71% free from revision for aseptic loosening and 57% free from revision for any reason. Also, the mean HHS was 80 thereby suggesting that THA after an acetabular fracture has reasonable survivorship and tends to function adequately in the long run.

Even though limited literature is available on the survival and on functional outcomes of THAs in patients of acetabular fractures, there is a paucity of data dealing with whether primary fracture pattern or fracture management has any influence on restoration of radiological parameters after THA. Also, studies which objectively evaluate the predictors of quality of life and their correlation with HHS, LLD and radiological parameters in these patients are lacking. We therefore believe that the data that has come out of this retrospective study has added to the existing knowledge.

There are a few notable limitations of the study. As it is a retrospective study, no pre-operative scores for the parameters under evaluation were available for comparison with post-operative scores. The follow up of most of the patients is of less than 4 years' duration i.e. the results are primarily of a short-term follow up. We did not notice any patient with aseptic loosening, dislocation or peri-prosthetic fractures. The short duration of follow up might have contributed to it. We believe that a longer follow up would bring more clarity to the effect these complications might have on the quality of life. Also, the sample size is relatively small. There was no standardized protocol for mobilization of the patients. This might have contributed to somewhat lower HHS during the early follow up. While acetabular malunion, non-union, malrotation and retained implants from the previous surgery might influence the activity level of the patient and may lead to patient dissatisfaction, we did not specifically look for these factors.

We believe that though it has few limitations, the present study brings forward the information that proper planning and execution of a THA in cases of prior acetabular fractures is essential to have a good outcome radiologically and functionally especially in the short-term. While in the short term the fracture suffered by the patient does not tend to influence the outcome of a properly performed THA, long term studies with a larger sample size is needed to evaluate the actual impact of the injury on functional outcome of such patients.

Conflict of interest

The authors have none to declare.

References

1. Kumar A, Shah NA, Kershaw SA, Clayson AD. Operative management of acetabular fractures: a review of 73 fractures. *Injury*. 2005;36:605–612.
2. Tornetta III PIII. Displaced acetabular fractures: indications for operative and nonoperative management. *J Am Acad Orthop Surg*. 2001;9:18–28.
3. Laird A, Keating JF. Acetabular fractures: a 16-year prospective epidemiological study. *J Bone Joint Surg*. 2005;87-B:969–973.
4. d'Imporzano M, Liuni FM, Tarantino U. Acetabular fragility fractures in elderly patients. *Aging Clin Exp Res*. 2011;23(2 Suppl):71–73.
5. De Bellis UG, Legnani C, Calori GM. Acute total hip replacement for acetabular fractures: a systematic review of the literature. *Injury*. 2014;45(February (2)):356–361.
6. Sermon A, Broos P, Vanderschot P. Total hip replacement for acetabular fractures. Results in 121 patients operated between 1983 and 2003. *Injury*. 2008;39(August (8)):914–921.
7. Jolly MJ, Mears DC. The role of total hip arthroplasty in acetabular fracture management. *Oper Tech Orthop*. 1993;1:80.
8. Bellabarba C, Berger RA, Bentley CD, et al. Cementless acetabular reconstruction after acetabular fracture. *J Bone Joint Surg Am*. 2001;83 (6):868–876.
9. Romness DW, Lewallen DG. Total hip arthroplasty after fracture of the acetabulum: long term results. *J Bone Joint Surg Br*. 1990;72:761–764.
10. Tonnis D, Heinecke A. Current concepts review: acetabular and femoral anteversion. Relationship with osteoarthritis of the hip. *J Bone Surg Am*. 1999;81:1747–1770.
11. Charles MN, Bourne RB, Davey JR. Soft-tissue balancing of the hip: the role of femoral offset restoration. *Inster Course Lect*. 2005;54:131–141.
12. Yamaguchi T, Naito M, Asayama I, et al. Total hip arthroplasty: the relationship between posterolateral reconstruction, abductor muscle strength, and femoral offset. *J Orthop Surg*. 2004;12:164–167.
13. Clark CR, Huddleston HD, Scoch EP, et al. Leg-length discrepancy after total hip arthroplasty. *J Am Acad Orthop Surg*. 2006;14:38–45.
14. Herman KA, Highcock AJ, Moorehead JD, et al. A comparison of leg length and femoral offset discrepancy in hip resurfacing, large head metal on metal and conventional total hip replacement: a case series. *J Orthop Surg Res*. 2011;6:65.
15. Meena UK, Sen RK, Behera P, Tripathy SK, Aggrawal S, Rajoli SR. WHOQOL-BREF Hindi questionnaire: quality of life assessment in acetabular fracture patients. *Indian J Orthop*. 2015;49(May–June (3)):323–328.
16. Borg T, Berg P, Larsson S. Quality of life after operative fixation of displaced acetabular fractures. *J Orthop Trauma*. 2012;26(August (8)):445–450.
17. Meena UK, Tripathy SK, Sen RK, Aggarwal S, Behera P. Predictors of postoperative outcome for acetabular fractures. *Orthop Traumatol Surg Res*. 2013;99(December (8)):929–935.
18. Learmonth ID, Young C, Rorabeck C. The operation of the century: total hip replacement. *Lancet*. 2007;370(October (9597)):1508–1519.
19. Weber M, Berry DJ, Harmsen WS. Total hip arthroplasty after operative treatment of an acetabular fracture. *J Bone Joint Surg Am*. 1998;80(September (9)):1295–1305.
20. von Roth P, Abdel MP, Harmsen WS, Berry DJ. Total hip arthroplasty after operatively treated acetabular fracture: a concise follow-up, at a mean of twenty years, of a previous report. *J Bone Joint Surg Am*. 2015;97(February (4)):288–291.