

A Non-Randomized Prospective Study of Management of Intracapsular Fracture Neck of Femur with Bipolar Hemiarthroplasty.

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ABSTRACT

Background: The fracture neck of femur is one of the commonest fractures in elderly. With life expectancy increasing with each decade, our society is becoming increasingly an active geriatric society, with significant number of hospitalized and nursing home patients with femoral neck fractures and their sequelae. Selection of the type of prosthesis is very important in hemiarthroplasty as different types are available. Since the last two decades, bipolar replacements of the femoral head have gained popularity for treating femoral neck fractures. **Aim & Objective –** To assess and analyse the results of management of fracture neck of femur with bipolar hemiarthroplasty. **Methods:** After obtaining ethical committee approval and informed consent from patient, detailed history of patient was taken with particular emphasize on mode of injury and associated medical illness. On the day of surgery, under anesthesia and patient in lateral position, following strict aseptic precautions, either lateral (Hardinge) or Posterior (Southern-Moore) approach incision made, tissues dissected, joint capsule incised and femoral head extracted with the help of cork screw. Then the appropriate size of prosthesis with cement was seated. The wound was closed meticulously in layers. Knee flexion, isotonic quadriceps exercises were started from 1st or 2nd post op day and patients were mobilized with walker as tolerated. Patients are educated on different position of legs that should be avoided in the post-operative period. Follow up was done after 6 weeks and for further at 3 months, 6 months & 1 year. **Result:** In our series, at the end of final follow-up, there was no evidence of loosening, radiolucent zones, distal migration or subsidence of prosthesis. The patient with Periprosthetic fracture healed and is weight bearing fully with no pain. One patient who had moderate heterotopic ossification had still has some mild pain occasionally. **Conclusion:** we conclude that bipolar hemiarthroplasty produces good functional outcomes with minimal complications for displaced intracapsular femoral neck fractures and has several advantages; these results are comparable to the other studies.

Keywords: fracture neck of femur, bipolar prosthesis, bipolar hemiarthroplasty, Harris hip score.

INTRODUCTION

Femoral neck fracture has been recognized since the time of Hippocrates (460-377 BC).^[1] The first description of hip fractures was by a French Surgeon Ambroise Pare in 1564.^[2]

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With life expectancy increasing with each decade, our society is becoming increasingly an active

geriatric society, with significant number of hospitalized and nursing home patients with femoral neck fractures and their sequelae. It has always presented great challenges to orthopedic surgeons and even today, it remains an unsolved fracture as far as treatment is concerned.^[3]

Epidemiology - Femoral neck fractures occur most frequently in elderly female patients. They are uncommon in patients under the age of 60 years. There is some racial variation in the incidence. They are less common in black race and more common in white females than males.^[4]

Epidemiologic studies have identified numerous risk factors associated with an increased risk of sustaining a hip fracture. These include, a low BMI (less than 18.5), low sunlight exposure, low

recreational activity, smoking, a history of previous osteoporotic fracture, maternal history of hip fracture and corticosteroid treatment.^[5-7]

Different modalities of treatment are used depending on consideration of many factors. Some of them include age of the patient, type of fracture, co-morbid conditions, and risk of developing complications such as nonunion or osteonecrosis.

Prosthetic replacement of femoral head with hemiarthroplasty has been the gold standard now in the management of intracapsular fracture neck of femur in geriatric patients. The advantages being early weight bearing to return to activity and help avoid complications of recumbency and inactivity, and avoiding complications of the fracture healing like nonunion and osteonecrosis.

Although the fixed head endoprosthesis like Austin-Moore Prosthesis has produced excellent results^[8,9], persistent pain and protrusio acetabuli have been associated with this device and led many surgeons to choose a bipolar system. This prosthesis is very useful and results are encouraging.^[10] Since the last two decades, bipolar replacements of the femoral head have gained popularity for treating femoral neck fractures. These devices incorporated the principles of low-friction arthroplasty including fixation with polymethyl methacrylate.

Bipolar Prosthesis:

Principle of bipolar prosthesis^[11]: Acetabular wear is diminished through reduction of total amount of motion that occurs between the acetabulum and metallic outer shell by the interposition of a second low-friction inner bearing within the implant. Because of compound bearing surface, bipolar designs provide greater overall range of motion than either unipolar designs or conventional total hip arthroplasty.

Bipolar Hemiarthroplasty:

Bipolar hemiarthroplasty has become a very popular alternative to unipolar hemiarthroplasty. A wide range of modern bipolar cemented and uncemented stems are available. Bipolar heads have a number of proposed advantages. There is an articulation between the inner head and shell and between the shell and acetabulum. This dual articulation was proposed to reduce the risk of wear and acetabular protrusio. Some studies have suggested that in some designs, the prosthesis ceases to function as it was intended and for practical purposes the implant behaves as a unipolar implant in a proportion of patients.^[12] There is some evidence that the function of the articulation varies with the diameter of the inner head.

Bipolar prosthesis is designed to allow movement to occur not only between the acetabulum and the prosthesis but also at a joint within the prosthesis

itself. The object of second joint is to reduce acetabular wear and tear. The internal joint may be of either the trunion type that allows axial movement between the head and neck of prosthesis of the ball or socket type, which allows universal movement at the inner joint.

Advantages of Bipolar Prosthesis

1. Provides greater range of motion
2. Improved stability may be due to self centering or self aligning mechanism
3. Reduces acetabular wear due to most motion occurring at inner bearing.
4. In modular design, it allows conversion to Total Hip Replacement without changing the femoral component.
5. With some designs, there is a possibility of adjusting neck length to achieve optimum limb length and joint tension.

In view of these, the present study is conducted to analyze the short-term results and the outcome of the management of fracture neck of femur with bipolar Hemiarthroplasty

MATERIALS AND METHODS

The present study is a non-randomized prospective study of Management of Intracapsular Fracture neck of femur with bipolar hemiarthroplasty. The study has been carried out after obtaining the clearance from ethical committee.

Inclusion criteria:

1. Elderly patients, aged above 50 years, with displaced acute intracapsular fracture neck of femur.
2. Nonunion following intracapsular fracture neck of femur.
3. Osteonecrosis following intracapsular fracture neck of femur.
4. Failed internal fixation following fracture neck of femur.

Exclusion criteria:

1. Age < 50 years
2. Undisplaced or minimally displaced intracapsular fracture.
3. Patients with senile dementia for whom the assent of their next of kin was not obtained.
4. Patients with a pathological fracture from a tumor or Paget's disease of bone.
5. Patients who were not considered to be fit for the surgical procedure.
6. Patients with significant arthritis of the hip that necessitated treatment with a total hip replacement.

Once the patient was admitted to the hospital, they were observed regularly during their hospital stay till they get discharged. They were asked to come

for follow up regularly to the outpatient department. Those who did not come were reminded by phone. Five patients who could not come answered the necessary questions through phone.

Preoperative Management

Patients were admitted to the ward. Detailed history was taken with particular emphasize on mode of injury and associated medical illness. In depth, clinical assessment was carried out in each case. Preoperatively Buck's traction with appropriate weight was applied and oral or parental NSAIDs were given.

Anteroposterior radiographs of the affected hip joint and pelvis with bone hips were taken. Routine blood investigations were done in all cases. Necessary and adequate treatment was given for those associated with medical problems.

Certain therapeutic exercises were taught preoperatively to the patients, which had to be continued postoperatively, such as deep breathing exercises, static quadriceps exercises, ankle movements. Informed written consent for the surgery was taken for all patients. Deep venous thrombosis prophylaxis with low molecular weight was given to all at risk patients. Intravenous antibiotics were given an hour before the surgery.

Surgical Procedure

All surgeries were performed on an elective basis using standard aseptic precautions surgery was performed under spinal or general anaesthesia.

Position of patient: Lateral position

Approach: Posterior approach / Lateral approach

Technique: After anesthesia, patient in lateral position, under strict aseptic precautions, with either lateral (Hardinge) or Posterior (Southern-Moore) approach incision made, tissues dissected, joint capsule incised and femoral head extracted with the help of cork screw.

With an appropriate rasp, medullary canal is rasped in Valgus and 10–15 degrees of anteversion relative to the plane in which the knee joint axis lies. Then the appropriate size of prosthesis with cement was seated in the prepared medullary canal with the 10 – 15 degrees of anteversion and Valgus position. The prosthesis was impacted with gentle blows in to the medullary canal and finally, the prosthesis was reduced in to the acetabulum.

The hip was tested for full range of movements and stability intraoperatively. The wound was closed meticulously in layers over a suction drain maintaining haemostasis throughout the procedure and dressing was applied. We noted the duration of surgery from incision to closure, blood loss, whether prosthesis can be easily reduced and

difficulty in reduction. Blood loss was assessed and blood transfusion carried out if required.

Post Operative Management -

A pillow was kept in between both the legs so that the leg was in abduction. Foot end of the bed was elevated and regular hourly Temperature, Pulse, respiratory rate, blood pressure charts were maintained for initial 24 hours. Whenever necessary, postoperative blood transfusion was given.

Antibiotics – In the form of intravenous route twice a day given for the first 48 hours and later shifted to oral antibiotics.

A post op check X-ray was taken and the Valgus seating with 10 – 15 degree of anteversion was confirmed. Any limb length discrepancy was noted. Knee flexion, isotonic quadriceps exercises were started from 1st or 2nd post op day and patients were mobilized with walker with partial weight bearing as tolerated and if patients are comfortably walking, we discharge them on 4th or 5th post operative day and ask them to come for suture removal on 10th post operative day, provided wound is healthy otherwise we keep the patients till suture removal and then discharge.

The patient was advised to use a straight high chair with arms to facilitate getting out of the chair and avoid a sofa. The patient was advised not to sit cross-legged or squat on the floor or squat on Indian style of toilet and patient was advised not to adduct or flex the hip excessively or involve in activities that place heavy load or stresses on the hip joint. The patient was advised to carry out the isotonic and isometric exercises to strengthen the muscles around the hip.

Follow Up: At the time of discharge the patients were asked to come for follow up after 6 weeks and for further follow up at 3 months, 6 months & 1 year.

At follow up, detailed clinical examination was done systematically. Patients were evaluated according to Harris hip scoring system for pain, limp, the use of support, walking distance, ability to climb stairs, ability to put on shoes and socks (in our study for some patients ability to cut toenail was enquired) sitting on chair, ability to enter public transportation, deformities, leg length discrepancy and movements. All the details were recorded in the follow up chart. The radiograph of the operated hip was taken at regular intervals, at each follow up.

RESULTS

The following observations were made from the data collected during the study of treatment of intracapsular fracture neck of femur with bipolar

hemiarthroplasty done at St Theresa hospital, Hyderabad from July 2008 to July 2010

Table 1: Age Incidence: The Average Age of Patients in Our Series Range from 40 Years to 75 Years.

Age in years	No. of cases	Percentage
<50	2	9.09
50-60	3	13.63
60-70	8	36.36
>70	9	40.90
TOTAL	22	100

Table 2 : Sex Incidence

	No of cases	Percentage
Female	16	72.72
Male	6	27.27
Total	22	100

Table 3: Side Incidence

	No. of cases	Percentage
Left	11	50
Right	11	50
Total	22	100

Table 4: Type of Fracture(Garden's Classification)

Type of Fracture	No. of cases	Percentage
Type III	10	45.45
Type IV	12	54.54
Total	22	100

Table 5: Mechanism of Injury

	No of Patients	Percentage
Fall due to slip	17	77.27
RTA	2	9.09
Giddiness	3	13.63
Total	22	100

Table 6: Interval Between Injury and Admission

Duration	No of Patients	Percentage
< 7 days	14	63.63
7 – 30 days	3	13.63
> 30 days	5	22.72

Table 7: Associated Diseases

Disease	No. of Pts	Percentage
Diabetes	14	63.63
Hypertension	11	50
Ischemic Heart Disease	4	18.18

Table 8: Duration of Follow U

Follow up	No. of Patients	Percentage
12-24 wks	3	13.63
24-52 wks	13	59.09
> 52 wks	6	27.27

The average follow up in our study range from 12 weeks to 72 weeks.

Intraoperative Complications:

We had intra operative complications in four patients, in two increasing duration of surgery and in another two increased amount of blood loss. Duration of surgery was also noted as one of the factor which was considered in our study. The duration of surgery ranged from 60 min to 120 min. The amount of blood loss is also an important factor because we operated many patients 13 (43.3%) whose hemoglobin was less than 10 gm %. So pre-operative blood transfusions as well as intra-operative and postoperative blood transfusions were done .The blood loss was noted from 250 ml to 600 ml with average of 300 ml.

Minimal reaming was done in all cases to prevent fat embolism and proper placement of the femoral stem in the proximal femoral shaft. In all cases in the intra-operative period close monitoring of the blood pressure and SpO₂ was done by the anaesthetist.

Postoperative Complications:

There was superficial infection in two patients (9.09%). No patient had dislocation of prosthesis or loosening of the stem. One patient had deep infection (4.54%) that required debridement and IV antibiotics. Limb length discrepancy seen in 3 (13.63%) patients, of which shortening was noted in 2 patients and lengthening was noted in one patient. However, the limp was corrected with a shoe raise for the shorter limb.

One patient developed heterotopic ossification, which was moderate at final follow-up, but the patient had good range of motion at hip joint.

One patient had a fracture of lateral cortex below the level of lesser trochanter that was found on postoperative X-ray. She was mobilized partial weight bearing after 10 days and she regained full functional mobility.

In our study we did not find any case of DVT/PE and there were no mortalities.

Table 9: Complications

Complication	No. Of Patients	Percentage
Superficial Infection	2	9.09
Deep Infection	1	4.54
Periprosthetic Fracture	1	4.54
Limb Length Discrepancy	3	13.63
Heterotopic Ossification	1	4.54

Follow Up: The activity level was checked at regular interval at 6 weeks, 3 months, 6 months, and 12 months. Most patients were able to perform house hold activities and were able to walk outside and to their work.

The ambulation was started on 4th-10th postoperative day. All the patients were able to walk comfortably with partial weight bearing walking with walker except few. But after 6 weeks,

many patients walked comfortably without walker just holding the walking stick. Harris Hip Score was evaluated at 6 weeks, 3 months, 6 months, and 12 months.

We assessed all patients during follow up visits with check X-ray and follow up X-rays for positioning of the prosthesis, any radiological signs of loosening. Acetabulum was normal till the last follow up in all cases; no acetabular erosion was noted in our study.

Range of movements was calculated in all patients. All the patients were able to do more than 90 degree flexion, more than 30 degree of abduction at regular follow up except those who were immobilized for around 3 weeks. We did not allow patients to cross leg sitting and squatting in our follow up. At the follow up we noted that few patients were squatting against our advice and used to sit on the floor comfortably. Others used to sit on chair and they used western toilet.

The pre fall activity level was achieved by 10 (45.45%) patients by the end of 3 months and 19 patients (86.6%) by the end of 6 months. Only 3 patients (13.63%) were unable to get their pre-fall level.

Table 10: Outcome

Harris Hip Score	Result	No. of Cases	Percentage
> 90	Excellent	8	36.36
80-90	Good	11	50
70-80	Fair	2	9.09
< 70	Poor	1	4.54
	Total	22	100

DISCUSSION

Management of fracture of femoral neck still remains major and difficult undertaking for an orthopaedic surgeon. The pendulum is swinging between reduction and internal fixation with various supplementary methods as osteosynthesis to total hip replacement. It is now the general feeling that reduction and internal fixation should be reserved for the younger patients in whom if needed revision surgery may be done at a later date. Primary prosthetic replacement should be considered in older patients who are active and need early mobilization.

The concept of dual bearing surfaces offers considerable advantage, it results in sharing of motion at the two surfaces and hence reduction of net wear at either surface, thus reducing erosion at the acetabular – joint interface. In addition, the total range of motion of joint is increased.

In India, the technically demanding procedure of total hip replacement lacks universal application and the hemi-replacement procedure needs to have continued application to fill the lacuna produced by deficient resources and finances.

In this context, we undertook the present study to evaluate the immediate and early results of hemiarthroplasty in fracture neck of the femur using bipolar prosthesis keeping in view the living condition of an average Indian.

Age Distribution: The average age of our patients was 62 years in case of males and 65.68 years in case of females, with an overall average of 64.68 years. Majority of the patients were between 51-70 years. The physiological age of our patients is more than the chronological age and hence these patients are considered old for all practical purposes.

Similar age distribution is reported by other authors. Saxena & Saraf^[13] (1978) had age distribution 45-90 years (Mean 66 years); Mukherjee & Puri^[14] (1986) 65 years.

Sex Incidence: In our series the intracapsular fracture of femoral neck were found to be more common in females. The elderly females are more prone to fracture neck of femur due to osteoporosis (Choudhari & Mohite^[15] 1987).

In our series, 72.72% of the patients were females.

Side of Fracture: Left and right sides are equally affected in our series. Some studies show preponderance of left side. Boyd and Salvatore^[16] (1964) reported 55% fractures on left side. D'Acry and Devas^[17] (1976) similarly found 55.4% fracture in left hip of their patients.

Type of Fracture: All the fractures in our series belonged to displaced fractures of Garden Type III and IV. Depending on the anteroposterior radiographs available, we could group 10 patients (45.45%) into type III and 12 patients (54.54%) into Garden type IV.

G.S. Kulkarni^[18] (1987) had grouped type III and type IV into one group of 'displaced fractures' and reported it in 82.5% of his patients. Mukherjee & Puri^[14] (1986) had 85% patients of Garden type III and IV fractures.

Nature of Injury: Ninety percent of our patients had trivial trauma and rest of the cases of fracture were due to severe trauma like road traffic accidents.

This is in accordance with majority of the series reported - [Gyepes^[1] (1962), Solomon (1968), Evarts^[19] (1973), Seth^[20] (1987) etc.], that the intracapsular fracture are stress fractures through pathological bone secondary to osteoporosis or osteomalacia.

Associated Medical Problems: The common problems in our series were gross anaemia, hypertension, diabetes mellitus, chronic bronchitis and bronchial asthma. Forty percent of our patients had one or more of the problem. Anaemia was a major problem.

Type of Prosthesis: We have used the Cemented Bipolar Hemiarthroplasty technique in all of our cases.

Some studies show better clinical ratings with uncemented bipolar than cemented bipolar^[21-23].

Other series show that cemented hemiarthroplasty is better than uncemented^[24,25]. These studies found that a cemented hemiarthroplasty led to less pain in the hip, improved return of mobility and a reduced hospital stay compared to an uncemented prosthesis. There was no increase in complications or mortality related to the use of cement.

In our study, we do not have any complications pertaining to the use of cement.

Hospital Stay: In our series hospital, stay ranges from 7 days to 30 days with a mean average of 15 days. Seventy-five percent of patients had prosthesis by first week of their admission to the hospital. About 70% of our patients could go home by second week. About 80% could go home within 3 weeks.

Patients who developed complications such as infection, bedsores etc., in the postoperative period had to stay longer in the hospital. Early ambulation and comparatively less hospital stay following hemiarthroplasty has also been reported in other series. This is an advantageous factor in relation to economy of hospital beds and favours financial condition of the patients.

We also found that significant number of our patients who had come from rural areas could not come to the hospital soon after the injury. Poverty, ignorance and difficulty in transportation of the patients to the hospital were the main explanations given for this delay.

Complications: The complications following the hemiarthroplasty for fracture neck of femur is reported in varying incidences. Moore (1957)^[8] reported 16.6% mortality; Salvatti et al (1973)^[26] reported 14.3% mortality, 8.3% superficial infection in their patients. C.M Robinson et al^[27] (1994) reported 11% mortality within one year, 5% infection, 2% deep vein thrombosis and 3% dislocation in their series.

We had no operative deaths in our series.

Infection: In our series 2 patients (9.09%) had superficial wound infection. Both the patients were diabetic. They were treated with proper antibiotics and dressings. One patient had deep infection that subsided after single debridement and intravenous antibiotics.

We had no mortality in our series.

Dislocation of the Prosthesis: Dislocation of the Bipolar prosthesis is a rare phenomenon. It has been reported in literature ranging from 1.1% at

one year follow up to 5% at 20 years^[28]. However, in our series, no dislocation has occurred at final follow up.

Salvatti et al^[29] (1974) believed that excessive postoperative flexion or rotation with hip adducted is the main cause for dislocation. In 1998, John E. Kenzora et al^[30] noted that all 6 dislocation in their series followed after posterior approach. Dislocation is a well known complication of posterior approach. In our series, we had done 5 cases through posterior approach, but there was no dislocation.

Periprosthetic Fractures: One patient in our series had undisplaced fracture of lateral cortex of femur following prosthetic replacement. It was treated conservatively delaying weight bearing. They had occurred while introducing the prosthesis per operatively. Hinchey and Day^[31](1964) emphasize that all fractures occur when the surgeon attempts to reduce the prosthesis

Painful prosthesis: We observed that 14 patients (63.63%) in our series had no pain. Out of 5 patients who had slight pain, one patient had heterotopic ossification, one had Periprosthetic fracture. One patient with deep infection and two patients with slight pain had no post operative complication.

Pain following hemiarthroplasty is a major concern. Up to 50% of the revisions are required within 3 years^[32].

Hinchey and Day^[31] in their series of 294 patients found pain following hemiarthroplasty in 22 patients in the early post operative period. They could not find any definitive cause in them.

Our 6 patients required treatment for pain. Four of them are partially relieved by analgesics. Two patients with slight pain were regularly on analgesics.

Limping and use of cane: Seven of our patients have varying degree of limping. All of them had slight limp. Limping is a common consequence of hemiarthroplasty in adults. Though three of them had mild limb-length discrepancy that was corrected with shoe rise, the exact cause cannot be attributed to this. Alteration in the abductor mechanism due to excision of little more neck is the most probable cause [Saraf and Saxena, (1978)^[13]; Hinchey and Day (1964)^[31]].

All the patients were asked to use a cane on the sound side regularly. This decreases load on the prosthetic head. Once the patient got enough endurance, they were advised to discard the cane.

Stinchfield and Cooperman (1957) reported 14% of their patients using cane regularly. 16% of Barr and Donovan^[33] (1964) series were using the cane always, 34% were using occasionally and 20%

discarded it. Saraf and Saxena^[13] (1978) reported 52.7% patients using cane regularly, 23.1% occasionally and 21.8% were not using it. Our patients are comparable to this.

Other complications: Polyethylene wear debris and metallosis causing failure of bipolar hemiarthroplasty were reported as isolated instances by Kim et al^[34] and Kobayashi et al^[35] respectively.

In our study, we did not find any case of Deep Vein thrombosis or Pulmonary Thromboembolism^[36] and there was no mortality.

Total functional results: Various criteria were used to assess the functional results following hemiarthroplasty. How best the patient could be returned to the pre-fracture state has been the main criteria. In India, our customs demand squatting and sitting cross legged without difficulty. To achieve this patient should have good range of flexion, abduction, adduction and external rotation at the hip and full flexion at the knee. Ability to squat and sit cross-legged was principally emphasized in Indian population. The final results at final follow-up after hemiarthroplasty in our series were analyzed by modified Harris hip scoring system^[37].

In our series, 8 (36.36%) patients had excellent results with Harris Hip Score more than 90, 11 (50%) patients had good results with 80 to 90 score, 2 (9.09%) had fair results with score 70 to 80 and 1 (4.54%) had poor results with score < 70.

The difference between excellent and good results is minimal and therefore they can be grouped together as satisfactory (good) results.

The results are compared with the available western and Indian series where hemiarthroplasty was done for the treatment of fracture neck of femur in elderly patients. Mean Harris Hip Score for Bateman's Bipolar prosthesis was 85 and for Unipolar hemiarthroplasty was 77 in other series^[38] and in our series was 85.18.

Radiographic results: In our series, at the end of final follow-up, there was no evidence of loosening, radiolucent zones, distal migration or subsidence of prosthesis. The patient with Periprosthetic fracture healed and is weight bearing fully with no pain. One patient who had moderate heterotopic ossification had still has some mild pain occasionally.

CONCLUSION

- Hemiarthroplasty is a common procedure in the treatment of femoral neck fractures in elderly. Decision to perform hemiarthroplasty using either unipolar or

bipolar prosthesis remains controversial with proponents on either side.

- The concept of dual bearing surfaces offers considerable advantage, it results in sharing of motion at the two surfaces and hence reduction of net wear at either surface, thus reducing erosion at the acetabular – joint interface. In addition, the total range of motion of joint is increased.
- From our relatively short-term prospective nonrandomized study, we conclude that bipolar hemiarthroplasty produces good functional outcomes with minimal complications for displaced intracapsular femoral neck fractures and has several advantages; these results are comparable to the other studies.

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