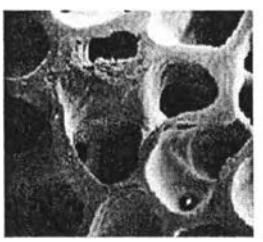
CHAPTER I

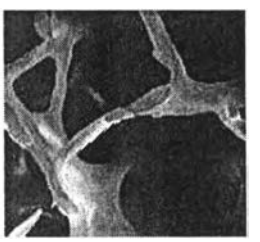
1. BACKGROUD AND RATIONALE

Osteoporosis is the common condition that can cause fracture in post-menopausal women. Osteoporosis and its consequence may be regarded as a major source of mortality, morbidity, and medical expenditure world[1,2]. It has been estimated that 75 million people in Europe, Asia, and the USA combined are affected by osteoporosis (figure 1.1). Furthermore, a significant increase in the age-adjusted incidence of osteoporotic fracture over the past 40-50 years has been reported from many countries. On a worldwide basis, osteoporosis will become an increasing public health problem in the future because the world population is aging[3,4]. Thus, a strategy to reduce the social burden of disease or costs of prevention would be welcome.

Figure 1.1 An example of normal and Osteoporotic bone.



Normal bone

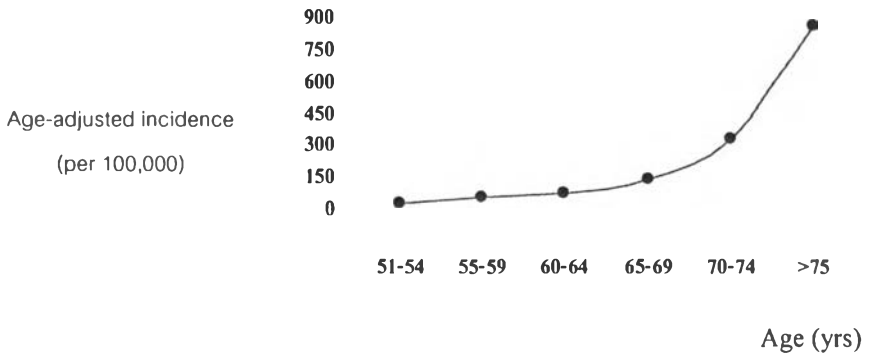


Osteoporotic bone

The most common age-related fractures are those of the distal forearm, vertebrae, and hip. Lifetime risk of Colles' fracture has been estimated to be 15% in white women. Vertebral fractures are the most common osteoporotic fractures. The estimated lifetime risk for a 50-year-old woman of sustaining a vertebral fracture is 32%. Vertebral collapse is often asymptomatic and found incidentally on x-ray. Progressive vertebral collapse can lead in some cases to kyphosis and chronic pain[5,6].

The incidence of hip fractures (figure 1.2) begins to rise after age 50, but will rise dramatically after age 70. A 50-year-old white woman whose average life expectancy is 80 years, has a lifetime hip fracture risk of 15%[6,7].

Figure 1.2 The incidence of Hip fracture in Thailand



Asian Osteoporosis Study Group, 1998

Currently, bone mass density (BMD) is recognized as the best and most easily measured for diagnosis of osteoporosis[7]. According to WHO definition, osteoporosis is diagnosed when BMD is beyond -2.5 SD from the mean of BMD among normal young women. Dual energy X-ray absorptiometry (DXA) is considered as a gold standard for bone measurement in the assessment of osteoporosis and has been demonstrated to predict those women who will sustain fracture both in older age groups and during the perimenopausal years[8,9].

In recent years, there is however a new diagnostic test propose such as quantitative ultrasound (QUS) (figure 1.3), which measures BMD using ultrasound at calcaneus. QUS has been developed as an alternative method for non-invasive assessment of bone mass density. This technique is less expensive, more time-saving, and free from radiation[10,11]. Ultrasound is a mechanical wave that can be measured in either transmission or reflection. When an ultrasound wave is propagated through a bone, it produces regions of temporary compression and rareflection of the bone tissue. By comparing the differences between the sound wave transmitted into a bone and the wave emerging after interaction with the bone, one can obtain information about the material and structural properties of the bone. The frequency range for the transmission of ultrasound used in human bone studies is generally from 100 kHz to 1.0 MHz[12]. This is called broadband ultrasound. Typically, the outcome is expressed either numerically as the

velocity of the wave that travels through the skin and bone, commonly known as the speed of sound (SOS) or ultrasound transmission velocity (UTV), or in terms of the rate that the energy is attenuated with increasing frequency, which is commonly known as broadband ultrasound attenuation (BUA). In general, healthy bone attenuates higher frequency sound than osteoporotic bone. Based upon these two variables, one can also compute arbitrary multiple variable indices. They have been given names such as "Stiffness index", which should not be mistaken for the accepted physics definition for stiffness. BUA is thought to be related to bone structure whereas SOS is closely related to the material properties of bone such as elasticity[13,14].

Although it is a portable, non-ionizing and economical system of measurement, there is still debate as to which bone parameter can be most effectively used as part of a comprehensive bone service[15].

In Thailand, we have been using Dual energy X-ray absorptiometry (DXA) (figure 1.4) for bone measurements in the assessment of osteoporosis and osteopenia for a long time. Therefore, QUS technique can be an alternative method that is less expensive, portable, and can be used at a primary care level to indicate osteoporosis and osteopenia women who should be considered for full assessment and health promotion, especially, those Thai postmenopausal women.

Figure 1.3 The quantitative ultrasound

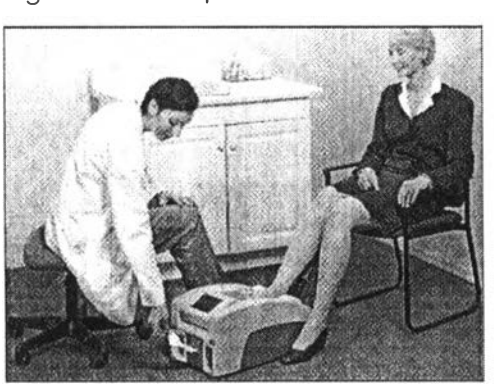


Figure 1.4 The Dual energy X-ray absorptiometry