

Bone mineral density among Palestinian patients suffering from hemoglobinopathy disorders

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Abstract

This study aimed to investigate the correlation between bone mineral density (BMD) with hemoglobin and ferritin levels in Palestinian patients suffering from various types of hemoglobinopathies. The study revealed the thresholds of hemoglobin and ferritin to protect against low BMD in these patients.

Purpose: Iron overload is the main cause of low BMD in subjects with hemoglobinopathies. We used iron overload-related parameters like hemoglobin and ferritin to estimate the cutoff values required to maintain bone health and identify subjects with low BMD.

Methods: Palestinian patients (135) suffering from various types of hemoglobinopathies were recruited from various medical centers including 87 β thalassemia major (TM), 13 thalassemia intermedia (TI), 16 sickle cell anemia (SCA), 17 sickle cell thalassemia (SCT), and 1 thalassemia trait (TT). Most subjects (84%) were below the age of 30 years. BMD was measured and the z score was used to identify subjects with low BMD ($z < - 2.0$). Receiver operator characteristic (ROC) curve analysis was used to estimate the thresholds of hemoglobin and ferritin levels needed to protect against low BMD in these patients.

Results: No difference in means of age, weight, BMI, hemoglobin, and ferritin levels among the recruited male and female subjects were observed. The results showed that 77% of TM subjects had low BMD levels and femoral neck and total hip BMD were significantly lower among female compared to male subjects. Thalassemia patients (TM, TI, and SCT combined) had significantly low BMD and lower hemoglobin mean values

compared to normal BMD subjects (8.54 vs. 9.25 g/dL, $p = 0.01$). Pearson's correlation analysis showed positive correlation between hemoglobin levels and BMD at the three sites, being higher with lumbar spine ($r = 0.444$) compared to femoral neck ($r = 0.291$) and total hip ($r = 0.224$). Ferritin levels in TM patients (4800 ng/ml) and TI subjects (1500 ng/ml) were abnormally high. ROC curve analysis showed that hemoglobin threshold ≤ 9.3 g/dL represents a risk for developing low BMD with an area under the ROC curve (AUC) 0.699 and sensitivity and specificity were 87.9% and 47.7%, respectively. Similar analysis revealed that Ferritin threshold to protect against low BMD should be maintained below 2300 ng/ml with AUC 0.619 and sensitivity and specificity were 55.0% and 71.4%, respectively.

Conclusions: The results of this study strongly recommend to maintain hemoglobin levels above 9.3 g/dL and ferritin below 2300 ng/ml to protect against low BMD in TM subjects and patients suffering from the other related hemoglobinopathies.

Keywords: BMD; BMI; Ferritin; Hemoglobin; Hemoglobinopathies; Thalassemia.