

## DISCUSSION

Hip fractures in elderly patients result in implications in medicine, rehabilitation, psychiatry, and healthcare economics, and continues to be regarded as the 'Unsolved fracture'. Patients who sustain a fracture of the hip have higher reported age and/or gender-adjusted mortality rates than the general population. There is still no agreement on the optimal operative treatment of displaced subcapital fractures in the elderly. Controversy exists regarding rehabilitation, durability of internal fixation and the type of prosthetic replacement hemi or total hip arthroplasty.<sup>(165)</sup>

Fixation in comparison to arthroplasty has a lower mortality, less peri-operative complications and has a better functional outcome. Secondary surgical procedures are however increased after internal fixation; they recommended hemiarthroplasty for those patients in which early mobilization is desired and in displaced fracture type.<sup>(165)</sup>

Comparative studies between unipolar, modular unipolar, bipolar hemiarthroplasty and total joint replacement were done by many authors, in resource-poor countries; cost is one of the major factors. The unipolar prosthesis is the least expensive procedure, and total hip replacement is the most expensive. In the study done by Narayan and George.<sup>(166)</sup> From 1997 to 1999, they preferred total hip replacement believing that it offered the best functional results and from 2000, they preferred the bipolar prosthesis, because they had had three dislocations after total hip replacement. The main concern with bipolar arthroplasty is the possibility of occurrence of protrusio acetabuli so they therefore decided to use the same femoral component as used in total hip replacement, so that if protrusion occurred, only the acetabular side would need to be revised this concept is also present in the modular unipolar prosthesis. At a mean follow-up of 5 years, they had not had to do any revisions, for protrusion, it was also seen that more than a third of the patients expire within 5 years of replacement, long before any protrusion occurs.<sup>(166)</sup>

The surgical technique of hemiarthroplasty is simpler than total hip replacement. Due to a large acetabular component, dislocations are uncommon.<sup>(167)</sup>

Minimally invasive approach was described as having a lower degree of trauma for the soft tissues and in particular for the muscles. This opinion was based on the fact that in hip arthroplasty the loss of blood is less rate of recovery is faster, the postoperative level of pain is lower and patients are released sooner from hospital.<sup>(109)</sup> However, it is unclear whether muscle trauma is really reduced as the result of the smaller sized access incisions and the lack of or lower amount of muscle detachment because normally the surgical hooks and retractors used during the operation exert a much greater pressure on and cause extensive contusions in the muscle tissue. Indeed, measurable muscle damage has been identified in all the currently used minimally invasive approaches tested in cadaver studies.<sup>(109)</sup>

Comparative studies between conventional and minimally invasive surgery for hemiarthroplasty of the hip were done by many authors. In the study done by Felix Renken et al.<sup>(168)</sup> comparing two different approaches to the hip joint for the implantation of a bipolar hemi-arthroplasty after fractured neck of femur, it can be stated that mobilization status is improved for the minimally invasive compared to the conventional approach, also there is less pain in the minimally invasive approach. There is no radiographic evidence that a minimal invasive technique leads to inferior implant position.<sup>(168)</sup> In the study done by Alexander Auffarth et al. they concluded that despite early

postoperative differences, postoperative mobility does not seem to be greatly influenced by the choice of the approach for hip hemiarthroplasty.<sup>(169)</sup>

In our study we report the results of a comparative and prospective study on fifteen patients operated on via the conventional posterior approach and fifteen patients operated by highly experienced surgeon. Using a minimally invasive posterior approach.

Minimally invasive bipolar hemiarthroplasty performed through a single-incision posterior approach by a highly experienced surgeon in less invasive approaches to the hip is safe and reproducible. However, it offers significant benefit in the early postoperative period compared with a standard approach. As it is not known whether the less experienced surgeons can achieve similar results, the mini-incision technique merits further study before wide dissemination and implementation of this family of surgical approaches can be recommended.<sup>(103)</sup>

### **Age & sex**

In our study there were no statistical significant differences between the two studied groups as regard age (p value=0.464), sex (p value=0.456) because the age of patients with femoral neck fracture mostly of elderly patients.

### **Weight**

In our study there was a significant difference between the two groups as regard weight (p value=0.012).

Authors had suggested hip that not all patients were suitable candidates for MIS hip arthroplasty procedures.<sup>(170)</sup> Those patients who are thin and with a lower risk of peri or postoperative complication would be most suitable for MIS.<sup>(82)</sup> However, Desser et al,<sup>(170)</sup> commented, these characteristics may not be reflective of the average hip surgeon. Sculco et al,<sup>(105)</sup> suggested hip arthroplasty patients with a body mass index greater than 30 should not be considered for MIS due to the difficulty in identifying anatomical landmarks during surgery.

### **Skin incision**

In our study there was significant differences between the two groups as regard length of skin incision (p value<0.001) in conventional group the Incision length ranged from 20-27cm with mean of  $23.2 \pm 2.27$ cm and. MIS group: Incision length ranged from 6.5-12cm with mean of  $9.23 \pm 1.73$ cm.

There is a lack of consensus over the actual definition of MIS and the relationship between skin incision and soft tissue trauma. Speranza et al.<sup>(171)</sup> and Procyk<sup>(172)</sup> suggested in hip arthroplasty, the ideal MIS is a procedure which has little tissue disruption without cutting muscles and tendons and therefore less pain to provide a significantly shorter rehabilitation with longer term outcomes which are equal or better to a conventional approach. Accordingly, the little difference in outcomes reported in Smith et al,<sup>(84)</sup> study may be attributed to similarities in the operative procedure after the skin incision for traditional and MIS procedures.<sup>(84)</sup>

Mow et al,<sup>(173)</sup> attribute these findings to skin and soft tissue damage caused by the high retractor pressure required for the MIS exposure.<sup>(84, 173)</sup>

### Blood transfusion

- In our study there was significant difference between the two groups as regard blood transfusion [p value < 0.001].
- The observation of smaller amounts of blood loss reported by Sculco et al,<sup>(105)</sup> could be confirmed by the results of Fink et al.<sup>(109)</sup> This could be explained by the fact that in hip arthroplasty the minimally invasive approach not only results in a smaller wound size but also involves detachment of only the upper part of the external rotator muscles, so sparing the rami profundus of the circumflexa femoris medialis artery. Therefore in Fink et al,<sup>(109)</sup> study the Hb-level is not a good parameter for blood loss due to the surgery. The smaller wound in the MIS group may also be responsible for the lower levels of postoperative pain hip arthroplasty we and others observed in the MIS group.<sup>(89, 108, 109)</sup>

### Operative time

In our study there was significant difference between two groups as regard the operative time [p value < 0.001] operative time in conventional group ranged from 100-120min with mean [120±18.61min], while in MIS group operative time ranged from 45-60 min with mean [50.67 ± 10.34 min].

Surgical learning curve is an important variable which may have accounted for the differences in surgical duration between the groups.<sup>(25,174,175)</sup> Desser et al,<sup>(170)</sup> and Pagnano et al,<sup>(176)</sup> reported hip arthroplasty of the MIS technique was more difficult hip arthroplasty than conventional exposure method, but hip arthroplasty complication rates would be expected to decrease with surgical experience.<sup>(23, 170)</sup> Whilst some authors have reported a low complication rate such as Berry et al,<sup>(82)</sup> of 2% with four experienced surgeons, others have reported much higher rates such as Pagnano et al,<sup>(171)</sup> conversely with 14%, which was attributed to surgical experience and the existence of a learning curve.<sup>(23, 82)</sup> Goosen et al,<sup>(177)</sup> concluded hip arthroplasty relatively inexperienced surgeons should consider carefully the advantages and disadvantages of MIS procedures before adopting such as approach given the long learning curve. Furthermore, Sculco et al,<sup>(105)</sup> suggested hip arthroplasty the posterior approach may be the most appropriate approach to adopt since it is familiar to most surgeons and still allows the easy extension of the wound if operative visibility is insufficient.<sup>(105, 178)</sup>

### Hospital stay

- In our study There was significant difference between two groups as regard hospital stay [p value 0.001].The duration of hospital stay in conventional group ranged from three to seven days with average four day while in MIS group ranged from two to five days average three days.
- Current trends in hip arthroplasty replacement have focused on shorter hospital stays, Gulotta et al,<sup>(179)</sup> compared one hundred forty nine patients undergoing hip arthroplasty were enrolled in an accelerated postoperative pathway and 134 were enrolled in the traditional pathway. Patients were followed prospectively and outcomes included hospital length of stay, intra and postoperative complications, readmissions, reoperations. A statistical model was created to determine factors predictive of a 2-day

discharge. At 1 year, there were no differences in complications, readmissions, or reoperations. The average length of stay decreased from 4.1 to 2.6 days ( $p < 0.0001$ ). In the fast track group, 58% of patients were discharged home within 2 days. Barriers to a 2-day discharge were postoperative pain, nausea, and dizziness. The only preoperative factor hip arthroplasty was predictive of a 2-day discharge was hypertension.

### **Cement mantle & femoral stem position**

In our study there were no statistical significant differences between the two studied groups as regard femoral stem position ( $p$  value=0.200) but there was statistical significant differences between the two studied groups as regard cement mantle ( $p = 0.005$ ).

Woolson et al.<sup>(175)</sup> reported femoral prostheses were more frequently mal-positioned in MIS compared to conventional approaches. Similarly, they reported a significantly higher percentage of cementless stems in the MIS cohort had a poor fit and fill with less hip arthroplasty 2 mm between the distal portion of the stem and the femoral cortex ( $p = 0.004$ ). They related this to the reduced visualization of the proximal femur from the small incision.<sup>(180)</sup> Given the findings of Smith et al.<sup>(84)</sup> study, such issues in implant positioning do not seem to be supported by the literature.

Smith et al.<sup>(84)</sup> was unable to distinguish the results between experienced and inexperienced MIS surgeons, it remained unclear whether this factor was important when generalizing complications to general clinical practice. Furthermore, since the longest follow up period documented was five years,<sup>(17, 105)</sup> it remained unclear whether the effect of implant positioning had any longer term effect on prosthesis survival. Future surveillance studies of longer follow up would enlighten as to whether this is a potential feature of MIS hip arthroplasty procedures.<sup>(84)</sup>

### **Harris hip score**

In our study there were no statistical significant differences between the two studied groups as regard post operative Harris hip score ( $p = 0.217$ ).

The number of patients with satisfactory results in conventional group were ten [66.7%] & number of patients with unsatisfactory results were five[33.3%]. While in MIS group. The number of patients with satisfactory results 13[86.7%] & patients with unsatisfactory results 2[13.3%].

Goldstein et al.<sup>(101)</sup>, Woolson et al.<sup>(175)</sup> Wright et al.<sup>(17)</sup>, and Ogonda et al.<sup>(103)</sup> did not observe any objective clinical advantages of the mini-posterior approach when compared to the standard posterolateral approach. It must be said, however, hip arthroplasty the minimal invasion in these studies was only at the level of a shorter skin incision. In contrast, Sculco et al.<sup>(105)</sup> and DiGioia et al.<sup>(107)</sup> observed a smaller loss of blood and a faster postoperative recovery following a mini-posterior approach while Inaba et al.<sup>(89)</sup> and Dorr et al.<sup>(108)</sup> Reported a lower level of postoperative pain and a more rapid recovery of muscle function using the same technique. The mini-incision technique used in these reports did not involve detachment of the quadratus femoris muscle however.<sup>(109)</sup>

Fink et al.<sup>(109)</sup> reported no statistically significant difference between surgical exposure method and wound healing complications ( $p=0.17$ ), the effect size was

substantial between the groups with nearly a three times greater risk following MIS compared to conventional hip arthroplasty in the overall analysis.

### **Walking with support**

In our study there was no statistical significant difference between the two studied groups as regard walking with support (p value<0.913).

The significantly earlier ability to walk alone illustrated the benefit of the minimally invasive approach with respect to the postoperative recovery period. This advantage was also reported by other authors.<sup>(89,108)</sup> However, a bias cannot be excluded because the patient in Fink et al,<sup>(109)</sup> study and in other studies were informed about the kind of their surgery which may result in higher motivation of patients of the MIS group. Six weeks after surgery the clinical scores In Fink et al,<sup>(109)</sup> study showed no longer any differences so hip arthroplasty there did not appear to be a benefit for longer term of minimally invasive surgery. This was also confirmed by gait analyses which showed hip arthroplasty there was no difference between the mini-posterior approach and the standard posterior approach six weeks after implantation of hip endoprostheses.<sup>(108,181)</sup>

### **Pain**

#### **In our study there was no statistical difference between two groups as regard pain**

Smith, et al,<sup>(84)</sup> had found hip arthroplasty the current evidence base suggested hip arthroplasty MIS hip arthroplasty had resulted in no clinically significant reduction in total blood loss or hip scores at final follow up with any difference in radiological outcomes at final review compared to a conventional approach. Whilst hospital stay and pain scores were lower in the MIS group, this was not a clinically significant difference.

### **Complication**

In this study there were no statistical significant differences between the two studied groups as regard complications.

Woolson et al,<sup>(175)</sup> compared hip replacements performed with a standard incision and a mini-incision with the numbers of patients available, no significant differences were found between the groups with respect to the average surgical time, intraoperative blood loss, hospital transfusion rate, length of hospital stay and the patients' disposition after discharge. The mini-incision group was found to have a significantly higher risk of a wound complication (p = 0.02) and poor fit and fill of femoral components inserted without cement (p = 0.0036).<sup>(175)</sup>

Desser et al.<sup>(170)</sup> and Pagnano et al.<sup>(176)</sup> reported hip arthroplasty the MIS technique was more difficult hip arthroplasty the conventional exposure method, but hip arthroplasty complication rates would be expected to decrease with surgical experience.<sup>(23,170)</sup>

A weakness of Fink et al,<sup>(109)</sup> study was the lack of any randomization of the patients which may bias the results. However, the primary objective of Fink et al,<sup>(109)</sup> study was to assemble a non-selected group of patients with as few exclusion criteria as possible and to avoid the exclusion of a number of patients because they wished to undergo minimally invasive surgery. This corresponded to procedures described in other studies hip

arthroplasty compared various minimally invasive approaches and the standard approach to hip replacement<sup>(17, 89, 175, 182, 183)</sup>

Furthermore, the fact hip arthroplasty two different surgeons performed the implantations via the standard approach may bias the results. However, all three surgeons were well experienced and the operative procedure was exactly the same except the shorter incision and the preserving of the lower external rotators in the minimal invasive group. In the standard approach both experienced surgeons did exactly every step identical and there was no difference in the results between them. Moreover, the patients were not entered into a post-operative recovery program especially designed for minimally invasive surgery patients as they were in the study of Dorr et al.<sup>(108)</sup> Instead, it was decided to examine whether an unchanged rehabilitation program would result in the minimally invasive surgery group attaining defined rehabilitation objectives at an earlier time and so avoid the mixing of the effect of a different rehabilitation program with the effect of the surgical approach. Moreover, the fact hip arthroplasty patients with the minimal invasive approach know hip arthroplasty they get this kind of approach may bias the results, but this is the problem in all studies analyzing minimally invasive approaches.<sup>(109)</sup>

In arthroplasty community a new and heightened level of interest existed in minimally invasive techniques for hip replacement. Several investigators had published their personal experience with differing techniques, all concluding hip arthroplasty there were multiple advantages to this concept for hip arthroplasty. Hartzband,<sup>(184)</sup> and other author's perception was hip arthroplasty the advantages of minimally invasive posterolateral approach hip arthroplasty were multiple. They included more rapid rehabilitation and more prompt return to activities of daily living. There had been a clear impression hip arthroplasty patients experienced less postoperative pain and improved satisfaction. A concomitant decrease in hospital stay had been noted. Patients undergoing the procedure today have an average length of hospital stay of 48 hours, which represented a 30% decrease in hospital stay over the last year. Other advantages had been included were improved cosmesis and potentially reduced blood loss without increasing complication rates.

Surgeons performing minimally invasive posterior approach procedure required familiarity with the local anatomy, because the technique is certainly more demanding hip arthroplasty is traditional arthroplasty. It was perhaps a technique best applied by surgeons performing more hip arthroplasty 50 hip arthroplasties a year. The two keys to successful application of the technique were adequate surgical training and use of specialized instrumentation if needed. It was a difficult procedure to teach, because only one person is able to access a good view of the anatomy at any one time.<sup>(184)</sup>

Procyk,<sup>(172)</sup> studied initial results with a mini-posterior approach for hip arthroplasty. Implantation of the hip prosthesis should always be as atraumatic as possible. The principle underlying this technique is to visualise the working area while keeping the aperture to a minimum, with a resulting reduction in trauma to the soft tissue. Procyk<sup>(172)</sup> presented a new improved single-incision approach in hip arthroplasty: the mini-posterior approach. Preliminary results from 60 patients operated using this approach indicate rapid functional recovery, minimal postoperative pain, a reduced duration of hospitalisation, few complications, and optimal component positioning.

## SUMMARY

The minimally invasive surgery (MIS) exposure in bipolar hemiarthroplasty hip surgery was developed to reduce postoperative bleeding, speed patient recovery and improve the early clinical results. Minimally invasive bipolar hemiarthroplasty hip surgery has been defined as an incision length of 7-10 cm. Surgeons have suggested that the smaller skin incision, with reduced soft tissue trauma to muscles, tendons and other soft tissues surrounding the hip should result in less postoperative pain, enhance the patient experience and reduce the hospital stay.

The aim of this work was to compare the results of bipolar hemiarthroplasty done by MIS posterior approach and conventional posterior approach.

This prospective and comparative study was including 30 patient in two groups, fifteen done through MIS posterior approach and fifteen through conventional posterior approach.

Functional outcome was assessed by Harris Hip Score questionnaire after their approval to share in this thesis, tabulated and analyzed using appropriate statistical methods.

**Age:** There were no statistical significant differences between the two studied groups as regard age (p value=0.464).

**Sex:** There was no significant difference between two groups as regard sex [p. value 0.456]

**Weight:** There was significant difference between two groups in weight with [p. value 0.012].

**Height:** There was no significant difference between two groups in height with [p. value 0.499].

**Occupation:** There was no significant difference between two groups in occupation with [p. value→0.674].

**Mode of trauma:** There was no significant difference between two groups in mechanism of trauma with [p. value 1.00].

**Affected side:** There was no significant difference between two groups according to affected side [p. value 0.456].

**Length of incision:** There was significant difference between two groups regarding the Incision length [p. value < 0.001].

**Operative time:** There was significant difference between two groups as regard the operative time [p. value < 0.001].

**Type of anesthesia:** There was significant difference between two groups as regard the type of anesthesia [p. value < 0.001].

## ***Summary***

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**Blood transfusion:** There was significant difference between two groups as regard the blood transfusion [p. value < 0.001].

**Hospital stay:** There was significant difference between two groups as regard hospital stay [p. value 0.001].

**Complications:** There was no statistical significant difference between two studies groups as regard complication.

**Post operative Harris hip score:** There was no statistical significant difference between two groups according to Harris hip score [p. value 0.217].

**Position stem:** There was no statistical significant difference between two groups according to position of the stem [p. value 0.200].

**Cement mental:** There was statistical significant difference between two groups regarding the cement mental [p. value < 0.005].

## **CONCLUSIONS**

- Minimally invasive posterior approach technique represented a viable option for the implantation of bipolar hemiarthroplasty.
- A demonstrable advantage over the conventional posterior approach during the implantation of bipolar hemiarthroplasty had been found.
- A good positioning of the implant and optimal cementing technique could be achieved by MIS posterior approach, and it was not associated with higher complication rates than the standard approach; (provided that both experienced surgeon and optimum patient selection were available).
- A little difference in the clinical or radiological outcomes of MIS to conventional bipolar hemiarthroplasty had been found in short term follow up.