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An Asian Perspective on the Management of Distal Radius Fractures

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Synopsis

There is little data with regards to the epidemiology, pathology, or management of distal radius fractures from centers in Asia. Asia includes five advanced economies, namely Hong Kong SAR, Japan, Korea, Singapore, and Taiwan and a number of emerging economies prominent among which are China, India, Malaysia, Philippines, and Thailand. This article examines the available epidemiological data from Asia, and compares the management of distal radius fractures in the advanced and emerging Asian economies and how they match up to the current management in the west. It concludes by offering solutions for improving outcomes of distal radius fractures in both the advanced and emerging economies of Asia.

Keywords

Asia; Distal Radius Fracture; Epidemiology; Wrist Fracture

One of the earliest descriptions of the management of the distal radius and other fractures is *Xian Shou Li Shang Xu Duan Mi Fang* (Secrets of treating wounds and rejoining fractures handed down by a fairy), written by a Taoist priest Master Lin of the Tang dynasty (841–846) in China. It describes position, fixation, exercise, and medication as the major methods in the treatment of fractures and depicts the method of external local immobilization with small splints, and the idea of integrating immobilization and exercise. Another early description of the treatment of distal radius fractures is in a book titled *Shi Yi De Xiao Fang* (Effective Formulas from Generations of Physicians) written in 1343 by Wei Yilin from Nanfeng in Jiangxi province of China.¹ Heo Jun (Figure 1) (1546–1615), a royal physician in Korea compiled a book known as the *Dong Eui Bo Gam* (Mirror of eastern medicine). He clearly defines early treatment and post reduction support for the management of distal radius fractures - “if the bone is broken or joint dislocated, reduction should be applied under the application of an anesthetic drug... immobilization with wood boards and intermittent joint motion should be started, if not motional deficit will remain”.² Despite these early contributions to the management of distal radius fractures from Asia, the vast majority of current publications dealing with distal radius fractures are from the West.

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The authors of this article had the benefit of a multicultural upbringing and training. This has given them a unique perspective about the differences in the management of distal radius fractures within Asia and how it compares with current treatments in the West. This chapter will discuss these differences from a surgeon and patient perspective. With increasing globalization, the cultural diversity in our local populations is only bound to rise. Understanding differences in socio-cultural perspectives will allow us to understand and treat our patients better.

Defining Asia

Asia is a vast continent with an amazing diversity of cultures and varying levels of economic prosperity. For the purpose of this study, we included only the countries in South-East Asia and excluded Russia, former republics of the Soviet Union, and the countries in the Middle-East. The South-East Asian countries can be divided into advanced economies and emerging economies based on the level of economic prosperity. The advanced economies include Japan and the four Asian Tigers namely Hong Kong SAR (now part of China), Singapore, South Korea, and Taiwan, whereas all the remaining countries in South-East Asia fall into the emerging economies bracket.³ Amongst the emerging economies, five Asian countries are considered as newly industrialized (as of 2011). They are China, India, Malaysia, Philippines, and Thailand.³ There is little data regarding distal radius fractures from any of the emerging economies in Asia. A search on pubmed using the term 'Distal Radius Fracture' brings up 4200 articles. However, only about 100 articles are from centers in Asia. More than 70% of these articles are from Japan and the remainder from the other advanced economies.

Epidemiology

The epidemiological features of distal radius fractures vary among populations and are associated with race, socio-economic status, culture, and degree of urbanization. There have been a number of population-based studies in Scandinavian countries, United Kingdom, and North America that have presented the epidemiological characteristics of distal radius fractures.⁴⁻⁷ These studies demonstrated a bimodal age distribution of these fractures, with peaks of incidence occurring in the youth and in the elderly. Although the overall gender rates were similar, the fractures in men tend to occur in the younger group, whereas there is a preponderance of females in the elderly group due to osteoporosis. There have been only a few epidemiological studies of distal radius fractures that have been done in Asia.

Taiwan

A population-based study using claims data obtained from the National Health Insurance in Taiwan from 2000 to 2007 revealed a 42.2% overall increase in the incidence of distal radius fractures over the eight year period of the study (10.2 to 14.5 per 10,000). Women were at greater risk than men, with average incidence rates of 15.1 per 10,000 persons in women and 9.5 per 10,000 persons in men. The incidence rates were lower than those in Northern Europe and America, however the rising incidence in the peri-menopausal women was similar to that seen in Scandinavia. The authors attribute this to an increase in the prevalence of osteoporosis as a result of lifestyle changes. The risk of fracture was higher in June and July and the authors postulated that this was due to typhoons, which commonly occur in the summer months and may increase the risk of fractures associated with fall and slip.⁸

Japan

A study measured the incidence of distal radius fractures in all adults older than 35 years in the Tottori prefecture of Japan in 1986–87, 1992, and 1995. The authors noted an increasing

trend in the incidence rates of distal radius fractures, especially in women. The age-adjusted incidence rates of distal radius fractures for women were 164.9 in 1986 and 211.4 in 1995, showing a significant increase with time. The authors also noted that the highest incidence of fracture was in December (winter), although the seasonal trend was not statistically significant.^{9,10} The authors mentioned that the use of a traditional futon (as opposed to a bed) was one of the significant factors associated with reduced risk of wrist fractures among the Japanese. They speculated that spreading futons and putting them away in a closet everyday contributes to the maintenance of muscular strength in the lower limbs, resulting in a reduced risk of falls.¹¹ The authors also conducted a similar study in patients under 20 years of age during the same time periods and concluded that the incidence of distal radius fractures in males was higher and had increased over time, peak incidence of fractures corresponded to the period of growth spurt with peaks at 12–13 years for males and at 10–11 years for females, and that the incidences peaked in spring and autumn.¹² A similar study done in Niigata prefecture in 2004 suggested an incidence of 76.9 per 100,000 population when adjusted for the Japanese population with a male to female ratio of 1:3.2, and average age at fracture being 60.2 years.¹³

South Korea

There are two studies from South Korea that have data with regards to the incidence of distal radius fractures obtained from the Korean Health Insurance Review Agency, which covers 97% of the population. However, both of these studies have only looked at distal radius fractures in the elderly (> 50 years) and their relationship to osteoporosis. According to these reports, the age adjusted incidence of distal radius fractures in 2008 was 425 per 100,000 population (164 per 100,000 population in men and 661 per 100,000 population in women).

Singapore

Unpublished data from the first author's center in Singapore based on a study done in 2008–2009, suggests that the incidence of distal radius fractures peaks between the ages of 50 and 60. In men, the peak incidence was between 30–50 years of age, whereas in women, the peak incidence was the perimenopausal age group (50–60 years). The sex ratio was 1.3:1 with slightly more distal radius fractures in men compared to women.¹⁴ This is not consistent with previous studies and is likely because this was not a population study and because we treat a large number of men with distal radius fractures following industrial injuries and motor vehicle accidents.

Other Asian Countries

No epidemiological data are available for any of the other Asian nations. A paper on pediatric fractures from India mentions distal radius fractures as the commonest fracture pattern seen in children, accounting for 22.4% of all fractures. This study from a single center in Mumbai treated 112 distal radius fractures over a period of one year in 2004–2005 and reported the highest incidence of distal radius fractures in the 13–16 age group followed by the 7–12 age group.¹⁵ Similar data were reported from another study on pediatric fractures from Hong Kong. This study from a single center in Hong Kong saw 617 distal radius fractures over a five year period (1986–1990). Distal radius fractures were the commonest fracture accounting for nearly 20% of all fractures, and occurred most frequently in the 8–11 followed by the 12–16 age group.¹⁶

Based on the available data, it seems that the incidence of distal radius fractures in Asia is lower than those in Europe and America, but similar to those in Australia. However the incidence in peri-menopausal women is rising and appears similar to rates described in the west and is believed to be linked to osteoporosis. In general, a higher incidence of osteoporotic fractures is seen in populations in higher latitudes (North America and Europe)

and Asian populations were considered to have a low to moderate risk for osteoporotic fractures.¹⁷ However it seems that the incidence of osteoporosis related distal radius fractures is rising in Asia. Epidemiological studies have indicated that risk factors for distal forearm fractures include low bone mass, estrogen deficiency, falls, drinking alcohol, poor visual acuity, frequent walking, and walking at a brisk pace.¹⁸ This, combined with an increased proportion of elderly people with weakened bones that are living longer due to better medical care, especially in the advanced economies may have contributed to this rise.⁹

Access to Healthcare

There is a vast difference in the healthcare systems between the advanced and the emerging economies in Asia. The healthcare system in the advanced economies namely Hong Kong, Japan, Singapore, South Korea, and Taiwan is on par with the West. The population in these countries has access to quality healthcare that is subsidized by the respective governments. The healthcare system in the emerging economies faces the challenges of a predominantly rural population, low per-capita income, inadequate transportation capabilities, overcrowding, illiteracy, inadequate resources, lack of supporting services such as orthopaedic nursing, unstructured referral practice, and a meager health insurance system. Modern orthopaedic services and training are most often directed toward the urban population. Most of this population receives their primary treatment from traditional bone setters. Modern orthopedic treatment has made traditional bone setting obsolete in the advanced economies; however, this practice is prevalent in most emerging economies and easily accessible and affordable to the poorer sections of society. The traditional bone setter usually wraps the area with a cloth containing some herbs and applies a tight splint at the fracture site. The splints are usually made of bamboo or a wooden bar. The bone setter also does not have a fundamental knowledge of anatomy, physiology, or radiography. This treatment often leads to complications like acute compartmental syndrome, complex regional pain syndrome, tetanus, Volkmann ischemic contracture, chronic osteomyelitis, gangrene, amputation, tetanus, and rarely death.^{19,20}

Availability of Infrastructure

In the advanced economies, the facilities are on par with those in the west. A wide variety of implants, powered drills, and intra-operative fluoroscopy machines are available in all hospitals. Although healthcare in emerging economies is either free or heavily subsidized by the government, good facilities and trained manpower are often available only in the major cities. Even in the major cities, the vast majority of distal radius fractures are managed with some form of traction and reduction and casting for 4–6 weeks. The prohibitive cost of implants makes plate fixation unavailable for most patients. In these centers, distal radius fractures that cannot be managed with closed reduction and casting usually undergo percutaneous pin fixation or external fixator application in more complex fracture patterns. This combination of factors, namely the patient's financial constraints, use of the cheapest technology available, and the unavailability of intra-operative fluoroscopy makes the treatment of distal radius fractures in the emerging economies suboptimal.

Surgical Training

There is no shortage of well-trained surgeons who are capable of handling varying types of distal radius fractures in the advanced economies. In contrast, there is a lack of appropriate training and shortage of dedicated hand surgeons who can treat injuries of the wrist and distal radius in the emerging economies. Current orthopaedic or plastic surgery training in these nations does not adequately prepare the trainees to handle wrist and distal radius injuries. In general, orthopedic trainees are comfortable managing forearm fractures, whereas plastic surgery trainees are comfortable managing hand fractures. The distal radius and the wrist therefore remains a grey area that is poorly understood and treated. Another

factor that improves surgical training is funding by the implant manufacturers. The manufacturers would like to introduce surgeons to the use of their implants and tend to focus on markets that use more implants and are therefore more profitable. Due to cost constraints, the emerging economies are not as attractive as the advanced economies.

Socio-Cultural Differences

The authors have noted some differences in the surgeon-patient interaction in Asia and the USA. In the US, patients are usually more independent and prefer to take the decision regarding surgery based on the options presented to them. In contrast, in Asia (both advanced and emerging economies), the patients prefer to be guided and the surgeon usually decides what is best for the patient. The discussion regarding other options is usually limited and the decision-making process is controlled by the surgeon. The plausible reasons for this could be a culture of implicit obedience between patient and surgeon, possible lack of patient education, or greater faith in the surgeon. With increasing westernization, this is gradually changing and younger patients in the advanced economies are beginning to question their surgeons more often.

In Asia, patients are usually more reluctant to undergo surgery compared to their western counterparts and frequently accept some deformity to avoid surgery. Patients in Asia also seem to have more implant related symptoms in the late post-operative period. Patients would often complain about the implant feeling cold during cold/rainy weather and often request for removal of implants. Similar complaints are seldom encountered in the west. One possible reason could be that most implants manufacturers are based in Europe or North America and the implants are sized for Caucasian patients. These are usually too large, especially in the small sized Japanese and Chinese women, and even volar plates can be easily palpated and often require removal. One peculiar question the first author faces from patients in Singapore is whether the distal radius plate would set off the alarm in the airport. His department routinely issues a certificate to patients that they can show the airport security staff.

Scope for Improvement

Advanced Economies

There is a large volume of good quality work being done in the five advanced Asian economies. However the scientific basis for treatment of distal radius fractures is still based on evidence from the west. There is an urgent need for these nations to produce better quality publications and move forward from the level 4 case series study design and technique papers. In addition, other areas of research and clinical study designs need to be considered. These include evidence-based medicine and the many options in diagnosis, prognosis, therapeutic and economic strata. The implant manufacturers also need to consider differences between the Asian and Caucasian wrist in the design of newer implants. The Asian wrist is smaller and more mobile when compared to the Caucasian wrist. This may affect the fracture pattern and the design, shape and size of the implant. For example, the knee arthroplasty prosthesis in a Japanese population needs to flex more compared to a similar prosthesis designed for the Caucasian population because the Japanese patient needs a greater flexion of the knee for his daily activities. Some progress has already been made with a few multicenter randomized control studies from centers in Hong Kong, Singapore, and Taiwan.^{21,22} A recent multimillion dollar multicenter NIH funded clinical trial (WRIST - Wrist and radius injury study group) led by the senior author has included two centers from Singapore in addition to the 19 centers in North America to study the outcomes of surgical treatment of distal radius fractures in the elderly.²³

Emerging Economies

The current treatment of distal radius fractures requires a technically up-to-date infrastructure and costly implants. These are usually out of reach for the common man in the emerging economies. A viable low cost alternative in these countries may be to educate and train traditional bonesetters in fracture treatment, both to minimize the mismanagement of fractures and to reduce the healthcare burden on secondary and tertiary institutions.²⁴ This training can include an introduction of radiographs, recognition of open and displaced fractures, guidance in the approximate duration of fracture healing, recognition of complications of fracture treatment and the ability to decide when they should refer a case to the hospital for management. A significant improvement in the knowledge and skills of traditional bone setters has been seen after completion of this training.²⁵ Interestingly, some of the traditional treatment methods have been adopted in medical education in China and India.²⁶

In the urban areas of the emerging economies, the emphasis should be on making the treatment of distal radius fractures more affordable. Western implant manufacturers can help by making available cheaper stainless steel implants instead of titanium and allowing local firms to manufacture implants by selective transfer of technology. There is also a need for increased training and exposure of the surgeons in the developing world, which can be accomplished through training fellowships. For example, the National University of Singapore in conjunction with the Lee Foundation offers a fully funded six month fellowship (Tan Sri Dr Runme Shaw Fellowship in Hand & Reconstructive Microsurgery) to surgeons from an ASEAN country (Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Thailand, and Vietnam) to learn hand surgery in one of Singapore's tertiary hospitals. It is also important for the developing Asian nations to contribute actively towards the current literature in distal radius fractures. Surgeons should look to publish in other avenues instead of the traditional 'I did so many cases, and I am presenting complications and my good results'. There is a need to perform epidemiological studies and health services type research on distal radius fracture to assess the barriers to adequate care, disparities of care, the use of costly technology and sociocultural issues affecting choice of treatment and outcomes.

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Figure 1.
Heo Jun (1537/1539–1615) was a court physician of the Yangcheon Heo clan during the reign of King Seonjo of the Joseon Dynasty in Korea.