# Too Old for Surgery? Outcomes of Hip Fracture Surgery in Centenarians

**Dear Editor,**

Advancement in healthcare has significantly improved overall life expectancy and it comes as no surprise that centenarians (individuals aged 100 years and above) are projected to increase by 17 fold to 3.2 million by the year 2050.[1] Ranked fourth in longest life expectancy, Singapore has already seen a 3-fold increase in 2010 to 724 centenarians just within a decade.[2,3] Since osteoporosis-related fracture risk does not diminish with advanced age, hip fracture remains a significant cause of increased morbidity and mortality in this group of patients. Management of centenarian hip fracture is especially challenging, as both healthcare providers and patients may be unwilling to consider corrective hip surgery in view of their age and perceived high anaesthetic risks. Few studies on centenarian hip fracture outcomes have been done previously and this is the first study of the centenarian population in Singapore.

## Materials and Methods

Data from a single institution with an orthogeriatric co-managed hip fracture programme was acquired via a database search of admitted centenarians who had sustained new hip fractures over a 9-year period between January 2005 and December 2013. All hip fracture patients were admitted to an orthopaedic ward and were also assessed by geriatricians and anaesthesiologists with medical optimisation of heart and lung functions. Informed consent was taken for surgery and patients received either fracture fixation or hemi-arthroplasty depending on the fracture type. Postoperative rehabilitation followed an established multidisciplinary hip fracture care pathway, involving the geriatrician, physiotherapists and occupational therapists. Patients who refused surgery or were deemed unfit for surgery were managed on the conservative hip fracture care pathway, with early wheelchair mobilisation as tolerated. All patients were started on thromboembolic prophylaxis such as graduated compression stockings and mechanical calf-compression pumps.

Retrospective review of patient medical records was performed after approval from the institutional review board. Inclusion criteria was centenarians with confirmed radiological diagnosis of a hip fractures (femoral neck, intertrochanteric or subtrochanteric type) and they were followed up for at least 1 year after discharge. Patients with active oncological history or severe concomitant injuries were excluded from the study.

At the conclusion of review in October 2014, patients who were deceased were confirmed via records taken from the death registry. Detailed analysis of the complete medical records of all patients in the study cohort was performed to understand individual patient profiles, including using the Charlson Comorbidity Index (CCI [a scoring system that ranges from 0 to 33, with diseases carrying different weightage in estimating risk of death of patients from comorbidity]).[4] The higher the CCI score, the greater the mortality risk within a 1-year period.

Statistical analysis was carried out using the Statistical Package for the Social Sciences programme. Mean and standard deviations were calculated, and comparisons were made via the one-way analysis of variance (ANOVA) test, with $P$ values of $<0.05$ considered as statistically significant.

## Results

*Patient Profile and Comorbidities*

Patient demographics are as shown in Table 1 and 2, comprising 13 patients (10 women, 3 men) with a mean age of 102.3 years (range, 100.1 years to 109.8 years), with no excluded patients. Majority were Chinese (92.2%) and each patient sustained only 1 hip fracture after his or her hundredth birthday. Patients were categorised into 2 groups based on the orthopaedic management operative group (Group A) and non-operative group (Group B).

Table 1. Patient Demographics and Profile

| Parameters | Operative Group A (n = 6) | Conservative Group B (n = 7) |
|---|---|---|
| Mean age | 101.9 years (range, 100.1– 107.1) | 102.8 years (range, 100.1– 109.7) |
| Premorbid ambulation status | All ambulant (5 require aids) | 4 ambulant (2 require aids) 3 chair or bedbound |
| Mean ASA score | III (range, II to IIIE) | I and III* |
| Mean CCI | 1 (range, 0 – 2) | 1.29 (range 0 – 3) |
| Anaemia† | 83.3% | 85.7% |

ASA: American Society of Anesthesia score; CCI: Charlson Comorbidity Index

*Unrecorded in 5 patients.

†Anemia taken as <12.0g/dL for female, <13.5g/dL for male.

Table 2. Treatment, Function Status and Mortality of Individual Patient

| No. | Age | Fracture Type | Treatment | ASA | CCI | Mortality within 1 Year | Time from Injury to Death (Days) | Previous Ambulatory Status | Latest Ambulatory Status | Length of Stay (Days) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 101y 4m | IT | PFNA | III | 2 | No | - | AID | AID | 8 |
| 2 | 100y 2m† | IT | PFNA | II | 0 | No | - | AID | AID | 24 |
| 3 | 107y 2m | IT | PFNA | III | 0 | No | - | AID | AID | 20 |
| 4 | 102y 4m | NOF | Hemi-arthroplasty | IIE | 2 | Yes | 97 | AMB | AID | 9 |
| 5 | 100y 4m | IT | DHS* | IIIE | 1 | No | 1079 | AMB | AMB | 11 |
| 6 | 100y 5m | IT | PFNA | III | 1 | Yes | 205 | AID | Non-AMB | 13 |
| 7 | 109y 9m‡ | NOF | Non-OP | I | 1 | Yes | 9 | Non-AMB | Non-AMB | 6 |
| 8 | 100y 4m† | IT | Non-OP | III | 1 | Yes | 237 | AMB | Non-AMB | 9 |
| 9 | 100y 2m‡ | NOF | Non-OP | NR | 1 | No | - | Non-AMB | Non-AMB | 16 |
| 10 | 101y 10m‡ | ST | Non-OP | NR | 2 | Yes | 157 | Non-AMB | Non-AMB | 5 |
| 11 | 104y 1m | NOF | Non-OP | NR | 3 | No | - | AID | Non-AMB | 6 |
| 12 | 102y 5m† | NOF | Non-OP | NR | 1 | Yes | 62 | AMB | Non-AMB | 21 |
| 13 | 100y 8m | NOF | Non-OP | NR | 0 | No | - | AID | AID | 9 |

AID: Ambulant with walking aid; AMB: Ambulant without walking aid; ASA: American Society of Anesthesia score; CCI: Charlson Comorbidity Index; DHS: Dynamic hip screw; IT: Intertrochanteric; NOF: Neck of femur; Non-AMB: Non-ambulant; NR: Not recorded; PFNA: Proximal femoral nail anti-rotation; ST: Subtrochanteric

*Underwent general anaesthesia.

†Male patient.

‡Bedbound or wheelchair bound.

In terms of comorbidities, hypertension, anaemia and osteoporosis were most common; 83.3% (n = 5) of Group A patients and 85.7% (n = 6) of Group B patients were anaemic. The CCI for Group A was 1.00 (range, 0 to 2) and 1.29 for Group B (range, 0 to 3), and were not significantly different (*P* value = 0.590). Mean CCI for the entire study group was 1.15.

Functionally, all patients in Group A (n = 6) were pre-morbidly ambulant and 1 patient could ambulate without walking aid. In Group B, 57.1% (n = 4) of the patients were pre-morbidly ambulant, 2 could ambulate without walking aid while the remainder 42.9% (n = 3) were non-ambulant, bed or chairbound.

Operative management was not pursued in Group B as 4 patients were pre-morbidly bed or wheelchair bound, 1 patient had a recent non-ST elevation myocardial infarction and 2 others had opted out of operative management.

*Management Outcomes and Complications*

With regards to mortality, 53.8% (n = 7) of the entire study group died from non-surgical-related complications. Mortality rates within 1 year from injury were consistently lower in Group A as shown in Table 3. Reasons for death in Group A include pneumonia and stroke, with earliest death at 97 days. Comparatively, 57.1% (n = 4) of Group B patients died from complications including ischaemic heart disease and pneumonia in 1 year. The earliest death in Group B occurred during admission at 9 days in a patient with femoral neck fracture (CCI = 1), cause of death being urinary tract infection complicated by septicaemia. Mean hospital stay of the study group patients was 14.2 days (range, 8 to 24 days) in Group A and 10.3 days (range, 5 to 22 days) in Group B.

## Discussion

The CCI scores of centenarians in our study group tended to be low. This was also reflected in a previous study of 134,527 centenarian admissions within a 5-year period – 57% of admissions had mild comorbidity (CCI = 0 to 1), 39.3% had moderate comorbidity (CCI = 2 to 4) and 3.7% severe comorbidity (CCI ≥5).[5] Tarity et al also cited mean CCI score of 1.61 (range, 0 to 5) in a group of 23 centenarian patients sustaining hip fractures.[6] We postulate that centenarians tend to be healthier than most elderly patients and have lower CCI scores, since most of those with multiple comorbidities would have died earlier from complications of those diseases.

Table 3. Mortality and Survival of Patients

| Time Period | Operative Group A (n = 6) | Conservative Group B (n = 7) | *P* Value* |
|---|---|---|---|
| Mortality | | | |
| Within 30 days | 0% | 14.3% | 0.377 |
| Within 90 days | 0% | 28.6% | 0.182 |
| Within 6 months | 16.7% | 42.8% | 0.349 |
| Within 1 year | 33.3% | 57.1% | 0.433 |
| Surviving patients | | | |
| Duration of survival post-injury (days) | 97, 205, 1079 | 9, 62, 157, 237 | 0.939 |
| Length of stay (days) | 14.2 | 10.6 | 0.327 |

*$P$ values of <0.05 is considered as statistically significant.

We found that mortality outcomes with operative management in Group A were lower than Group B within a 1-year interval from injury, which were consistent with findings in previous studies.[6,7] This was contrary to the common belief that centenarians generally have higher surgical risks due to their advanced age and are at higher risks of postoperative-related complications and mortality. Granted, the mortality rate was not statistically significant between both groups due to the small sample size.

Operative management resulted in 83% (n = 5) of Group A patients being able to achieve ambulation, as opposed to only 1 out of 4 Group B patients who were previously ambulant with or without walking aid. Since prolonged bed rest may increase immobility-related complications, surgery followed by early mobilisation remains the best option for these patients.[8,9]

One of the limitations of our study includes small sample size as the centenarian population are small in numbers. Secondly, CCI scores in this study were in the low range from 0 to 3 points and may not be applicable in patients with high CCI scores. With more centenarians in the future, further studies with comparison of larger groups of centenarians, nonagenarians (aged 90 to 99) and octogenarians (aged 80 to 89) will be useful to aid clinical decision-making.

## Conclusion

Our study shows that the centenarian hip fracture population does not necessarily correlate with high surgical risk patients. In fact, operatively treated patients experienced consistently lower mortality rate within 1 year and also managed to better retain ambulatory ability. We advocate due consideration for surgical management of this patient group despite their advanced age in patients with few comorbidities.

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