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Hip fracture care and national systems: Australia and Asia

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Abstract

The Asia-Pacific region includes countries with diverse cultural, demographic, and socio-political backgrounds. Countries such as Japan have very high life expectancy and an aged population. China and India, with a combined population over 2.7 billion, will experience a huge wave of ageing population with subsequent osteoporotic injuries. Australia will experience a similar increase in the osteoporotic fracture burden, and is leading the region by establishing a national hip fracture registry with governmental guidelines and outcome monitoring. While it is impossible to compare fragility hip fracture care in every Asia-Pacific country, this review of 4 major nations gives insight into the challenges facing diverse systems. They are united by the pursuit of internationally accepted standards of timely surgery, combined orthogeriatric care, and secondary fracture prevention strategies.

Keywords: Asia, Asia-Pacific, Australia, China, fragility fracture, geriatric hip fracture, India, Japan

1. Introduction

The Asia-Pacific region is the most populous part of the world, and it includes countries with diverse economic background and very different population demographics. This review attempts to summarize the hip fracture-related epidemiology, clinical care standards, and outcomes in 4 culturally and demographically different countries of the region. Australia, with a relatively young but rapidly aging population, has a significantly improved system during the last 10 years in hip fracture care. China and India, with a combined population of over 2.7 billion and preparing for a huge wave of ageing population with osteoporotic injuries, are getting ready with their national guidelines and systems of care. Japan has a unique population due to its very high life expectancy; but while the country is a leader in many fields of medicine and well resourced, timely operative hip fracture management is still a major challenge. This paper aims to provide some insight into the specifics of hip fracture care in each country, highlighting their contribution to the better management of this fragile population.

2. Australia

2.1. Epidemiology

The future burden of osteoporosis and subsequent fracture in Australia is well recognized. Australia's population is predicted to increase from 25 million in 2025 to 29 million in 2050, with an increased life expectancy. The population aged 50 and above will increase in prevalence from 33% (8.3 million) to 41% (12 million) in 2050. Currently, 14% of this population has osteoporosis. The cost of osteoporosis in Australia is $2.6B (USD) annually, of which $1.7B is dedicated toward fracture management.[1] Australia currently spends $750 M on hip fracture care.[2] In 2013, 26,000 hip fractures were managed with the acute encounter costing up to $22–32K.[1] Longitudinal data demonstrate decreasing age-adjusted incidence in men and women,[3] however, 60,000 hip fractures have been estimated to occur by 2050.[4]

2.2. Governance of care

Four national systems are established to regulate hip fracture care: Australian Commission on Safety and Quality in Health Care (ACSQHC), Australia New Zealand Hip Fracture Registry (ANZHFR), Australian Orthopaedic Association National Joint

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Replacement Registry (AOANJRR), Royal Australasian College of Surgeons (RACS), and Combined Hospital Audit of Surgical Mortality (CHASM).

The ACSQHC have developed a national Clinical Care Standard for hip fracture care[5] based on guidelines from the ANZHFR.[6] Seven clinical care standards are outlined: care at presentation (timely assessment, imaging, analgesia, cognitive screening); pain management (multimodal analgesia, emergency department [ED] nerve blocks, pain pathways); orthogeriatric model of care; timing of surgery (within 48 hours if no clinical contraindication exists); mobilization and weight-bearing (unrestricted weight-bearing the day after surgery); minimizing risk of another fracture (falls assessment, bone assessment, and management plan); and transition from hospital care (individualized care plans acknowledging ongoing care goals and involving the family doctor).

A major step toward advocating a high standard of care was the development of the ANZHFR, a voluntary registry providing quality assurance for ACSQHC guidelines. Inclusion criteria are being aged 50 or above with a low-energy hip fracture.[7] In 2017, 52 Australian hospitals contributed information on 7117 patients to the database, a total of 18 424 since its inception in 2015. Funding is provided by Neuroscience Research Australia, the University of New South Wales, the New Zealand Accident Compensation Corporation, ACSQHC, and Federal and state governments.[7]

The RACS has implemented a national surgical mortality audit, CHASM, for which all inpatient deaths have a comprehensive assessment, which is subsequently audited. No formal death review process is performed on a hospital basis, as is recommended by the UK's National Hip Fracture Database.[8]

The AOANJRR is a globally respected register that aims to improve the quality of care for individuals receiving joint replacement surgery in Australia. The Commonwealth Department of Health fund the Australian Orthopaedic Association to manage the AOANJRR, and since 2009 the government cost recovers funding from industry.[9] It has information on over 100 000 hip fractures treated with arthroplasty.

2.3. Australia-specific statistics on hip fracture management

Traditionally, the public hospitals manage orthopedic trauma, however, private sector management occurs via private ED admission or transfer of privately insured patients from public hospitals. A paucity of information exists comparing the 2 broad categories of institutions. Currently, 116 public hospitals and 2 private hospitals contributed to the ANZHFR facility level audit.[7]

The Australian median age for hip fractures is around 84 years.[10] Females account for 73% with 70% from private residence and 25% from residential aged care facilities (RACF).[7] Cognitive impairment is seen in over 40% of patients on admission.[7]

The ANZHFR cites operative rates that are 97%, with preoperative medical assessment in over 80% of patients, and with an orthogeriatric team involved preoperatively in 63%. Orthogeriatric involvement has been cited in less than 50% in previous papers.[11]

Antithrombotics are taken by 50% of hip fracture patients, anticoagulation in 9.7%, with 81% having surgery within 48 hours.[12] The ANZHFR states that anticoagulation accounts for 16% of surgical delays. While the National Hip Fracture Database has recently started collecting data regarding the Direct Oral Anticoagulant class,[8] the ANZHFR does not. There is no policy directive for antithrombotics in ACSQHC guidelines.[5]

General anesthesia is administered in 73% of cases, with or without regional anesthesia. Australia is characterized by large distances with interhospital transfer occurring in 13% of patients. Median time to surgery is 30 hours in nontransferred patients and 41 hours in transfers; however, differences in outcomes are not known.[7]

Fracture patterns in coding studies follow a distribution of femoral neck (51.7%), intertrochanteric region (43.6%), and subtrochanteric (4.7%).[10] The ANZHFR divides fractures as Intracapsular—undisplaced/impacted, Intracapsular—displaced, Intertrochanteric (including basicervical), and Subtrochanteric. Arthroplasty is used in 58% of patients with "*undisplaced/impacted*" intracapsular fractures, which is contrary to the experience of the authors and challenges the accuracy of fracture classification data.

The AOANJRR provides insight into current arthroplasty practice and trends, and the potential exists for meaningful ANZHFR collaborations.[9] For hemiarthroplasty (HA), a steady decline in monoblock prostheses has been counterpointed by increases in modular HA. The use of total hip replacement (THR) (rather than HA) has increased from 19.7% to 26.4% between 2000 and 2016.[13] Age-, sex-adjusted revision rates at 10 years are 16% for monoblock, 14.3% for unipolar modular, 9.3% for bipolar heads, and 7.9% for THR.[9]

Bipolar use has increased, with lower revision compared with unipolar (HR = 0.79, CI 95% 0.70–0.89, $P < .001$) reported in the AOANJRR.[9] Cementless stems have a higher risk of revision in both unipolar (HR = 1.49 (1.32, 1.70), $P < .001$) and bipolar HA (HR = 1.55 (1.31, 1.84), $P < .001$). In THR (for fracture) over 70, hybrid fixation is the most common.

For intertrochanteric fracture, the ANZHFR does not differentiate between stable and unstable fracture patterns. Nearly twice as many nails (58%) are used than sliding hip screws (33%) for intertrochanteric fracture fixation. Arthroplasty is used in 6%, with other or unknown options in 2%.[7]

Subtrochanteric fractures received Intramedullary nails (length not specified) in 75% of fractures, with the remainder a mix of arthroplasty and sliding hip screw. It is the authors' experience that 25% of subtrochanteric femurs not receiving Intramedullary nail is high, and may reflect coding error.[7]

Postoperatively, the ANZHFR states that 95% of patients are full weight bearing and over 90% are given the opportunity to mobilize on the first postoperative day. Anecdotally, physiotherapy access on weekends is scarce; however, orthopedic and trauma wards with experienced nurses mobilize patients and drive this important management goal.

Geriatric medicine assessed 92% within admission and 81% underwent a falls assessment. Half of the patients are discharged to a rehabilitation facility, with 23% discharged to RACF and 12% home from the acute setting. Of RACF admissions, 84% returned without rehab.

The risk for hip refracture in Australia is 6.1% within 3 years.[10] Fracture Liaison Services in Australia have been shown to reduce hip refracture by 40%, with a number needed to treat 20% over 3 years.[14] ANZHFR data recorded 27% of patients taking calcium and/or vitamin D on admission, increasing to over half on discharge. More active treatment (bisphosphonates, denosumab) was 8% on admission increasing to 18% on discharge and to 30% at 120 days. We consider this to be an area of focus for improvement and several studies and implementation programs are currently underway to increase secondary fracture prevention.

No specific follow-up exists for patients with hip fracture. The ANZHFR attempts the collection of data on reoperation, bone protection, weight-bearing, mobility, residence, and mortality at 30 and 120 days; however, postdischarge data are incomplete. Efforts to establish data linkage programs to improve post-discharge surveillance are currently underway.

Inpatient mortality from acute admission is approximately 4%, with 30-day mortality at 6% and 120-day mortality 10%. Mortality at 30 days has been previously cited at 7.4%[11] for surgically treated patients and 8.2% for all admissions.[3] Adjusted 30-day mortality is less in hospitals with orthogeriatric services (6.2% [IQR: 2.1%] vs 8.4% [IQR: 2.4%], $P < .002$); however, no difference was seen in major trauma centers vs nonmajor trauma centers (7.2% vs 7.8%, $P = .3$).[11] Annual mortality for hip fracture is 23% and 5-year mortality is 55%.[10]

The establishment and acceptance of the ANZHFR has been a large step toward achieving a better standard of care. As more hospitals combine data toward the ANZHFR, its role will move toward being a research tool in addition to assessing facility performance.

2.4. Summary

In conclusion, Australia has an aging population with an increasing burden of hip fracture patients. Adoption and monitoring of evidence-based guidelines will enable the provision of the highest standard of care to one of the most vulnerable patient cohorts. With the recent introduction of the ANZHFR and data sources from the governing bodies, we have a higher level of understanding where improvements are required.

3. China

3.1. Epidemiology

The global annual number of hip fractures is predicted to increase to 2.6 million by 2025 and 4.5 million by 2050.[15] Similar trends have been projected for China. Si et al[16] proposed that the number of annual hip fractures was projected to rise to 1.64 million by 2020, and annual costs of osteoporosis-related fractures were estimated to increase to $25.43 billion by 2050 in China. Ren et al[17] used the national survey data collected from the China Health and Retirement Longitudinal Study and found the prevalence of hip fracture significantly increased after the age of 70. They also found that the geographic variation, lower education, under-weight, having self-reported history of chronic lung diseases, heart diseases, stroke, and arthritis appear to be associated with prevalence of hip fracture.[17] Tian et al[18] performed a cross-sectional study in 2015 and found that the incidence of hip fracture in Tangshan was 45.39 fractures per 100 000 men per year and 59.64 fractures per 100 000 women per year. The age-specific incidences of hip fracture in females aged over 65 and males aged over 75 in Tangshan increased compared with the results in 2010.[19] The majority of patients with hip fracture in rural areas reportedly stay at home instead of receiving surgical treatment in hospitals, which results in underreporting of hip fractures in China.[20]

3.2. Current state of hip fracture care

The Blue Book guidelines[21] recommended that patients should receive the surgery after hip fracture within 48 hours. However, Tian et al[22] concluded that the proportion of patients receiving the surgery within 48 hours was only 8% in Beijing Jishuitan Hospital, a leading orthopedics hospital in China, compared with 97% in the United Kingdom. In the experts' consensus on diagnosis and management of geriatric hip fractures (2017) in China,[23] professor Wu Xinbao of Beijing Jishuitan Hospital proposed that the collaboration between orthopedic surgeons and geriatric medicine consultants would improve the outcome of the hip fracture. The multidisciplinary comanagement intervention program for hip fracture consisted of "a pathway of care spanning ED presentation to discharge from hospital." [24] The comanagement program should be coordinated by geriatricians, emergency physicians, anesthesiologists, and physiotherapists and led by orthopedic surgeons, and involves standardized emergency management, preoperative assessments and treatments, admission to a specialist orthogeriatric ward, early surgery, and early discharge.[24] We found that the collaboration model increased the proportion of patients who received the surgery within the timeframe of 48 hours and significantly decreased the complications and mortality.[24]

3.3. Osteoporosis therapy

It is estimated that the population with osteoporosis will increase from 83.9 million in 1997 to 212 million by 2050 in China.[20] The receipt of osteoporosis management and assessment is recommended by the experts' consensus on diagnosis and management of geriatric hip fractures (2017) in China. However, it is a national problem that patients do not receive adequate antiosteoporosis therapy after hip fracture due to the poor patient compliance.[25] Yu and Xia[25] investigated the related studies published in English and Chinese from 1990 to 2017 and found only 50% of patients were still on medication after 1 year and one-third of them persisted with the treatment for 2 years or more.[26] Another problem concerning the osteoporotic hip fracture is the low incidence of diagnosing osteoporosis. Bone mineral density measurement by dual-energy X-ray absorptiometry (DXA) was the most important examination for osteoporosis.[27] However, more than 60% patients have never performed the DXA before or after the hip fracture. In some rural areas in China, the lack of disease recognition by doctors and limitation of DXA also leads to the low diagnostic rate of osteoporosis.[25] Therefore, the treatment of osteoporosis after hip fracture was insufficient in China.

3.4. Prognosis

Hip fractures exact a terrible toll on the elderly and lead to severe complications and high mortality due to their severity and high economic cost.[28] It has been reported that having a hip fracture can cause excess mortality and that there is a greater mortality risk for patients with hip fractures than for those without hip fractures.[17,25] Li et al[29] reported that the 1-year mortality rate after hip fracture in Beijing was about 23.4%. They found that comorbidities, such as cancer, cardiovascular disease, cerebrovascular disease, renal disease, and pneumonia, were the risk factors for death.[29] The 1-year mortality rates in China were different from those in Canada and some countries in Asia,[30,31] which might be caused by the different nutritional and physical exercise habits.[32] Attitudes toward hip fracture might prolong the wait time for surgery, which has been demonstrated to be associated with a poor prognosis after hip fracture.[33] The delay phenomenon is common in China due to geographic and economic factors and plays an important role in the mortality rates. On the other hand, we hypothesize that the elderly Chinese people are unwilling to separate from their children and to live in nursing homes because of

their traditional cultural attitudes and the low quality of care in nursing homes. The community dwellers make up a large part of the Chinese people whose fracture rates are lower than those of nursing home residents.[34,35]

4. India

4.1. Background

A comprehensive, well-defined system with specific protocols guiding treatment for specific fracture types and patient demographics does not exist in India. Hip fractures are currently managed without national guidelines or specific therapeutic targets. There is no national audit or registry.

There are, however, some accepted practices generally followed that are primarily driven by teaching institutions. Early surgical intervention, stabilization with intramedullary devices for intertrochanteric fractures, and joint replacements for subcapital fractures allowing early ambulation is the preferred treatment in most hospitals.

The implementation of globally accepted best practice in India is impeded by differences in health service delivery, referral practices, care-seeking behavior, the burden of out-of-pocket expenditure, which are factors not encountered during the development of guidelines in high-income countries.[36]

4.2. Funding model

Most people in India do not have private health insurance and pay for their care as an out-of-pocket expenditure. This results in inconsistent levels of care between insured and uninsured patients with frequent delays in care in the latter group. Even government health insurance requires one to opt in or apply to particular health schemes, which most people are unaware of. The heavy out-of-pocket expenditures lead to complex and difficult decisions often involving multiple hospital transfers and visit to local bonesetters. Families are less likely to risk such financial burden to seek treatment for female members, leading to gender inequities in care.[37] Funding also influences the choice of implant, even as performed by the same surgeon who works in different institutions. The suboptimal outcomes from poor quality implants are obvious.

4.3. Perioperative multidisciplinary care

Preoperative traction and an internal medicine consultant are standards to establish fitness for surgery and anesthesia. Orthopedic and internal medicine services function in most hospitals without an integrated orthogeriatric service approach. Oral or subcutaneous postoperative thrombosis prophylaxis is used. Patients on warfarin usually wait for surgery for 4 days until their INR drops below 1.5. Patients on antiplatelet medication are more likely to get timely surgery. Preference for type of anesthesia is institution based. The operative management and indications for surgery for different fracture types demonstrate a wide variety of approaches, based on the abovementioned factors. However, overall the treatment practices for those without economic constraints would not be different from the rest of the world.

4.4. Recent improvements

Even without overarching national guidelines most surgeons and institutions make efforts to implement internationally accepted best practices within their own socioeconomic restrictions. Various orthopedic and trauma societies organize conferences with experts to move toward a more standardized approach to hip fracture management. There are encouraging publications recognizing the need for implementation of universal protocols to standardize management practices and creation of a database to assess changes in the management of hip fractures.[37,38]

5. Japan

5.1. Epidemiology

In Japan, the elderly population is increasing quickly, with life expectancies of 81.0 years for men and 87.1 years for women, which is the second highest in the world. There are increasing numbers of geriatric hip fracture patients with the rapid growth in the population of elderly people.[39] The Japanese guidelines for the treatment of hip fractures in the elderly were developed in 2005, and the second version was published in 2011. For research funding, there are several grants to study hip fracture care through the Japan Osteoporosis Foundation. A nationwide survey of hip fractures by the Japanese Orthopaedic Association (JOA) from 1998 to 2008 found a dramatic increase in incidence of hip fractures. A total of 488 759 hip fractures were registered. More trochanteric fractures than neck fractures occurred; however, the neck/trochanter ratio increased over time. The mean duration of preoperative hospital stay was 4.5 days. There were significant differences in outcomes between patients who waited for surgery up to 3 days and those who waited longer than 3 days. The most frequent reason for delay to surgery over 3 days was due to the lack of access to an operating room.[40]

5.2. Specifics of classification

Complications such as nonunion and cutout of the lag screws happen even in stable fractures. This may be due to the difficulty of exact diagnosis of fracture patterns with plain radiographs. Shoda et al proposed a classification system for trochanteric fractures using three-dimensional CT (3D-CT) based on the Nakano classification and investigated the relationship between this classification and conventional plain radiographs-based classification.[41,42] Using 3D-CT, fractures were classified as 2-, 3-, or 4-part fractures using combinations of the head, greater trochanter, lesser trochanter, and shaft. Five subgroups of 3-part fractures were identified according to the fracture pattern involving the greater and lesser trochanters. Many fractures exhibited a large oblique fragment of the greater trochanter, including the lesser trochanter. This fracture type was identified as unstable in the 3D-CT classification but was often classified as stable with the radiographic classification. The 3D-CT shows the fracture line very clearly, making it easy to classify the fracture pattern.

5.3. Protocols for falls prevention and bone health screening

Exercise therapy is effective for falls prevention, but there is no clear evidence that it will decrease the incidence of proximal femur fractures. Currently, there are no clear protocols for fall prevention in the JOA guidelines. National bone health screening started in 2008, and the target was female age between 40 and 70, with DXA scanning every 5 years. According to the Japan Osteoporosis Foundation in 2016, approximately 60% of Japanese communities offered osteoporosis screening. However, the participation rate of females aged 40 and above who accessed

screening was 5.0% in Japan. This is despite clear data indicating communities with a higher participation rate of osteoporosis screening had significantly less femoral neck fractures.

5.4. Protocols for follow-up of patients

There are no clear protocols for follow-up outlined in the JOA guidelines. The Japan Osteoporosis Society is developing an osteoporosis liaison service that is an advanced service for fracture liaison promoted by the International Osteoporosis Foundation. There are attempts to develop the osteoporosis network among hospital, family physician, and community in order to continue the osteoporosis medication and prevent the second fracture.

5.5. Key improvements in recent years

Integrated orthopedic and geriatric care resulted in shorter time to surgery and hospital stay relative to the national average. The average days from patient admission to surgery were about 3 days shorter than the national average. The average duration of hospital stay was more than 14 days shorter than the national average. The incidence of serious complication was low, including pneumonia 3%, heart failure 0.8%, and pulmonary embolism 0.8%, and the in-hospital mortality rate was 0.9%. The multidisciplinary treatment has resulted in a high rate of osteoporosis treatment at discharge and at follow-up; the rate of patients who had antiosteoporosis pharmacotherapy at discharge was 88%, and the continuation rate of pharmacotherapy was 95% at 1-year follow-up due to the presence of the fracture liaison service. Furthermore, this approach produced better functional recovery, and the total hospitalization medical cost per person for the multidisciplinary treatment was less than the national average.

A multidisciplinary treatment approach for geriatric hip fractures is possible in Japan and has been effective. Therefore, there has been a call for more hospitals to consider adopting a multidisciplinary approach for geriatric hip fractures.[43]

6. Conclusions

It is impossible to have comprehensive comparisons of Asia-Pacific countries' fragility hip fracture care, but there is clearly something to learn from each system. It is obvious that the international trends toward timely surgery, orthogeriatric patient care models, and second fracture prevention efforts are becoming established in all 4 countries. Most data are available from Australia due to the existing recently established hip fracture registry. China and Japan have impressive data on improvement of care associated with the implementation of new guidelines and India is attempting to disseminate the knowledge of their experts at the top academic centers to their vast population.

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