systematic review

An epidemiological analysis of the incidence of osteoporosis and osteoporosis-related fractures among the Saudi Arabian population

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BACKGROUND AND OBJECTIVES: Osteoporosis is common in Saudi Arabia and the burden of management in an aging population will increase in coming decades. There is still no national policy nor consensus on screening for this silent disease. The objective of this analysis was to determine from the published data the prevalence of osteopenia and osteoporosis in Saudi Arabians, the prevalence of secondary osteoporosis, and the prevalence of osteoporosis-related fractures (ORF). We also sought to determine the best age to begin and best modality for screening .

METHODS: Data Sources were MEDLINE (1966 to May 2011), EMBASE (1991 to May 2011), the Cochrane Central Register of Controlled Trials and Cochrane Database of Systematic Reviews (1952 to May 2011), and the Science Citation Index (1966 to May 2011), published data from the Saudi Medical Journal (1985-2011) and Annals of Saudi Medicine (1985-2011). We selected English-language articles with at least 100 Saudi individuals. Two authors independently reviewed articles and abstracted data.

RESULTS: The authors identified 36 potentially relevant articles, of which 24 met the inclusion criteria. Of 5160 healthy women 50 to 79 years of age (mean, SD: 56.8 [2.7]), 36.6% (6.6%) were osteopenic and 34.0% (8.5%) were osteoporotic. In three studies on males (n=822), the prevalence of osteopenia was 46.3% and osteoporosis 30.7%. Males had a significantly higher frequency of osteopenia in comparison to females (*P*=<.001 95% CI<-0.0333), The mean age of the patients with secondary osteoporosis was 37.4 (13.5, 18-57) years, with the osteoporosis in 46.4% and osteopenia in 34.1%. In 5 studies of ORF, the incidence of vertebral fractures was between 20%-24%.

CONCLUSION: The currently available literature on Saudi Arabian population suggests that the ideal age for screening for low bone mass among the Saudi population should be earlier (55 years) than the ≥65 years in Western countries. Both quatitative ultrasound and dual-energy x-ray absorptiometry could be used for screening. The relatively small number of studies on Saudi Arabians and the different machines used for diagnosis limited the authors ability make conclusions with surety.

Osteoporosis and its related complications are one of the major healthcare problems around the globe. It is estimated that osteoporosis affects about 200 million women worldwide and is a substantial cause of morbidity and mortality. Fifty-four percent of postmenopausal white women are osteopenic and 30% are osteoporotic, and by the age of 80, 27% of women are osteopenic and 70% are osteoporotic.[1] It is reported that about 40% of US white women and 13% of US white men aged 50 years will experience at least one fragility fracture in their lifetime.[2] In 1990s it was realized that the problem of osteoporosis in Saudi Arabia was more severe than in the rest of the world with a reported prevalence between 30% to 48% in this country.[3-9]

Even though safe therapies are freely available for the treatment of osteoporosis and to reduce the risk of fractures,[10-15] most affected individuals are asymptomatic, undiagnosed, and untreated.[16-18] Moreover, the majority of patients at high risk who have already

had at least one osteoporotic fracture, are neither identified nor treated adequately.[19] Several organizations, including the US Preventive Services Task Force[20] and International Osteoporosis Foundation[21] recommend screening so as to make an early diagnosis of low bone mass, but in Saudi Arabia still there is no consensus on whom to screen, what age to screen and which modality to use. To be able to make any recommendations, we performed a systematic review to find answers to four questions, which we thought could help in formulating a future plan for Saudi Arabian patients with osteoporosis. First, what is the prevalence of postmenopausal osteoporosis, and male osteoporosis; secondly, how common is secondary osteoporosis; thirdly, what is the incidence of osteoporosis-related fractures (ORF); and lastly, at what age should screening be instituted and which modality used.

METHODS

We searched MEDLINE (1966 to May 2011), EMBASE (1991 to May 2011), the Cochrane Central Register of Controlled Trials and Cochrane Database of Systematic Reviews (1952 to May 2011), and the Science Citation Index (1966 to May 2011), published data from the *Saudi Medical Journal* (1985-2011) and the *Annals of Saudi Medicine* (1985-2011). We supplemented our searches by manually reviewing bibliographies of eligible studies and relevant review articles. The key words selected were Saudi Arabia, osteopenia, osteoporosis and bone mineral density. The inclusion criteria were clinical studies involving at least 100 Saudi Arabian patients or healthy individuals. We included English language studies that diagnosed osteoporosis by radiographs, single photon absorptiometry (SPA), dual photon absorptiometry (DPA), dual-energy x-ray absorptiometry (DEXA) and calcaneal quantitative ultrasound (QUS).

RESULTS

The authors identified 36 potentially relevant articles, of which 24 met the inclusion criteria. Of 5160 healthy women 50 to 79 years of age (mean, SD: 56.8 [2.7]), 36.6% (6.6%) were osteopenic and 34.0% (8.5%) were osteoporotic (**Table 1**). In three studies on males (n=822), the prevalence of osteopenia was 46.3% and osteoporosis 30.7% (**Table 2**). The mean age of the patients with secondary osteoporosis was 37.4 (13.5, 18-57) years, with the osteoporosis in 46.4% and osteopenia in 34.1% (**Table 3**). Males had significantly higher osteopenic in comparison to females (P=<.001 95% CI <-0.0333) Osteopenia in women was 30.7% compared to 44.1% in men. The statistical comparison of osteopenia in women and men was that in 5160 women, osteopenia was reported in 1586, while in men out of 822 the osteopenia reported was in 365. Five studies which reported ORF data showed that the prevalence of femoral fractures in 1991 in men was 71/100 000 and 100/100 000 in women, while in 2007 it was 599/100 000 (men and women). The incidence of vertebral fractures was between 20% to 24% (**Table 4**).

DISCUSSION

Our systematic review of the published data indicate that the prevalence of low bone mass (osteoporosis and osteopenia) in Saudi Arabia is 70.5% in men and women with an average age of 56 years. This suggests that women in Saudi Arabia become osteoporotic earlier than the western women; hence it is recommended that if screening is to be mandated it should be around 55 years of age. The recent census of the Saudi population showed that the number of women aged ≥50 years is 906 526, which suggests that 326 349 (36%) are osteopenic and 308 612 (33%) are osteoporotic. The total population at risk of sustaining an ORF is 634 961. The World Health Organization estimated the prevalence of osteoporosis in Western women (adjusted to 1990 US white women) at any site as 14.8% in women aged 50-59, 21.6% for ages 60-69.[39] Comparing the figures prevalence of osteoporosis in Saudi women is twice that of US white women and their suggestion is to screen women at ≥65 years for osteoporosis is not tenable; hence we believe that the screening for low bone mass in Saudi women should be at least a decade earlier. The analysis of studies published on male osteoporosis showed that the prevalence is similar to the postmenopausal group. Osteopenia in males is reported to be 46.3% while osteoporosis at 30.7%. The average at which the males suffer is at a much younger average age (57.4 [6.3]) years than in western countries. The prevalence of male osteoporosis is 7% in white men, 5% in black men, and about 3% in Hispanic-American men,[40] while osteopenia in US men is reported to be 33% to 47%, which is similar to the 44.1% in the Saudi male population.[41] Even in the male Saudi population we tend to believe that screening should be instituted earlier than recommended by the Western criteria.

Secondary osteoporosis, which is caused by various disorders, metabolic derangements, drug administration and can be chemotherapy induced due to malignancies, still remains underdiagnosed and undertreated. Romagnoli et al[42] reported the prevalence of primary osteoporosis to be significantly higher than secondary osteoporosis in both men and women. In our patients, secondary osteoporosis occurred in a young age group

Table 1. Studies with data on postmenopausal Saudi women.

Studies	No. of patients	Age (y)	Methodology	Osteopenia n (%)	Osteoporosis n (%)
Al-Habdan et al (2009)[5]	3311	55.6	Ultrasonography	948 (30.3)	720 (23)
Ardawi et al (2005)[7]	220	50-79[a]	DEXA	95 (43.4)	62 (28.2)
Sadat-Ali et al (2004)[9]	256	57.6	DEXA	79 (31)	107 (42)
ElDesouki (2003)[6]	830	59	DEXA	254 (30.6)	(328) 39.5
El Desouki (1999)[22]	283	52-62[a]	SPA	(96) 34	68 (24)
Sadat-Ali et al (1996)[4]	150	54.1	SPA	68 (45)	60 (40)
Sadat-Ali et al(1993)[3]	110	58	Radiographs	46 (42)	45 (41)

DEXA: dual-energy x-ray absorptiometry, SPA: single photon absorptiometry. Age data are mean and standard deviation. [a]mean age and SD not available in the publication

Table 2. Studies with data on male osteoporosis.

Studies	No. of patients	Age (y)	Methodology	Osteopenia n (%)	Osteoporosis n (%)
El-Desouki and Sulaimani (2007)[23]	429	53 (12.6)	DEXA	158 (36.9)	101(23.5)
Sadat-Ali and Al-Elq (2006)[24]	115	61.8 (1.8)	DEXA	55 (47.9)	35(30.8)
Ardawi et al (2005)[7]	278	50-79[a]	DEXA	150 (54.1)	105(37.8)

DEXA: dual-energy x-ray absorptiometry. Age data are mean and standard deviation. [a]mean age and SD not available in the publication

Table 3. Reports on secondary osteoporosis.

Studies	Age (y)	No. of patients	Primary disease	Methodology	Osteopenia n (%)	Osteoporosis n (%)
Sadat-Ali et al (2011)[25]	28.4	186	Sickle cell disease	DEXA	30 (16)	135 (72.5)
Al-Turki H (2009)[26]	27.5	35	Sickle cell disease and pregnancy	DEXA	14 (39.8)	21 (65)
Al-Amri and Sadat-Ali (2009)[27]	49	71	Postchemo-therapy	DEXA	24 (33.9)	19 (26.8)
Sadat-Ali et al (2008)[28]	30	87	Sickle cell disease	DEXA	22 (25)	27 (31)
Sadat-Ali et al (2009)[29]	38.3	165	Steroid use	DEXA	81 (49.1)	48.3
Sadat-Ali et al (2008)[30]	18	32	Scoliosis	DEXA	9 (28.1)	20 (62.5)
Sadat-Ali and Al-Elq (2007)[31]	33	36	Sickle cell disease	DEXA	7 (19.5)	14 (38.9)
Al-Elq and Sadat-Ali (2006)[32]	57.5	154	Diabetes mellitus	DEXA	80 (52)	40 (26)
Al-Maatouq et al (2004)[33]	55	101	Diabetes mellitus	DEXA	44 (43.6)	47 (46.8)

DEXA: dual-energy x-ray absorptiometry.Age data are mean and standard deviation (when available).

Table 4. Data related to osteoporosis-related fractures.

Studies	No. of patients	Sex	Methodology	Site of Fractures	n (%)
Sadat-Ali et al (2011)[34]	980	Male	Retrospective	Vertebral	157 (13.1)
Al-Osail, Sadat-Ali et al (2010)[35]	165	Male and female	Retrospective	All	25 (15.2)
Sadat-Ali et al (2009)[36]	785	Female	Retrospective	Vertebral	159 (20.3)
Bubshait and Sadat-Ali (2007)[37]	4910	Male and female	Retrospective	Proximal Femur	138 (2.8)
Al-Nuaim et al (1995)[38]	203 000	Male and female	Retrospective	Proximal Femur	103 (0.05)

(mean age and SD, 37.4 [13.5] years) and higher than primary osteoporosis in men and women (46.4 [16.1] to 31.9 [1.6], $P<.001$, 95% CI<-13.4486). This comparison suggests that patients with known diseases and on medications which cause osteoporosis should be screened earlier, to institute early therapy and prevent complications of ORFs.

Five studies on ORF reported 582 fractures in 2 071 400, making an incidence of 280 fractures per 100 000 population. A recently published study by Brauer and colleagues[43] concluded that in the US the annual mean number of hip fractures was 957.3 per 100 000 for women and 414.4 per 100 000 for men. Our analysis shows that the annual prevalence of all ORF was 277.4/100 000. The prevalence reported in 1995 for femoral fractures was 50.7/100 000 and by 2007 the population of ≥50 years men and women was 164 128 and the number of femoral fractures was 984, giving a yearly prevalence of 599/100 000. Such an increase was observed in other countries as well due to aging of the population. Figures from United Kingdom showed the age-standardised incidence rates of fracture femurs increased by 32% in women and 38% in men,[44] while Koh et al[45] reported that hip fracture rates from 1991 to 1998 were 152/100 000 in men and 402/100 000 in women, and this was 1.5 and 5 times higher than corresponding rates in the 1960s. With the aging of the Saudi Arabian population, the number of fractures is expected to rise unless appropriate screening measures and adequate treatment is given.

Various methodolgies have been used for screening for osteoporosis in different parts of the world. Currently, DEXA is the method of choice for measuring bone mass in the axial skeleton and is used for making a diagnosis of osteoporosis. DEXA allows accurate diagnosis of osteoporosis, estimation of fracture risk and monitoring of patients undergoing treatment. Additional features of DEXA include measurement of bone mineral density at multiple skeletal sites, safety of performance, short investigation time and ease of use.[46-48] The use of QUS of the calcaneum came into vogue, to predict fracture risk due to low bone mass on the basis of calculation of the stiffness index, broadband ultrasound attenuation, speed of sound velocity, and T-score. The QUS is an inexpensive, radiation free, portable, and may provide information on bone quality and bone structure. Recently a new reference value for the diagnosis of low bone mass for the Saudi population has been assessed and reported.[49] The reported sensitivity and specificity of the QUS in detecting low bone mass is around 90%.[50,51] Studies also supported its routine use to predict fracture risk due to low bone mass.[52,53] At present in Saudi Arabia, approximately 30% of women aged ≥56 years, 30.7% of men aged ≥60 years are expected to have osteoporosis and 25 percent of these women will develop a vertebral deformity due to fractures of the spine, and half of them will end up having a hip fracture.

The authors thus conclude that screening for postmenopausal woman in the Saudi Arabian population should start at the age of 50 years and for male osteoporosis at 55 years so that early preventive measures may be instituted. An awareness program is needed to stress the need for early diagnosis of secondary osteoporosis. We further believe that screening either by ultrasound or DEXA could be used (though DEXA is more accurate and precise).

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