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(CASE REPORT)

Mandibular changes in a patient suspected with Thalassemia trait: A case report by radiograph finding

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Abstract

Thalassemia is an inherited hemolytic anemia characterized by abnormal synthesis the hemoglobin globin component. A forty-year-old woman presented to a private dentist complaining of a left-sided facial pain and headache that occurred out of the blue. Panoramic radiograph showed severe caries on several teeth, generalized reduction in the alveolar crest, thin lamina dura and changes in trabecular pattern of mandible and the inferior alveolar canal on each side was partially absent. Unmanaged anemia caused ineffective erythropoiesis resulting extensive bone marrow with sparse coarse trabecular. As the mean hemoglobin falls, enhanced osteoclastic bone resorption thus thinning lamina dura, reducing alveolar crest and lacking radiopaque line of inferior alveolar canal. Panoramic is widely used in dentistry, this case report presents a case of patient discovered thalassemia through radiological findings.

Keywords: Thalassemia; Oral manifestation; Radiograph; Panoramic

1. Introduction

Thalassemia is an inherited hemolytic anemia characterized by abnormal synthesis of either α- or β-polypeptide chain of the hemoglobin globin component. (1–3) α- globin gene carries four alleles, and the severity of thalassemia varies from moderate to severe based on the quantity of allele deletions. β-thalassemia arises when one or both globin genes are either abnormal or nonexistent. (4) Thalassemia minor, also known as thalassemia trait, denotes the presence of a thalassemia gene in an individual, yet the individual's hemoglobin production remains sufficient to qualify them as a healthy individual. Thalassemia minor can be classified into three distinct types: α^{+} thalassemia trait, α^{-0} thalassemia trait, and β-thalassemia trait. The former consists of the absence of one of the four α-genes, the latter of which is two α-hemoglobin genes, and at last, β-thalassemia trait, which is the absence of one out of two β-hemoglobin genes. (4–6) In thalassemia major, β-globin chain production is absent or severely deficient, causing severe anemia that requires lifelong transfusion assistance. β-thalassemia intermedia is a disease in between the two types. Hb H diseases is another kind of thalassemia in which three of the four α- hemoglobin genes are absent or defective. Hb Bart's, the most severe form of thalassemia, occurs when all four α- hemoglobin genes are absent or defective. This variant of thalassemia is so severe that no hemoglobin can be developed before the birth. (4,7,8)

From all genetic variants, thalassemia major has prominent clinical features. Thalassemia minor and intermedia may have not demonstrated serious harmful consequences, although the prognosis is determined by the musculoskeletal system symptoms risked to osseous changes. Marrow hyperplasia represents the serious osseous alteration which are further characterized with medullary expansion, generalized cortical thinning, spreading of bone caliber, coarsened

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trabecular pattern, cancellous bone resorption as well as osteopenia, which may result in pathological fractures. (9,10) A study on the radiographic features of jaws and teeth in patients with thalassemia using orthopantomography resulted large bone marrow spaces widely found in the posterior mandibular region.(11) On top of that, the study also found most cases revealed canal mandibular loss, imbalance crown body length of mandibular incisor, thinning of lamina dura and inferior cortex. (11–13)

The region known as the "thalassemia belt" spans over the Mediterranean coastline, the Arabian Peninsula, Turkey, Iran, India, and southeastern Asia. (14) Combinations of globin gene mutations cause approximately 60 thalassemia disorders, with Southeast Asians having the most complicated genotypes. According to common globin gene mutations found in the Southeast Asian population, the four major thalassemia diseases are Hb Bart's, homozygous β-thalassemia, Hb E/β-thalassemia, and Hb H diseases. (15) Indonesia considered as epicenter with a high prevalence case of hemoglobinopathies. Research conducted in Jogjakarta, mid-city of Indonesia, revealed that the carrier rate resulting from voluntary screening was around 31 % of population divided into 18 % for Hb E/β-thalassemia, 12 % for α-thalassemia, and 0.4% for α/β-thalassemia. Yayasan Thalassemia Indonesia, a private foundation focuses on thalassemia-related issues in Indonesia had reported 10,973 registered thalassemia patients in Indonesia by June 2021. (14,16–18) The current number is thought to be far lower than the actual value, as it remains well below the officially estimated total. Multiple variables may have contributed to this potentially inaccurate number, including a limited capability for diagnosis that has resulted in many infected persons being undetected, particularly in rural regions. (16) This report presents a case of patient discovered thalassemia through radiological findings.

2. Case Presentation

A 40 years old woman visited a private dentist in Kediri, East Java, Indonesia with a chief complaint random episode of headache and facial pain on the left side. Intraoral examination showed normal mucous but several teeth had decayed, therefore patient referred to get panoramic taken.

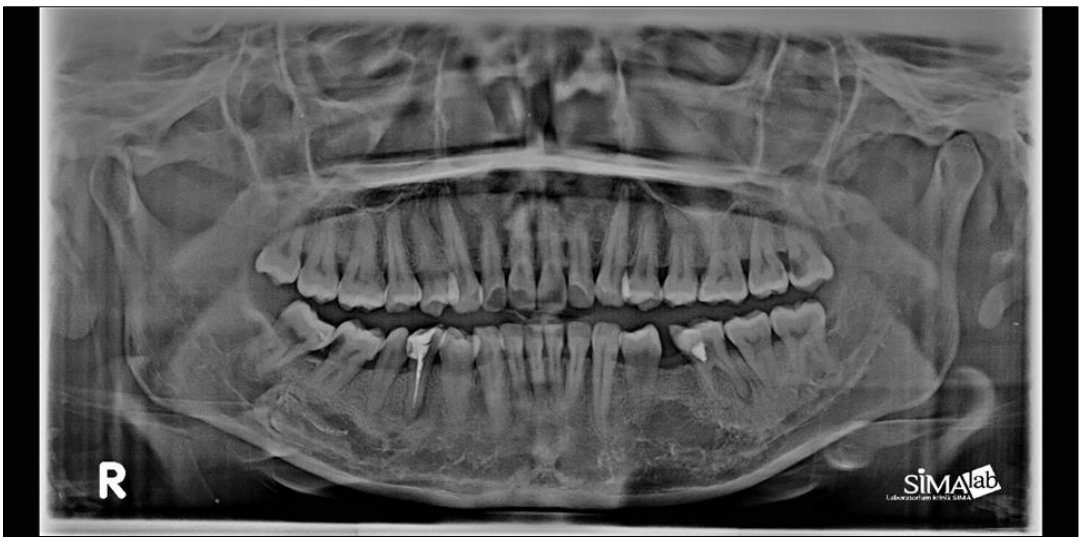

Figure 1 Radiograph of patient showed several teeth decayed and trabecular bone changes

Next visit, radiograph revealed severe caries on upper left third molar, lower left first molar and lower right second premolar, a generalized alveolar crest reduced, thin lamina dura and noticeable changes on trabecular pattern throughout body mandibula. The trabecular appeared more radiopaque, coarse, irregularly shaped, but on the several part the bone marrow are enlarged so the mandible appeared radiolucent. On the right, the canal mandibula was partially absent near the mental foramen, and its border was fuzzy. Cortical inferior border remains intact. No abnormality was found during palpation on mandible, patient denied paresthesia, previous trauma and familial history of same disease. According to medical history, patient had admitted to emergency unit care a month ago due to low hemoglobin and discharged upon blood transfusion. Based on anamnesis, clinical and radiographic information, initial diagnosis was blood disorder with jaw manifestation.

The patient underwent endodontic treatment for decayed teeth and at the same time referred to internist for further examination. Laboratory test presented Hb 9.1 g/dl (11.0-16.5 g/dl), Iron serum 11.4 ug/dl (37-145 ug/dl), erythrocyte

microcytic hypochromia with target cells and teardrop cells, leucocyte eosinophilia and thrombocyte normal. These findings lead to suspected diagnosis of chronic anemia and thalassemia trait. The patient was advised to follow up with more advanced hemoglobin test.

3. Results and discussion

Thalassemia can lead to chronic anemia due to inadequate production of the beta-globin chains. (19) In patients with uncontrolled thalassemia, this long-lasting anemia results in overactive bone marrow which causes hypertrophy of the broad bones, reduction in trabeculae. (1,20) The large bone marrow spaces are caused by ineffective erythropoiesis, which damages the red blood cell membrane. In response, the body makes more red blood cells, which makes the bone marrow grow up to 15–30 times its normal size. One of the most important radiography signs of thalassemia is large bone marrow spaces with sparse coarse trabecular pattern. (11) The secondary or tertiary bone trabeculae blurring, and the primary trabeculae are apparent thick, giving the bone a "lace-like" or “chicken-wire” look. (21,22) These features can be seen right away and are easy to spot in this report.

Panoramic of patient showed thinning of lamina dura and generalized alveolar crest resorption. It is similar to previous observation, a significant proportion of the patients exhibited thin lamina dura. (23) Receptor activator of nuclear factor kappa-B ligand (RANKL) and osteoprotegerin (OPG) are cytokines that influence bone metabolism in thalassemia. The pathogenesis of osteoporosis in the postmenopausal period and other metabolic bone diseases has been linked to these cytokines. (24) Research demonstrated that thalassemia patients experience an upregulation of RANKL expression by stromal or osteoblastic cells when the OPG/RANKL system is perturbed. It was hypothesized that thalassemia patients might be associated with increased osteoclastic bone resorption and subsequent bone loss thus lamina dura thinning and alveolar height reducing were commonly found. (1,12,25)

Multiple studies have found a significant increase in dental caries among individuals with thalassemia compared to healthy individuals. This can be attributed to poor dietary habits, bone deformities, higher susceptibility to infections, excessive iron accumulation in the parotid glands, dry mouth due to median concentrations of phosphorous and IgA in saliva are lower in these individuals. (26) In accordance to this report, patient had poor oral hygiene led to several teeth decayed and failed in previous treatment.

The inferior alveolar canal is usually seen on radiographs as two parallel lines of radiopacity, one roofs the canal and the other forms its floor. (27) The lack of the two radiopaque lines of the inferior alveolar canal is explained by the increasing degree of remodeling that occurs as the mean hemoglobin falls. In different research, the inferior border thickness ranged from 1 to 2.5 mm in 80% of the patients, and from 3 to 4 mm in the remaining individuals. In the group under supervision, it ranged from 3 to 4.5 mm. (22) This similarity shows in radiograph of patient which shows partial tram line of canal mandibular appeared faint, though it did not dismiss the possibility of the loss due to overlapping with radiolucent from enlargement of marrow space.

The severity of radiologic manifestations is also affected by the type of thalassemia, time of treatment onset, number of transfusions, and complications related to iron chelating therapy. (28).

4. Conclusion

Dentist should aware any suspicious radiographical finding may hide systemic disease in daily dental practice. The imaging of thalassemia in the oral and maxillofacial region is expected to continue improving to meet changing clinical requirements and developments in technology.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

References

[1] Helmi N, Bashir M, Shireen A, Mirza Ahmed I. Thalassemia review: features, dental considerations and management. Electron Physician. 2017 Mar 25;9(3):4003–8.

[2] Nabi A, Muttu J, Chhaparwal A, Mukhopadhyay A, Pattnaik S, Choudhary P. Implications of β-thalassemia on oral health status in patients: A cross-sectional study. J Family Med Prim Care. 2022;11(3):1174.

[3] Roussos P, Mitsea A, Halazonetis D, Sifakakis I. Craniofacial shape in patients with beta thalassaemia: a geometric morphometric analysis. Sci Rep. 2021 Dec 1;11(1).

[4] Muncie HL, Campbell JS. Alpha and Beta Thalassemia [Internet]. Vol. 80. 2009. Available from: www.aafp.org/afp.

[5] Wang X, Li Y, Feng Y, Cheng H, Li D. The role of macrophages in osseointegration of dental implants: An experimental study in vivo. J Biomed Mater Res A [Internet]. 2020 Nov 9;108(11):2206–16. Available from: https://doi.org/10.1002/jbm.a.36978

[6] Vij R, Machado RF. Pulmonary complications of hemoglobinopathies. Vol. 138, Chest. American College of Chest Physicians; 2010. p. 973–83.

[7] Bajwa H BH. Thalassemia [Internet]. [cited 2023 Dec 12]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK545151/

[8] Kyriakou A, Skordis N. Thalassemia, Endocrine Sequelae. In: Reference Module in Biomedical Sciences [Internet]. Elsevier; 2015. Available from: https://www.sciencedirect.com/science/article/pii/B9780128012383044883

[9] Gosein M, Maharaj P, Balkaransingh P, Banfield R, Greene C, Latchman S. Imaging features of thalassaemia. Vol. 92, Br J Radiol. 2019.

[10] Chandna P, Ismail Kazia S, Rajesh Reddy K. Breakthrough in Radiographic Imaging in Appropriation of Relevant Diagnosis of Thalassemia [Internet]. Vol. 4, Quest Journals Journal of Medical and Dental Science Research. 2017. Available from: www.questjournals.org

[11] Ohri N, Khan M, Gupta N, Bhatt G, Malhotra P, Ranjanpati A. A study on the radiographic features of jaws and teeth in patients with thalassemia major using orthopantomograph. Journal of Indian Academy of Oral Medicine and Radiology. 2015 Jul 1;27(3):343–8.

[12] Bayati S, Keikhaei B, Bahadoram M, Mahmoudian-Sani MR, Vaneshani M, Behbahani F. Radiographic Features of the Maxillofacial Anomalies in Beta-Thalassemia Major: With New View. World J Plast Surg [Internet]. 2021 Sep;10(3):78–83. Available from: http://www.ncbi.nlm.nih.gov/pubmed/34912670

[13] Hazza'a AM, Al-Jamal G. Dental development in subjects with thalassemia major. Journal of Contemporary Dental Practice. 2006 Sep 1;7(4):063–70.

[14] Chapin J, Giardina PJ. Chapter 40 - Thalassemia Syndromes. In: Hoffman R, Benz EJ, Silberstein LE, Heslop HE, Weitz JI, Anastasi J, et al., editors. Hematology (Seventh Edition) [Internet]. Seventh Edition. Elsevier; 2018. p. 546-570.e10. Available from: https://www.sciencedirect.com/science/article/pii/B9780323357623000408

[15] Nuinoon M. Interaction of Thalassemia and Hb Variants in Southeast Asia: Genotype-Phenotype Relationship. In: Zakaria M, Hassan T, Sherief L, Erhabor O, editors. Thalassemia Syndromes [Internet]. Rijeka: IntechOpen; 2023. Available from: https://doi.org/10.5772/intechopen.110001

[16] Wahidiyat PA, Sari TT, Rahmartani LD, Iskandar SD, Pratanata AM, Yapiy I, et al. Thalassemia in Indonesia. Vol. 46, Hemoglobin. Taylor and Francis Ltd.; 2022. p. 39–44.

[17] Husna N, Arif A Al, Putri C, Leonard E, Handayani NSN. Prevalence and Distribution of Thalassemia Trait Screening. Journal of thee Medical Sciences (Berkala Ilmu Kedokteran). 2017 Jul 10;49(03):106–13.

[18] Widyawati. Talasemia Penyakit Keturunan, Hindari dengan Deteksi Dini – Sehat Negeriku [Internet]. 2022 [cited 2023 Dec 12]. Available from: https://sehatnegeriku.kemkes.go.id/baca/rilis-media/20220510/5739792/talasemia-penyakit-keturunan-hindari-dengan-deteksi-dini/

[19] Hajimoradi M, Haseli S, Abadi A, Chalian M. Musculoskeletal imaging manifestations of beta-thalassemia. Vol. 50, Skeletal Radiology. Springer Science and Business Media Deutschland GmbH; 2021. p. 1749–62.

[20] Azizi V, Abesi F, Tamaddoni A, Khafri S. Complications of patients with thalassemia major and intermedia in a selected Iranian population. Caspian J Intern Med. 2022;13(4):765–71.

[21] Mahdavi MR, Hojjati MT, Roshan P. A Review on Thalassemia and Related Complications. Vol. 23, J Mazand Univ Med Sci. Persian; 2013.

[22] Thalassemia Major and related Dentomaxillofacial Complications: Clinical and Radiographic Overview with Reference to Dental Care. International Journal of Experimental Dental Science. 2017 Dec;6(2):95–104.

[23] Hattab FN. Periodontal condition and orofacial changes in patients with thalassemia major: a clinical and radiographic overview. J Clin Pediatr Dent [Internet]. 2012;36(3):301—307. Available from: http://europepmc.org/abstract/MED/22838236

[24] Morabito N, Gaudio A, Lasco A, Atteritano M, Pizzoleo MA, Cincotta M, et al. Osteoprotegerin and RANKL in the pathogenesis of thalassemia-induced osteoporosis: new pieces of the puzzle. J Bone Miner Res [Internet]. 2004 May [cited 2024 Jan 12];19(5):722–7. Available from: https://pubmed.ncbi.nlm.nih.gov/15068494/

[25] Bayrak S, Göller Bulut D, Orhan K, Sinanoğlu EA, Kurşun Çakmak EŞ, Mısırlı M, et al. Evaluation of osseous changes in dental panoramic radiography of thalassemia patients using mandibular indexes and fractal size analysis. Oral Radiol [Internet]. 2020;36(1):18–24. Available from: https://doi.org/10.1007/s11282-019-00372-7

[26] Al-Raeesi S, Kowash M, Hassan A, Al-Halabi M. Oral manifestations and dentofacial anomalies in β-thalassemia major children in Dubai (UAE). Special Care in Dentistry. 2018 Jan 1;38(1):25–30.

[27] Hazza'a AM, Al-Jamal G. Radiographic features of the jaws and teeth in thalassaemia major. Dentomaxillofacial Radiology. 2006 Jul;35(4):283–8.

[28] Tyler PA, Madani G, Chaudhuri R, Wilson LF, Dick EA. The radiological appearances of thalassaemia. Clin Radiol. 2006 Jan 1;61(1):40–52