Assessment of efficacy of charnley type and modular type total hip prosthesis in patients undergoing total hip arthroplasty: A comparative study

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Abstract

Background: Arthroplasty is an operation to restore pain free motion to a joint and function to the muscles, ligaments and other soft tissue structures that control the joint. Originally the primary indication for total hip arthroplasty was alleviation of incapacitating pain in patients older than 65 years of age who could not be relieved sufficiently by non-surgical means and for whom the only surgical alternative was reconstruction of hip joint, of secondary importance was the improved function of the hip [1-3].

Absolute contraindication for total hip arthroplasty include active infection of hip joint or any other region and any unstable medical illness that would significantly increase the risk of morbidity or mortality. Relative contraindications include any process that is rapidly destroying bone, neurotrophic arthritis, an absence or relative insufficiency of abductor musculature, and rapidly progressive neurological disease [4,5].

The cement mantle and interfaces have been cited as weak links in fixation of femoral components for total hip replacement (THR). Aseptic loosening at the cement - prosthesis interface has been a primary mode of failure leading to secondary indication of implant subsidence, cement mantle failure and osteolytic response at the cement bone interface [6,7].

Materials & methods: 30 patients of either sex, who were operated for total hip replacement, were assessed. Each case was subjected to detailed history regarding age at operation, sex, indication of surgery, type of replacement, duration after replacement, any associated comorbid condition that may affect outcomes of total hip replacement, whether joint replacement was unilateral / bilateral. A scoring system used by Harris called as Harris hip scoring system was used to evaluate the patients. 100 points will be given to a person who can painlessly walk without any support or limp and the walkable distance should not be limited. All the results were analyzed by SPSS software.

Results: 2(13.33%) patient in Charnley Group developed dislocation which was managed by closed reduction and traction for 6 weeks. 1(6.67%) Patient in Charnley Group developed peri prostatic fracture which was managed by open reduction and internal fixation with plating and circlage wire. No patient in the group both groups had shortening more than 2 cms. There was no lengthening in any of the patients. The average Harris Hip Score in Modular Group patients was 85.67 and in Charnley Group was 79.87.

Conclusion: Since appreciable limb length shortening and dislocation of hip after fixed type is seen in this study so our results shows that Modular type of hip prosthesis is better than fixed type prosthesis (Charnley type hip prosthesis).

Keywords: Arthroplasty, charnley, modular

Introduction

Arthroplasty is an operation to restore pain free motion to a joint and function to the muscles, ligaments and other soft tissue structures that control the joint. Originally the primary indication for total hip arthroplasty was alleviation of incapacitating pain in patients older than 65 years of age who could not be relieved sufficiently by non-surgical means and for whom the only surgical alternative was reconstruction of hip joint, of secondary importance was the improved function of the hip [1-3].
Aseptic loosening continues to play the most significant role in the failure of cemented total hip arthroplasty. When using contemporary cementing technique, the incidence of aseptic acetabular component loosening was high as compared to the incidence of aseptic femoral component loosening. Primary concern was the high incidence of mechanical loosening and the extensive bone loss sometimes associated with fragmented cement [3].

Evaluation of the long-term outcomes of an operative procedure is important to determine the durability of the results of the procedure. In addition, it provides a mean for comparison with the results of any changes in the procedure, including alterations in operative technique, implant design, type of joint - cemented and non-cemented hybrid that occur over times. This is especially true for the total hip arthroplasty procedure. Present study is to evaluate the results of total hip arthroplasty specially comparing most commonly performed modular type with charnley type i.e. fixed type of THR. In our institute modularity in respect to neck length is used. The various neck lengths used are medium, short (-3.5mm) and long (+3.5mm) neck.

Material and Methods
In this follow up study the Cohort comprised of 30 patients of either sex, who were operated for total hip replacement in the Department of Orthopaedics at Govt. Rajindra Hospital, Patiala.

Method of study
1. Each case was subjected to detailed history regarding age at operation, sex, indication of surgery, type of replacement, duration after replacement, any associated comorbid condition that may affect outcomes of total hip replacement, whether joint replacement was unilateral / bilateral.

2. Evaluation of Functional / Clinical Outcome
A scoring system used by Harris called as Harris hip scoring system [9] was used to evaluate the patients. The sum of the points is then multiplied 0.05 to obtain the number of points for overall evaluation of the range of motion.

Results were graded as under
Excellent - 90-100
Good - 80-90
Fair - 70-80
Poor - <70

Criteria for Evaluation
Patients will be evaluated as per modified Harris hip scoring system. Modified Harris Hip scoring system includes assessment of both the hip joint itself and functional score that rates the patient’s ability to walk and carry out daily activities. Total Score allotted is 100
Two parameters are directly related to assessment of hip joint itself i.e
i) Absence of deformity- 04 points
ii) Range of motion score- 05 points

Rest 91 points are allotted to functional parameters of patients.
Thus 100 points will be given to a person who can painlessly walk without any support or limp and the walkable distance should not be limited. Also the said person should be able to enter public transport, put on shoes and socks with ease, climb stairs normally without using railing and should be able to sit comfortably in ordinary chair for about 1 hour. Beside his/her range of motion of hips joint must be between 211-300 degrees and any deformity should be absent.

Results
The age of the patients ranged from 40 years to 78 years. The average was 60.23 years. Most of the patients were in 5th & 6th decade. Mean age in Modular group was 59 years. Mean age in Charnley group was 61.46 years. There were 9(60%) males and 6(40%) females in Modular group. The male to female ratio in Modular group was 3: 2. There were 9 (60%) males and 6 (40%) females in Charnley group. It was found that avascular necrosis (due to various etiologies) accounted for maximum number of cases. 7(46.6%) cases in Modular group and 6(40%) cases in Charnley group were of AVN. 5(33.33%) cases in Modular group and 4(26.67%) cases in Charnley group were due to Osteoarthritis of hip. 3(20%) cases in Modular group and 5(33.33%) cases in Charnley Group were due to fracture neck of femur. The patients were followed up for a maximum of 60 months and a minimum of 15 months with the maximum number of cases in 31-50 months group of follow up in both the groups. Average of all cases comes out to about 40 months of follow up in Modular Group and 42 months in Charnley Group. 1(6.67%) patient in Charnley Group developed urinary tract infection which was successfully managed by proper antibiotic coverage after culture and sensitivity and increased hydration. 1(6.67%) patient in Modular Group developed loosening of femoral component. It was managed by revision with longer stem. 2(13.33%) patient in Charnley Group developed dislocation which was managed by closed reduction and traction for 6 weeks. 1(6.67%) Patient in Charnley Group developed peri prosthetic fracture which was managed by open reduction and internal fixation with plating and cerclage wire. In this series 12 cases (80%) had no shortening and in 2 cases (13.33%) there was shortening up to 1cm in Modular group and 1(6.67%) patient had shortening more than 1 cms and less than 2 cms. In Charnley group 10 cases (66.67%) had no shortening while 3 cases (20%) had shortening up to 1cm and 2 cases(13.33%) had shortening more than 1 cms.

No patient in the group both groups had shortening more than 2 cms. There was no lengthening in any of the patients. Out of 30 patients in this study, 13(87.67%) patients in Modular Group had good results and 9(60%) patients of Charnley Group had good results. 2 (13.67%) patients of Modular Group had fair result and 5(33.33%) of Charnley Group had fair result. None of the patient of Modular Group had poor result whereas 1(6.67%) of patient in Charnley Group had poor results.

The average Harris Hip Score in Modular Group patients was 85.67 and in Charnley Group was 79.87.

| Months | Modular Group n(%age) | Charnley Group n(%age) |
|--------|-----------------------|------------------------|
| 0 – 10 | 0(0%)                 | 0(0%)                  |
| 11 – 20| 2(13.33%)             | 2(13.33%)              |
| 21 – 30| 2(13.33%)             | 2(13.33%)              |
| 31 – 40| 4(26.67%)             | 4(26.67%)              |
| 41 – 50| 5(33.33%)             | 4(26.67%)              |
| 51 – 60| 2(13.33%)             | 3(20%)                 |
| Total  | 15(100%)              | 15(100%)               |
Table 2: General Complications

| Complications              | Modular Group | Charnley Group |
|----------------------------|---------------|----------------|
| No complication            | 15(100%)      | 14(93.33%)     |
| Pleurisy                   | 0(0%)         | 0(0%)          |
| Broncho pneumonia          | 0(0%)         | 0(0%)          |
| Cardiac failure            | 0(0%)         | 0(0%)          |
| Pulmonary embolism         | 0(0%)         | 0(0%)          |
| Coronary occlusion         | 0(0%)         | 0(0%)          |
| Fat embolism               | 0(0%)         | 0(0%)          |
| Paralytic ileus            | 0(0%)         | 0(0%)          |
| Urinary infection          | 0(0%)         | 1(6.67%)       |
| Total                      | 15(100%)      | 15(100%)       |

Table 3: Local Complications

| Complications              | Modular Group | Charnley Group |
|----------------------------|---------------|----------------|
| No complication            | 14(93.33%)    | 12(80%)        |
| Deep wound infection       | 0(0%)         | 0(0%)          |
| Heterotopic ossification   | 0(0%)         | 0(0%)          |
| Dislocation (traumatic)    | 0(0%)         | 2(13.33%)      |
| Periprosthetic fractures   | 0(0%)         | 1(6.67%)       |
| Loosening of cup           | 0(0%)         | 0(0%)          |
| Loosening of femoral stem  | 16.67%        | 0(0%)          |
| End pain                   | 0(0%)         | 0(0%)          |
| Deep vein thrombosis       | 0(0%)         | 0(0%)          |
| Sciatic nerve palsy        | 0(0%)         | 0(0%)          |
| Vascular injury            | 0(0%)         | 0(0%)          |
| Total                      | 15(100%)      | 15(100%)       |

Table 4: Shortening

| Nil                        | Modular Group n (%) | Charnley Group n (%) |
|----------------------------|---------------------|----------------------|
| 12(80%)                    | 10(67.67%)          |
| 0-1 cm                     | 2(13.33%)           | 3(20%)               |
| 1-2 cm                     | 16.67%              | 2(13.33%)            |
| 2-3 cm                     | 0(0%)               | 0(0%)                |
| Total                      | 15(100%)            | 15(100%)             |

Table 5: Results Using Harris Hip Score

| Results        | Modular Group n (%) | Charnley Group n (%) |
|----------------|---------------------|----------------------|
| Excellent      | 0(0%)               | 0(0%)                |
| Good           | 13(87.67%)          | 9(60%)               |
| Fair           | 2(13.33%)           | 5(33.33%)            |
| Poor           | 0(0%)               | 1(6.67%)             |
| Total          | 15(100%)            | 15(100%)             |

Average duration of follow up in other series

| Series                                      | Duration |
|---------------------------------------------|----------|
| Zoran and Cupic (1974)                      | 9 years  |
| Colville and Rounio (1978)                   | 2.5 years|
| Delamarter and Moreland (1985)              | 3.8 years|
| Hamadouche and Bolander (2002)              | 18.5 years|
| Present series                              | 3.4 years|

Average duration of follow up in our series is comparable to Colville and Rounio (1978) and Delamarter and Moreland (1985) series. Although longer follow up always give better results however average duration of follow up in our study is sufficiently long and its results are comparable with internationally published studies.

Complications

Peri-prosthetic fracture
There were one post traumatic periprosthetic fractures in Charnley Group. Mode of trauma was road traffic accident. Patient treated with open reduction and internal fixation with plating and circlip wire.

Loosening
1 hip (3.33%) in Modular Group showed evidence of loosening. It was managed by revision with long stem.

Table 6: Results in Aseptic Loosening in other series

| Series                                      | Percentage |
|---------------------------------------------|------------|
| Exeter series (1969)                        | 5%         |
| Colville and Rounio (1978)                   | 34%        |
| Omniflex series (1989)                       | 32%        |
| Present series                              | 33.33%     |

The lower incidence of aseptic loosening may be due to shorter duration of follow up compared to other series. Out of 30 patients in this study 13 (87.67%) patients in Modular Group had good results and 9(60%) patients of Charnley Group had good results. 2 (13.67%) patients of Modular Group had fair result and 5(33.33%) of Charnley Group patients had fair result. None of the patient of Modular Group had poor result whereas 1(6.67%) of patient in Charnley Group had poor results. Statistically when both groups were compared, p value is significant and it is 0.012.

Discussion
Osteoarthritis as well as avascular necrosis of femoral head and fracture neck of femur are common orthopaedic problems of hip joint in a community and significant difference of opinion persists regarding the choice of modalities of treatment. With life expectancy increasing with each decade, our society is becoming a geriatric society with significant number of hospitalized and nursing home patients suffering from hip joint problems. The patients were followed up for a maximum of 60 months and a minimum of 15 months with the maximum number of cases in 31-50 months group of follow up in both the groups. Average of all cases comes out to about 40 months of follow up in Modular Group and 42 months in Charnley Group. Statistically when both groups were compared, p value is not significant and it is 0.32.

Since appreciable limb length shortening and dislocation of hip after fixed type is seen in this study so our results shows that Modular type of hip prosthesis is better than fixed type prosthesis (Charnley type hip prosthesis).
Conclusion
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