

Use of Bone Mineral Density assessment in Brunei Darussalam

Arrianne Mae PADUA ¹, Kian Chai LIM ¹, Ketan PANDE ²

¹ Department of Radiology and ² Department of Orthopaedics, Raja Isteri Pengiran Anak Saleha (RIPAS) Hospital, Brunei Darussalam

ABSTRACT

Introduction: Clinical practice guidelines from various health organisations are available for use of Bone Mineral Density (BMD) testing using Dual Energy Xray Absorptiometry (DXA) in osteoporosis. The purpose of this audit was to study the referral pattern for BMD testing in Brunei Darussalam. **Material and Methods:** Data was extracted from the referral form for DXA stored in a Department of Radiology computer database. This information was used to obtain the total number of patients undergoing DXA from 2009 to 2014 with their age, sex and source of referral. Additional information was available for patients referred from the Department of Orthopaedics in 2013-2014. The T-score of BMD is expressed as mean $\pm$ SD. The statistical analysis was done using SPSS version 17.0. **Results:** The total number of patients undergoing DXA was 820. More women than men were referred and maximum numbers of patients were in the 6th and 7th decade of life. The most common sources of referral were Rheumatology, Endocrine, Orthopaedic and Internal Medicine clinic. A total of 51 patients (Male 7, Female 44) were referred from the Department of Orthopaedics in 2013-2014. The most common reason being osteoporosis seen on radiographs (n=16), fragility fracture (n=8) and post-menopausal status (n=7). The BMD T-score at lumbar spine and hip in patients referred with fragility fracture and radiological osteoporosis was significantly lower than those referred for other indications. **Conclusions:** Compared to the international recommendations and the likely number of subjects at high risk of osteoporosis, BMD testing is underutilised in Negara Brunei Darussalam particularly in men and in patients with fragility fractures.

Keywords: Osteoporosis, Bone Mineral Density, DXA, Fragility fracture

INTRODUCTION

Osteoporosis is now recognised as a major problem of health care across the world as well as in the Asia-Pacific region. ¹ Data from industrialised countries suggests that in females, osteoporosis prevalence ranges from 9-15% based on total hip BMD and 16% to

38% when spine BMD is included. For males the prevalence ranged from 1% to 4% and 3% to 8% respectively. ²

Fragility fractures at the hip, vertebrae and distal radius are the hallmark of osteoporosis. These can lead to considerable morbidity and are also associated with excess mortality. There are socio-economic consequences associated with these fragility fractures. ³ Over 50 years of age, 1 in 2 women

Correspondence author: Ketan C PANDE
Department of Orthopaedics, RIPAS Hospital,
Bandar Seri Begawan BA 1710, Brunei Darussalam
Tel: +673 2242424
Fax: + 673 2242690
E mail: ketanpande@yahoo.com

and 1 in 5 men will suffer fragility fracture.⁴ A prior fracture at any skeletal site is associated with a doubling of future fracture risk.⁵ It is estimated that by 2050, the largest increase in the rate of hip fractures will be in Asia.⁶

In 1994, the World Health Organisation developed a definition of osteoporosis based on Bone Mineral Density (BMD).⁷ More recently clinical risk factors together with BMD at the hip have been used to assess fracture risk in patients.⁸ Guidelines are available from various health organisations for indications for BMD testing and referral.⁹⁻¹¹

Dual Energy X-ray Absorptiometry (DXA) is available in RIPAS Hospital, however no standard recommendations for its use or indications for referral are available. The aim of this audit was to study the referral pattern for BMD testing in Brunei Darussalam with an aim to optimise its use, increase awareness and refine indications for its use.

MATERIALS AND METHODS

DXA has been available in RIPAS Hospital since April 2009. There is only one DXA equipment in Brunei Darussalam, which is installed in the Department of Radiology and scans are done once a week. The Lunar Prodigy Advance (GE Healthcare) device uses Asian database to provide BMD results on the patients. The data extracted from the referral form is stored in a departmental computer database. This information was used to obtain the total number of patients undergoing DEXA from 2009 to 2014 with their age, sex and source of referral. The patients referred included those who were admitted as well as

those from outpatient clinics.

Additional information like indication for referral was available for patients referred from the Orthopaedic department in 2013-2014. The T-score of BMD is expressed as mean $\pm$ SD. The statistical analysis was done using SPSS version 17.0. No data which could reveal patient identity or affect their confidentiality was recorded.

RESULTS

From April 2009 till December 2014, the total of 820 patients (average 136 per year) underwent DXA. The cases per year are presented in Figure 1. The ratio of men to women assessed during the study period ranged from 1:4.3 to 1:13.6.

With a few exceptions, maximum numbers of patients were in the 6th and 7th decade of life as seen in Table 1.

The most common sources of referral were Rheumatology, Endocrine, Orthopaedic and Internal Medicine clinic. The sources of BMD referral are shown in Table 2.

A total of 51 patients (Male 7, Female 44) were referred from the Orthopaedic De-

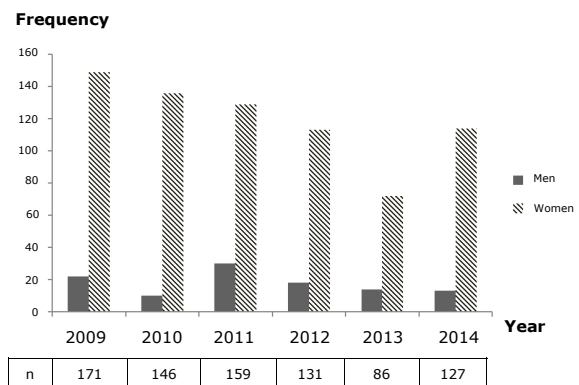


Fig. 1: Breakdown on the number by year and genders.

Table 1: Age Distribution of patients referred for BMD assessment.

Age (Years)	<50	50-59	60-69	70-79	>80	Total
2009	57	60	28	24	2	171
2010	25	42	39	31	9	146
2011	41	47	33	29	9	159
2012	26	41	34	20	10	131
2013	26	22	17	15	6	86
2014	10	27	48	32	10	127

partment in 2013-2014. The age distribution of this sample is shown in Table 3.

The most common reasons for referral from the Department of Orthopaedics were osteopaenia noted on radiographs (n=16), fragility fracture (n=8) and post-menopausal status (n=7). The other reasons for referral being secondary osteoporosis (n=4), thoracic kyphosis and low back pain (n= 3 each) and no reason was mentioned in 10 cases.

The BMD T-score at lumbar spine, hip and forearm in patients referred with fragility fracture and osteopaenia seen on radiographs (Group 1; n=24) was significantly lower than those referred for other indications (Group 2; n=17) (Table 4).

DISCUSSION

A total of 820 patients underwent DXA assessment over six years of study with an average of 136 patients per year. Referrals in men made up only 13% of the total number of referrals. The most common sources of referral for BMD assessment were Rheumatology, Endocrinology and Department of Orthopaedics. Only a few patients were referred for BMD assessment even after sustaining a fragility fracture.

Morris *et al.*⁹ had pointed out lack of uniformity in the development and contents on the indications for BMD testing from various clinical societies and associations. A more recent review of guidelines reveals that except some minor differences, there is agreement on who should be subjected for BMD testing.¹⁰ The International Society for Clinical Densitometry recommends BMD testing for all women over 65 years of age and all men over 70 years of age. BMD testing is also recommended at an earlier age in the presence of additional clinical risk factors like prior fragility fracture, low body weight, high risk of medications use with impact on bone density and presence of diseases and conditions associated with bone loss.¹¹

Table 2: Source of referrals for BMD.

Specialty	Year	2009	2010	2011	2012	2013	2014	Total
Rheumatology		104	45	57	36	17	28	287
Endocrinology		31	18	19	18	15	8	109
Orthopaedics		9	53	43	36	27	24	192
Internal Medicine		12	18	15	19	4	4	72
Obstetrics & Gynaecology		1	1	0	1	1	1	5
Renal Medicine		0	0	7	9	9	4	29
Oncology		2	0	1	5	4	55	67
Others		12	11	17	7	9	3	59

Table 3: Referrals from Department of Orthopedics in year 2013-2014.

Age (years)	No. of patients	% of patients
< 50	7	13.7
51-60	15	29.4
61-70	6	11.8
71-80	17	33.3
81 and >	6	11.8

One of the early studies of referral patterns identified female gender, corticosteroid use and rheumatologist care positively associated with BMD testing. Female physicians, rheumatologists and physicians caring for more postmenopausal patients were more likely to refer patients.⁹

Even in countries like the United States of America with advanced primary care, not enough eligible women are being screened for osteoporosis.¹² In a study from Australia looking at reasons for referral for BMD testing in younger men and women, it was found that glucocorticoid use in women and low energy fracture in men were the most common reasons.¹³ Another study from the same authors in older population identified age more than 70 years as the most common reason for BMD referral followed by monitoring of fracture and low BMD.¹⁴

Mohammad *et al.*¹⁵ in a cross sectional study of 2025 DXA referrals found that 33% were inappropriate, with limited information and no appropriate indication. The authors stressed the need for educating the referring physicians for optimal use of DXA.

In Brunei Darussalam, the life expectancy in 2013 for men was 75.7 years and for women it was 78.4 years and a total of 42

thousand men and women were noted to be above 55 years of age.¹⁶ The incidence and prevalence of end stage renal diseases in Brunei Darussalam was reported to be 265 and 1,250 per million population respectively.¹⁷ If the number of patients with fragility fractures and secondary causes of osteoporosis are added to this, the potential number of subjects who would be candidates for BMD assessment will be much higher. The data from the present study suggests that the number of patients undergoing BMD assessment is lower and number of men referred for BMD assessment was even lower. Contrary to expectation, the number of patients referred for BMD assessment showed a decline over years of its use. Other than lack of awareness of the usefulness of BMD assessment, no reason can be put forward for this trend.

Between 2007 and 2012, an average of 42 hip fractures were recorded per year in Brunei Darussalam.¹⁸ No data on the more common distal radius and vertebral fractures is available. Thus the number of patients with fragility fractures is likely to be much higher. Data from present study suggests that only 8 patients with fragility fracture were referred for BMD estimation in 2013 and 2014 suggesting that a large number of patients with

Table 4: BMD in subgroups according to reasons for referral from the Department of Orthopaedics.

	n	Group 1	Group 2	p value
Lumbar spine	24	-2.0 ± 1.8	-0.7 ± 2.1	0.03
Hip	27	-1.8 ± 1.0	-1.0 ± 1.6	0.03
Forearm	13	-4.1 ± 1.2	-2.7 ± 2.0	0.03

Group 1: Fragility fracture + Osteopaenia noted on radiographs.
Group 2: other reasons

fragility fracture do not get referred.

An important component of secondary prevention strategies for fracture is estimation of BMD for patients who have sustained a fragility fracture.¹⁹ In a systematic review of 37 studies about diagnosis and investigation for osteoporosis in patients who have sustained fragility fracture, 14 of 16 studies reported investigation of less than 32% of patients. It was also seen that investigation by bone mineral density resulted in high rates of diagnosis of osteoporosis (35-100%).²⁰ An Osteoporosis care gap has been recognised even in countries like US and Canada. Only 1.7% to 50% of Canadian patients over 40 years of age with fragility fracture underwent DXA testing.²¹ In a study of fragility fractures between 2001 and 2009 from US 30% of women and 15% of men were referred for DXA²² while only 10.3% were referred following a hip fracture.²³ In both these studies more women were referred compared to men. More recently, in a retrospective study of 1122 postmenopausal women who were discharged after a fragility hip fracture from treatment centres in China, Hong Kong, Singapore, South Korea, Malaysia, Taiwan and Thailand, only 28.2% had undergone BMD measurement.²⁴ Similar to reports in the literature, we found that more women compared to men were referred for BMD assessment and the number of subjects with fragility fracture referred for BMD assessment was very low.

Osteopaenia noted on radiographs is a good predictor of osteopaenia or osteoporosis diagnosed after BMD assessment²⁵, however identification of osteopenia from the spinal radiograph is highly subjective and variable from film to film and observer to observer.²⁶

Osteopaenia noted on radiographs was the second most common reason for BMD referral from our Department of Orthopaedics in the present study followed by post-menopausal status and secondary osteoporosis which are recognised indications for BMD referral. We have also demonstrated that patients referred for BMD assessment with fragility fracture and those with osteopaenia noted on radiographs have significantly lower BMD T-score compared to patients referred for other reasons.

The role BMD assessment by DXA is now established in the diagnosis and risk assessment of osteoporosis and related fractures, helping make treatment decisions and monitor response to treatment.²⁷ With the availability of guidelines for BMD assessment, the number of patients referred for BMD assessment can be improved with a view to detect osteoporosis early and start effective treatment. This would involve dissemination of information about indications for BMD assessment amongst clinicians as well as standardising the referral form for DXA assessment.

There were some limitations of the study. The retrospective design meant that only information available on the referral forms could be used. The sources of referral were identified from the referring clinic. It was difficult to ascertain the specialty when the patients were referred from the wards. Referrals from other sources would have included post-menopausal women though the numbers directly referred from the Gynaecology clinics were lower.

In conclusion, compared to the international recommendations and the likely number of subjects at high risk of osteoporosis,

BMD testing is underutilised in Brunei Darussalam particularly in men. Efforts should be directed to identify high risk patients who would benefit from BMD testing from various sources of referral. Orthopaedic patients with fragility fractures and osteopaenia noted on radiographs have lower BMD T-score. There is a need to educate clinicians about indications for DXA assessment to optimise its use.

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