Long-term survival of femoral neck fracture patients age over ninety: Arthroplasty compare with conservative treatment

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Yang Liu
West China Hospital of Sichuan University
ly196818@163.com
ORCID: https://orcid.org/0000-0003-4808-5114

Chong-wei Zhang
Sichuan University West China Hospital

Xiao-dan Zhao
Sichuan University West China Hospital

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Abstract

**Background** The aging of the China population is expected to lead to increasing of nonagenarian and centenarian. The mortality rates of nonagenarian hip fracture patients would return to an equivalent mortality risk to the normal population at five years after injury. It is imperative to evaluate the 5-year mortality for this small but very challenging subgroup patients in order to optimize patient management. The main purpose of the current retrospective study was to compare the five-year survival between arthroplasty treatment and conservative treatment of femoral neck fracture patients age over 90 years during the same 16-year period.

**Methods** From January 1998 to December 2014, all consecutive nonagenarian and centenarian patients with femoral neck fracture admitted to our hospital were included for evaluation. The primary outcome was defined as thirty-day mortality, 1-year, 3-year, and 5-year mortality after injury. Survival status analysis was performed by the Kaplan–Meier method for mortality. Using the log-rank test, the stratified analyses were performed to compare the difference of overall cumulative mortality and three-time points (1-year, 3-year, and 5-year) mortality after injury were performed to compare the difference of survival distributions.

**Results** Over the 16-year study period, the arthroplasty group and the conservative treatment group included 33 and 53 patients, respectively. The long-term survival probability of the arthroplasty group is significantly higher than the conservative treatment group (p=0.002277). The survival time of the arthroplasty group is significantly higher than the conservative treatment group(Median(P_{75-P_{25}})=53(59) versus Median(P_{75-P_{25}})=22(52), p=0.001). The difference of five time points (1-year, 2-year, 3-year, 4-year, and 5-year) mortality between the conservative group and arthroplasty group is significant except for 30-day mortality. The stratified analyses of overall cumulative mortality and three-time points (1-year, 3-year, and 5-year) mortality after injury demonstrated that the arthroplasty group is significant higher than the conservative treatment group.

**Conclusions** Our study demonstrate that, compared with conservative treatment, arthroplasty surgery is more likely to improve the long-term survival of femoral neck fracture patients over 90s. What can be expected is that nearly half of patients will survive more than five years after surgery.
Background
The aging of the China population is expected to lead to increasing of nonagenarian and centenarian. The Chinese people constitute approximately 15% of the global population age over 90 years by the end of 2017[1]. Meanwhile, the mortality of people over 80 years will reach a “plateau” after age 105 years [2]. Thus, the extended life-expectancy of elderly would profoundly influence many aspects of medical care.

Hip fracture rank among the top 10 causes of disability and mortality of the elderly population [3]. Intracapsular femoral neck fractures account for 50% of all hip fractures[3]. The age-specific incidence of hip fracture of China elderly increased during the last decade [4-5]. Accordingly, the femoral neck fractures of extremely elderly in China will represent a tremendous burden for the public health system.

Despite extensive researches on the thirty-day or 1-year mortality of femoral neck fracture patients age above 90s, very little data exist on the 2-year or 5-year survival for these patients[6-9]. The additional life expectancy for nonagenarian hip fracture patients is 4-5 years[10-11]. Moreover, recent studies demonstrated that the mortality rates of nonagenarian hip fracture patients would return to an equivalent mortality risk to the normal population at five years after injury [9, 12-15]. Therefore, it is imperative to evaluate the 5-year mortality for this small but very challenging subgroup patients in order to optimize patient management.

Currently, there is no consensus of definition about the long-term survival for hip fracture patients over ninety. There are few articles discussed the five-year survival of the nonagenarians [9,16-17]. Furthermore, less than 5% of patients can survive for more than ten years[16]. Thus, several authors considered 5-year survival as long-term survival result for this extremely elderly[17]. Unfortunately, there is a lack of study evaluated the long-term survival of femoral neck fracture patients age over 90s in a China mainland context. The main purpose of the current retrospective study was to compare the five-year survival between arthroplasty treatment and conservative treatment of femoral neck fracture patients age over 90 years during the same 16-year period.

Methods
From January 1998 to December 2014, all consecutive nonagenarian and centenarian patients with femoral neck fracture admitted to our hospital were included for evaluation. Patients with poly-trauma, open fractures, pathological fractures, femoral head fractures, subtrochanteric fractures, and intertrochanteric fractures were excluded from this study. The endpoint of follow-up was defined as the date of death or emigration, or 1 April 2019, whichever came first, and survival was determined at this time. The institutional review board of our academic hospital approval of this study.

The goal of care discussion was typically attended by the patient, their family, and representatives from the medical hip fracture co-management service and orthopedic surgery. The purpose of this discussion was to hear from the patient and better understand their previous and current quality of life and ensure an informed decision was being made. Nonoperative management was undertaken only when requested by the patient, or their family.

According to the different treatment regimes (conservative group versus arthroplasty surgery), we divided the patients into the Conservative group and Arthroplasty group. Seven senior surgeons performed the arthroplasty procedures (included total hip arthroplasty and hemiarthroplasty).

**Covariates**

The data included age, sex, injury side, comorbidities, length of stay, BMI (body mass index), in-hospital complications, transfusion mount, hyperthermia, ICU stay, mortality date, 30-day readmission obtained from the hospital's patient management system. Detailed definitions of admission laboratory parameters are available in the User Guide for the ACS NSQIP Participant Use File [18].

**Comorbidity**

Comorbidity of admission was assessed by the Charlson comorbidity index (CCI) [19] and the American Society of Anesthesiologists (ASA) physical status classification[20]. The CCI determines comorbidity level by the number and severity of 19 predefined conditions. The CCI is the most popular tool for evaluating comorbidity used in clinical researches. Due to the study participants only contained patients age over 90 years, the age-adjusted variant of the CCI was not used. The ASA grading scale includes five classes, from Class I to Class V. No patient in this study was grading as class V. The ratings were divided into two categories: Class I or II and Class III or IV.
Complications

Complications were categorized as cardiac, pulmonary, gastrointestinal, urologic, cerebrovascular manifestations. Cardiac complications include acute myocardial infarction, arrhythmia, congestive heart failure exacerbation, and unexplained hypotension. Pulmonary complications include acute respiratory failure, prolonged intubation, pneumonia. Gastrointestinal complications include obstruction, perforation, bleeding. Urological complications include urinary tract infection and urinary retention. Cerebrovascular manifestations include cerebral vascular accident and pulmonary embolism. Each type of complication was then transformed into a bivariate variable to defined whether a patient did or did not have a complication.

Mortality data

The mortality date of the participants in both groups was obtained from the National Public Security System (NPSS) and three primary health insurance schemes in China: Urban Resident Basic Medical Insurance (URBMI), Urban Employee Basic Medical Insurance (UEBMI), and the New Rural Cooperative Medical Scheme (NRCMS). These register systems include the survival status of all citizens and are updated annually. If the mortality date was not retrievable from the system, it was retrieved through local community registration charts, nursing home, or phone follow-up. We defined short-term mortality as death occurring 30-day and less than 12 months after femoral neck fracture and long-term mortality as death occurring 5-year after a fracture. The primary outcome was defined as thirty-day mortality, 1-year, 2-year, 3-year, 4-year, and 5-year mortality after injury.

Statistical analysis

Data were analyzed with the 22.0 IBM-SPSS statistical package (SPSS Inc., USA) for Windows. Results are expressed as the mean± SD, median [25–75 interquartile] for non-normal distribution quantitative date or number (percentages), and 95 % confidence interval. The standard distribution variables were assessed using an independent t-test and a Chi-square test. When comparing two independent samples without normal distribution, the Wilcoxon rank sum test was used. Survival status analysis between two groups was performed by the Kaplan-Meier method for all-cause mortality. Using the log-rank (Mantel-Cox) test, the stratified analyses of cumulative mortality and three time points (1-
year, 3-year and 5-year) mortality after injury were performed to compare the difference of survival distributions. A two-sided significance test was performed for all tests, where a p-value <0.05 was considered statistically significant.

Results
Over the 16-year study period, eighty-nine femoral neck fracture patients who age over 90 years admitted into our hospital. Among them, one patient was excluded because he performed internal fixation (2.8%, 1/35, 1 hip). Of the arthroplasty group, one patient (2.8%, 1/35, 1 hip) was excluded from this review due to having performed arthroplasty in another hospital. The survival data of 1 patient in the conservative treatment group (1.8%, 1/54, one hip) was not retrievable, and therefore, these three patients were excluded from the final statistic analysis.

Finally, 86 patients, 43 women (50%) and 43 men (50%) were included in the study. The arthroplasty group and the conservative treatment group included 33 and 53 patients, respectively. The median age of the arthroplasty group and conservative was 92 (90—104) years and 91.5 years (90—103), respectively. Baseline characteristics of the two groups are shown in Table 1.

First, as shown in Table 1, regarding the delirium, pressure ulcers, low HCT<0.30, low ALB, patient number of transfusion red cell and plasma, the difference between the conservative group and arthroplasty group is statistically significant (Table 1). Other baseline variables between the two groups have no significant difference.

Subsequent stratified analysis indicates that in terms of the ASA grade, CCI score, and age, the difference between the two groups is not significant (Table 2). However, the long-term survival probability of the arthroplasty group is significantly higher than the conservative treatment group (p=0.002277). Undoubtedly, the length of stay among the arthroplasty group is higher than the conservative treatment group (Table 3).

The survival time of the arthroplasty group is significantly higher than the conservative treatment group (Median(P75-P25)=53(59) versus Median(P75-P25)=22(52), p=0.001). Until the latest follow-up, the longest survival time of two groups is 175 months for the arthroplasty group and 93 months for the conservative treatment group, respectively. The Wilcoxon rank-sum test also demonstrates that
the difference in BMI, serum sodium level at admission between two groups is significant (Table 3). The cumulative mortality after injury of 30-day, 1-year, 2-year, 3-year, 4-year and 5-year for conservative group and arthroplasty group was 17.0% versus 9.1%, 43.4% versus 12.1%, 50.9% versus 24.2%, 64.2% versus 39.4%, 71.7% versus 45.5%, and 79.2% versus 51.5%, respectively (Table 4.). The overall cumulative mortality of conservative group is 1.5 fold higher than that of the arthroplasty group. The statistical difference between the two groups is significant (P=0.007). The difference of five time points (1-year, 2-year, 3-year, 4-year, and 5-year) mortality between the conservative group and arthroplasty group is significant except for 30-day mortality.

Table 5 demonstrated that the survival length of arthroplasty group at six different time interval (30-day, 1-year, 2-year, 3-year, 4-year, and 5-year) is significantly higher than the conservative group. The overall survival time of arthroplasty group is also higher than that of the conservative group (p=0.002). As a secondary analysis, the survival status analysis between two groups was performed by the Kaplan–Meier survival curve for all-cause mortality. As presented as Figure 1, using the log-rank (Mantel-Cox) test, the stratified analyses of overall cumulative mortality and three-time points (1-year, 3-year, and 5-year) mortality after injury were performed to compare the difference of survival distributions (Figure. 1).

Discussion

According to our study, the cumulative five-year mortality of arthroplasty group and conservative treatment group is 51.5% and 79.2%, respectively. The femoral neck fracture patients age over ninety can benefit from arthroplasty surgery. Our study suggested that patients receive conservative treatment had higher rates of short and long-term mortality compared with that performed surgery. They also had a shorter mean survival time compared with arthroplasty patients. Also, the annual mortality of arthroplasty group is significantly lower than the conservative treatment. To our knowledge, the current study is the first to assess this critical issue in a low-income or middle-income country, and timeline spans more than sixteen years in the world.

The chance of surviving to the age of 90 has increased markedly over the last 50 years in high-income countries[21]. The life expectancy for 90-year-olds (ranging 4 - 5 years) is still reasonably
short than that for an 80-year-old (ranging 8-10 years) [10,11,21,22]. Recently, two successive cohorts study from China also present consistent with the results of these developed countries [23,24]. Liu et al. demonstrated that the life expectancy of the population ages 90-99 was 3.9-4.0 years [23].

On the other hand, there is a lack of consensus on the definition of long-term survival for hip fracture patients age 90 and older. However, recent studies demonstrated that the mortality rates of nonagenarian hip fracture patients would return to an equivalent mortality risk to the average population at five years after injury [9,12-16]. Furthermore, less than 5% of patients can survive for more than ten years[16]. Consequently, the five-year survival rate can be considered as a reliable parameter to reflect the long-term outcomes of patients in the extremely elderly suffered hip fractures.

During the several decades, the dilemma of how to optimal care the extremely elderly hip fracture patients included two aspects. First, previous reports about hip fracture patients age above 90s mainly focused on the 30-day and 1-year mortality, paid less attention to the survival status for more than two years. Secondly, many studies have previously evaluated the long-term mortality among hip fractures, but only a few have assessed the survival of the nonagenarians fracture patients[9, 11,17, 25, 26].

Compared to other investigations into short-term mortality after surgery for hip fracture, our 30-day rates were similar (9.1% versus a range from 5.6 to 9.6%) with the previously reported [6,10,11,17,27,28]. An exception of a Taiwan investigation in which 95.4% survived to 30 days, which is the lowest mortality of nonagenarian femoral neck fracture patients in literature[16]. However, there are some researches revealed conflict results with this current study, which the 30-day mortality higher than 10%[7,26,29]. This gap may be partially due to different social and cultural aspects, policy, and Health System services. Advances in medications, lifestyle, and socioeconomics might also contribute to this mixed survival outcomes.

Based on national data from the Chinese Longitudinal Healthy Longevity Study, 7234 individuals who survive to age 90 years have an all-cause annual death rate of 22.4-23.4%[24]. An earlier published
study identified that the expected 1-year survival rate for the average Japanese population aged 90 years and older was 83.7% for women and 77.6% for men[30]. In our study, the 1-year mortality rate of the arthroplasty group and conservative group was 12.1 % and 43.4%, respectively. One of the possible reasons for this difference is the surgical treatment of the femoral neck fracture no longer increasing the mortality compared with the general population during the last two decades[31]. Our 1-year mortality result is also consistent with another study performed in North China. In this multicenter retrospective study of 327 nonagenarian individuals, Liu et al. showed the 1-year mortality after surgery is 11.6%[32]. Previously studies demonstrated that the 1-year mortality for nonagenarian femoral neck patients varied range from 23.3% to 47.6%[6,16,30, 33-35]. Although our result of 1-year mortality of arthroplasty group was lower than previously mentioned studies, similar to other studies [11,36-38], another possible explanation for the difference of mortality rate between this study and previous studies might be related to different demographics including age, distribution of gender, and comorbidity in each study.

There are limited studies that demonstrated that the five-year mortality of hip fracture patients varied from 55% to 82%[11,16,17,26]. After retrospective analysis of a total of 149 patients, de Leur et al. found that the five-year survival of nonagenarian hip fracture patients is 18% after osteosynthesis[17]. In a large nationwide database study of 11,184 nonagenarian patients undergoing surgery for hip fracture in Taiwan, the mortality rates increased from 29.5% at 1-year to 78.1% at 5-years [16]. Lin et al. also demonstrated that 10-year mortality is 95.90%, which means less than 5% of patients can survive more than ten years[16]. The five-year mortality (51.5%) of the arthroplasty group in this study is consistent with the result of Gregory et al. (55%) and Knauf et al. (61.5%) [11,25], but higher than previously mentioned the two studies.

The survival time of the arthroplasty group is significantly higher than the conservative group (53 months versus 22 months, P=0.001). This gap of survival time may be a result of highly selective patient recruitment in that series, resulting in only 33 nonagenarians operated on over 16 years. Larger sample size and multicenter study deserve to comprehensive evaluate and get a more explicit scene of long-term survival among these patients.
In our study, we found a higher 5-year survival probability in the arthroplasty group patients (39.3% vs. 11.3%, p=0.002277). Manton et al. showed that the five-year survival probability of Japan age at 90 is range from 22.7 to 33.0%[39]. In the Netherlands, the survival rate of people age 90s increased from 19.45% of 1990 to 31.4% of 2016[40]. Comparing with the observed survival probability for patients in the current study, the survival rate among the conservative group (11.3%) was less than those of average population data, and the result of the arthroplasty group (39.3%) is similar with these average population. Although the sample size is limited, the result can partially reflect the advantage of surgery for long-term survival among this unique group patients. This encouraging result can contribute to the fast rise in healthcare expenditure infrastructural development and the recent implementation of universal healthcare coverage in China [24,41].

The primary strength of this study was the data collection, low rate of lost follow-up (<3%) and the duration of follow-up, which more than ten years, is the longest of any published series and exceeds the life expectancy for this age group. This cohort spanned more than ten years, which eliminated the bias effects of demographic change. To the authors’ knowledge, this is the most extensive study to date comparing the conservative treatment and arthroplasty in patients with femoral neck fracture age over ninety.

The findings from our study must be comprehensively considered the limitations of our study design. The limitations of our study have inherent to the nature of retrospective review performed in a single teaching hospital. The inclusion of institutionalized patients could add heterogeneity to the study. Future longitudinal and multi-center studies should be the optimal research design to establish practice guidelines for the treatment of femoral neck fractures in extremely elderly. Second, as the hospital medical record system provides only inpatient information, pre-hospitalization and post-discharge functional outcomes were not available for analysis. The further prospective, longitudinal studies should assess the influence of these factors on the outcome of the patient. Finally, because this study did not include intertrochanteric fractures, so our conclusions are not representative of all nonagenarian and centenarian hip fractures.

Conclusion
Our study suggests that, compared with conservative treatment, arthroplasty surgery is more likely to improve the long-term survival of femoral neck fracture patients over 90s. Despite the comparably high prevalence of the chronic disease, patients age over 90s can tolerate surgery quite well. What can be expected is that nearly half of patients will survive more than five years after surgery. Even though advanced age carries an increased risk of morbidity and mortality, it seems that age is no barrier to surgery. This subpopulation can be treated similarly to the rest of the elderly population if initial preoperative assessment suggests comparable health.

**Abbreviations**

BMI: body mass index; CCI :Charlson comorbidity index; ASA: American Society of Anesthesiologists; URBMI: The Urban Resident Basic Medical Insurance; UEBMI: The Urban Employee Basic Medical Insurance; NRCMS: The New Rural Cooperative Medical Scheme.

**Declarations**

- **Ethics approval and consent to participate**

The study was approved by Biomedical Ethics Sub-Committee of West China Hospital of Sichuan University (ref. 2017/48). Upon registration in West China Hospital of Sichuan University, the patients accept that their data maybe used in research. No further approval from the patients has therefore been sought for this study. **Informed consent**: No consent was required. Only general non-identifiable data on a series of patients is included. All data are presented on an aggregated level and the individual patient cannot be identified.

- **Consent for publication**

Not applicable.

- **Availability of data and material**

The data that support the findings of this study are available from the corresponding author but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of corresponding author.

- **Competing interests**
The authors declare that they have no competing interests.

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-Authors’ contributions

All authors participated in the design of the study. YL and ZXD collected the data. YL set up the dataset and performed the analysis with support from CWZ. YL was a major contributor in writing the manuscript. All authors participated in revising the manuscript. All authors read and approved the final manuscript.

-Acknowledgements

Not applicable.

Author Contributions

All authors participated in the design of the study. YL and ZXD collected the data. YL set up the dataset and performed the analysis with support from CWZ. YL was a major contributor in writing the manuscript. All authors participated in revising the manuscript. All authors read and approved the final manuscript.

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Tables
Table 1. Chi-square test compares the baseline variable of the two groups with a normal distribution.
| Variable                     | Conservative group n% | Arthroplasty group n% | $\chi^2$ | $p$  |
|------------------------------|-----------------------|-----------------------|----------|------|
| **Gender**                   |                       |                       |          |      |
| Female                       | 27(62.8)              | 16(37.2)              | 0.049    | 0.825|
| Male                         | 26(60.5)              | 17(39.5)              |          |      |
| **Fracture side**            |                       |                       |          |      |
| Left                         | 28(65.1)              | 15(34.9)              | 0.443    | 0.506|
| Right                        | 25(58.1)              | 18(41.9)              |          |      |
| **Complications**            |                       |                       |          |      |
| Pulmonary complications      | 32(72.7)              | 12(27.3)              | 3.101    | 0.078|
| Peptic ulcer disease         | 5(62.5)               | 3(37.5)               | 0.003$^a$| 0.958$^b$|
| UTI                          | 4(57.1)               | 3(42.9)               | 0.065$^a$| 0.799$^b$|
| Cardiac Complications        | 6(60.0)               | 4(40.0)               | 0.013$^a$| 0.910$^b$|
| Cerebrovascular complications| 8(100.0)              | 0(0.0)                | 3.849$^a$| 0.050$^b$|
| DVT                          | 9(90.0)               | 1(10.0)               | 2.614$^a$| 0.106$^b$|
| Delirium                     | 26(74.3)              | 9(25.7)               | 3.999    | 0.046$^*$.|
| Pressure ulcers              | 20(83.3)              | 4(16.7)               | 6.632    | 0.010$^*$.|
| Hyperthermia                 | 13(48.1)              | 14(51.9)              | 3.024    | 0.082|
| **Commodity**                |                       |                       |          |      |
| Diabetes mellitus            | 5(41.7)               | 7(58.3)               | 1.471$^a$| 0.225$^b$|
| COPD                         | 34(69.4)              | 15(30.6)              | 2.900    | 0.089|
| Renal disease                | 9(81.8)               | 2(18.2)               | 1.306$^a$| 0.257$^b$|
| Coronary artery disease      | 5(50.0)               | 5(50.0)               | 0.210$^a$| 0.647$^b$|
| Commodity Hypertension       | 21(56.8)              | 16(43.2)              | 0.652    | 0.420|
| Commodity UTI                | 2(50.0)               | 2(50.0)               | 0.240$^a$| 0.624$^b$|
| Commodity Stoke              | 9(81.8)               | 2(18.2)               | 1.306$^a$| 0.253$^b$|
| **Admission laboratory parameters** |               |                       |          |      |
| Low HGB(<12g/dL)             | 30(61.2)              | 19(38.8)              | 0.008    | 0.929|
| Low HCT (<30%)               | 14(87.5)              | 2(12.5)               | 5.564    | 0.018$^b$.|
| Low WBC count (<4500/mcL)    | 2(50.0)               | 2(50.0)               | 0.240$^a$| 0.624$^b$|
| High WBC count(>10,000/mcL)  | 14(66.7)              | 7(33.3)               | 0.298    | 0.585|
| Low platelets (<150,000/mcL) | 23(62.2)              | 14(37.8)              | 0.008    | 0.929|
| High INR (>1.1)              | 23(71.9)              | 9(28.1)               | 2.263    | 0.133|
| High BUN (>30 mg/dL)         | 15(71.4)              | 6(28.6)               | 1.129    | 0.288|
| Creatinine (>1.3 mg/dL)      | 9(60.0)               | 6(40.0)               | 0.020    | 0.887|
| Low ALB<34G/L                | 29(80.6)              | 7(19.4)               | 9.381    | 0.002* |
| High Bilirubin (>1.9 mg/dL)  | 3(60.0)               | 2(40.0)               | 0.006$^a$| 0.939$^b$|
| High sodium (>145 mEq/L)     | 1(25.0)               | 3(8.1)                | 1.033$^a$| 0.310$^b$|
| Low sodium (<135 mEq/L)      | 15(65.2)              | 8(34.8)               | 0.171    | 0.679|
| **Transfusion**              |                       |                       |          |      |
| Number of Transfusion Red cell | 8(30.8)              | 18(69.2)              |          |      |
| Number of Transfusion Plasma |                       |                       |          | 0.030$^b$* |
| ICU stay                     | 4(30.8)               | 9(69.2)               |          | 0.973$^b$|
| 30-day re-admission          | 5(55.6)               | 4(44.4)               |          | 0.0355$^b$ |
|                             | 8(80.0)               | 2(20.0)               |          |      |

* $P < 0.05$ was considered statistically significant. $a$. The chi-square test of continuous correction was used, and the expected count of the cell was less than 5 and greater than 1. $b$. Continuous
correction chi of square test significance 2-sided).

Table 2. The stratified analyses of ASA, CCI, age, and survival patient number of two groups.

| Variable                      | Treatment regime groups |  |  |χ²  |
|-------------------------------|-------------------------|---|---|----|
|                               | Conservative group n%   | Arthroplasty group n% |   |    |
| ASA                           |                         |                           |   |    |
| 1or2                          | 27(60.0)                | 18(40.0)                  | 0.056 |
| 3or4                          | 26(63.4)                | 15(36.6)                  |    |    |
| CCI                           |                         |                           |   |    |
| 0or1                          | 18(50.0)                | 18(50.0)                  | 4.508 |
| 2                             | 11(61.1)                | 7(38.9)                   |    |    |
| ≥3                            | 24(75.0)                | 8(25.0)                   |    |    |
| Age-stratified               |                         |                           |   |    |
| 90—94 years                  | 41(62.1)                | 25(37.9)                  | 0.029 |
| ≥95 years                    | 12(60.0)                | 8(40.0)                   |    |    |
| Long-term survival probability|                         |                           |   |    |
| Survival > 5 years           | 6(31.6)                 | 13(68.4)                  | 9.31201 |
| Survival<5 years             | 47(70.1)                | 20(29.9)                  |    |    |

* P< 0.05 was considered statistically significant.

Table 3. The Wilcoxon Rank - Sum test for two variables without a normal distribution between two groups

| Variables          | Conservative group MedianP75-P25 | Treatment regime Arthroplasty group MedianP75-P25 | Wilcoxon W |
|--------------------|----------------------------------|--------------------------------------------------|------------|
| Age                | 91.5(4.0)                        | 92.0(4.0)                                        | 805.0      |
| Length of stay     | 8(17)                            | 18(59)                                           | 458.5      |
| Delay of Admission | 3(9.60)                          | 1(3.71)                                          | 630.5      |
| Survival timemonths| 22(52)                           | 53(59)                                           | 514.0      |
| BMI                | 17.7(3.2)                        | 19.1(3.0)                                        | 582.0      |
| Laboratory parameters |                         |                                                   |            |
| WBC                | 7.23(3.83)                       | 7.95(3.68)                                       | 846.0      |
| Platelets          | 166(98)                          | 161(119)                                         | 794.0      |
| BUN                | 7.51(5.86)                       | 6.92(3.47)                                       | 791.5      |
| INR                | 1.09(0.11)                       | 1.08(0.12)                                       | 742.0      |
| Creatinine         | 75.50(46)                        | 79.60(37)                                        | 849.0      |
| Sodium             | 138.15(7.20)                     | 139.20(6.90)                                     | 874.0      |
| Bilirubin          | 13.05(10.60)                     | 14.60(7.40)                                      | 746.0      |

* P< 0.05 was considered statistically significant.

Table 4. The compare of cumulative mortality after injury between two groups
Cumulative mortality after injury

|               | Treatment regime | χ²  | P  |
|---------------|------------------|-----|----|
|               | Conservative group N (%) | Arthroplasty group N(%) |     |    |
| 0-30days      | 9(17.0)          | 3(9.1)       | 1.055 | 0.304 |
| 0-1 year      | 23(43.4)         | 4(12.1)      | 9.236 | 0.001 |
| 0-2 year      | 27(50.9)         | 8(24.2)      | 6.008 | 0.014 |
| 0-3 year      | 34(64.2)         | 13(39.4)     | 5.029 | 0.021 |
| 0-4 year      | 38(71.7)         | 15(45.5)     | 5.923 | 0.011 |
| 0-5 year      | 42(79.2)         | 17(51.5)     | 7.261 | 0.007 |
| Total         | 42(79.2)         | 17(51.5)     | 7.261 | 0.007 |

* P< 0.05 was considered statistically significant.

Table 5. The Log-Rank test for survival length during the different time interval between two groups

| Different Time intervals | Conservative group () | Treatment regime Arthroplasty group () | χ²   | P   |
|--------------------------|-----------------------|----------------------------------------|------|-----|
| (0-30]days               | 34.78±4.26            | 62.00±7.04                             | 10.017 | 0.002* |
| (0-1]year                | 40.01±4.45            | 57.93±7.18                             | 5.021  | 0.025* |
| (1-2] year               | 31.56±4.22            | 62.62±7.45                             | 12.373 | <0.001* |
| (2-3] year               | 33.56±4.49            | 64.00±7.75                             | 11.100 | 0.001* |
| (3-4] year               | 30.85±4.30            | 58.82±7.48                             | 10.048 | 0.002* |
| (4-5] year               | 30.58±4.35            | 58.93±7.80                             | 5.021  | 0.025* |
| Total                    | 31.36±4.22            | 73.26±11.65                            | 9.568  | 0.002* |

* P< 0.05 was considered statistically significant.

Figures
Figure 1

A. shown the overall survival of the arthroplasty group is significant higher than the conservative treatment group. B-D. The 1-year (B), 3-year (C) and 5-year survival (D) distribution difference between two groups is significance (Log-rank P=0.025), (Log-rank P=0.001) and (Log-rank P=0.025), respectively.