

Hematologic and Metabolic Abnormalities in a Patient with Anorexia Nervosa

Victoria L. Vande Zande, MD; Joseph J. Mazza, MD; Steven H. Yale, MD

ABSTRACT

Anorexia nervosa is a common problem in young adults that may present with a variety of metabolic and hematologic abnormalities, as well as weight loss and psychological disturbances. We present a young man with a long history of anorexia nervosa who developed pancytopenia associated with decreased bone marrow cellularity and abnormal architecture and marrow infiltration with an amorphous, gelatinous substance characteristic of anorexia nervosa. The patient also developed osteopenia with evidence of excessive calcium excretion. The pancytopenia and marrow function reverted to normal with therapeutic and dietary intervention.

The effects of eating disorders can result in serious consequences with respect to an individual's health and well-being. A host of hematologic abnormalities that are associated with anorexia nervosa have the potential of increasing the risk of infection and bleeding. Additionally, because of the insidious development of anemia in some patients, decreased performance status and chronic fatigue can pose significant compromises in one's daily activities and work effort. Anorexia nervosa is a chronic illness that is distinctly more common in females than in males (ratio of 10 to 1), but can affect males in an equally debilitating manner, requiring multiple modalities of therapeutic intervention and consultation.¹⁻⁴ We present the case of a male referred to the hematology department because of pancytopenia, chronic fatigue, and back pain. A diagnosis of anorexia nervosa had been made 10 years prior at the age of 18 years.

CASE REPORT

A 28-year-old male nurse was referred to the hematology

department with mild anemia and thrombocytopenia. He had a diagnosis of anorexia nervosa made in 1992 at age 18 when he complained of unexplained weight loss and low back pain. Lab studies at that time consisted of a hemoglobin (Hgb) of 13.1 g, white blood cell count (WBC) 4200/m², and platelet count of 160 k/m². Red blood cell indices were normal, as was the differential. Serum ferritin was 127 ng/ml. He weighed 164 lb and was 73.5 in tall. X-rays of his lumbar spine revealed spondylolisthesis and osteopenia, and bone densitometry studies confirmed marked osteopenia. He was later found to be HLA-B27 positive. He was started on a vigorous physical therapy program and multi-vitamins. In August of 1994, when seen in follow-up, his Hgb was 12.0 g, WBC 3000/m², and platelet count was 103 k/m². By June of 1999, he had lost 30 lb and was being followed in the adolescent medicine department.

He was first seen in the department of hematology in May 2000 with a Hgb of 11.1 g, WBC of 3500/m², and platelet count of 161 k/m². He weighed 149 lb. Two years later, he was again seen in hematology and at that time had a Hgb of 11.8 g, WBC of 2400/m², and platelet count of 97 k/m². RBC indices were normochromic normocytic. Cortisol, thyroid stimulating hormone, follicle stimulating hormone, and luteinizing hormone levels were normal, but his testosterone was 214 ng/dl (N=270-1200 ng/ml) with a free testosterone level of 3.1 pg/ml (N=10-34 pg/ml). His 24 h urine calcium excretion was 407 mg (normal 53-283 mg) and at that time he weighed 141 lb. A bone marrow aspiration and biopsy showed decreased cellularity and hematopoietic cells with an increased amount of adipocytes. The bone marrow biopsy sections stained with hematoxylin and eosin showed a diffuse, amorphous, pink, gelatinous background that dominated the histologic appearance of the marrow. Both the aspirate smears and biopsy sections of the bone marrow showed complete absence of iron stores. He was started on oral iron daily and multi-vitamins and returned for dietary and psychologic counseling for his anorexia nervosa. Twelve weeks later,

Doctor Vande Zande is a hospitalist, Doctor Mazza is a hematologist/oncologist, and Doctor Yale is a general internal medicine physician with Marshfield Clinic, Marshfield, Wis. Please address correspondence to Joseph J. Mazza, MD, Department of Hematology/Oncology, Marshfield Clinic, 1000 N Oak Ave 3A3, Marshfield, WI 54449; phone: 715.387.5426; fax: 715.387.5434; e-mail: mazza.joseph@marshfieldclinic.org.

his Hgb was 13.1 g, WBC 5,500/m², and his platelet count improved to 245 k/m². He had also gained 15 lb, but his free testosterone level remained low at 7.7 pg/ml. Repeated bone densitometry studies showed significant improvement in the osteopenia.

DISCUSSION

Anemia and low peripheral blood counts are frequently seen in the setting of chronic starvation, and are likely due to multiple vitamin and mineral deficiencies as a result of inadequate oral caloric intake. In the current existing body of literature on anorexia nervosa, anemia, and leukopenia are commonly reported, with the incidence of thrombocytopenia being less common. The anemia is usually normochromic normocytic and bone marrow dysfunction is related to decreased marrow hematopoiesis. Abella et al, in their series of 44 patients, found a hypocellular marrow in 70% of cases.⁵ The incidence of anemia varies from 10%-35% and leukopenia 25%-35%. Thrombocytopenia is reported in approximately 10% of cases.⁶⁻⁹ The diffuse, amorphous, pink staining material noted on the bone marrow biopsy sections of our patient have been described by other investigators in the same descriptive manner.¹⁰⁻¹² Parenthetically, it should be noted that the bone marrow changes described above have been identified by magnetic resonance imaging, eliciting a low signal intensity on the T2 weighted images.^{13,14} The bone marrow changes reported in this group of patients have not been associated with any specific deficiency state and their pathogenesis has not been fully elucidated. However, the marrow hypoplasia and altered morphology of the adipocytes is a reversible process, with recovery and normalization occurring commensurate with the reestablishment of adequate nutritional intake and eating habits.^{15,16} The prompt changes that occur in the peripheral blood parameters and marrow cellularity provide ample evidence of the cause and effect relationship between nutritional status and marrow function. The amorphous, gelatinous substance noted to be diffusely present has been identified by histochemical staining as an acid mucopolysaccharide and its role in the altered cellularity and function of the marrow is not known.

Multiple endocrine or metabolic abnormalities are also present in a significant number of anorexia nervosa patients.¹⁷⁻²¹ Our patient presented at an early age with low back pain and was found to have a reportable degree of osteopenia despite his involvement in athletics in high school. His serum testosterone levels were also low, affecting his libido and remained low until supplemental hormone therapy was prescribed.

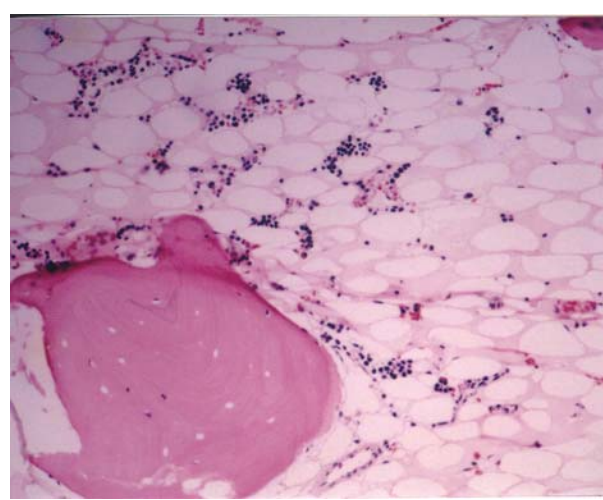


Figure 1. Shows the marked degree of hypocellularity of the bone marrow with scant amount of myeloid elements present.

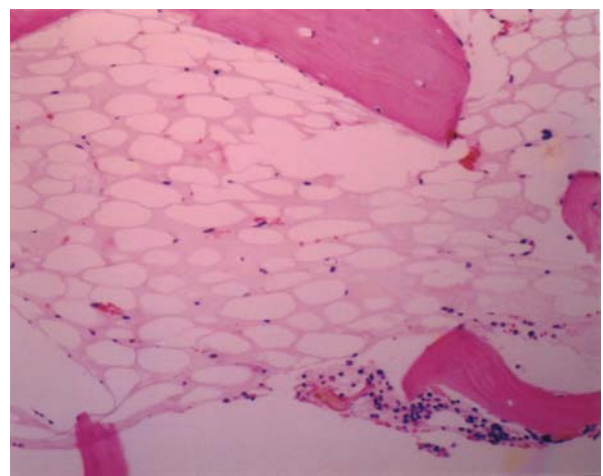


Figure 2. Increased number of adipocytes that are small and separated by broad septa of pink staining, amorphous substance.

In summary, our patient is a young active male whose eating disorder occurred at a young age and whose presentation seemed normal except for his weight-loss appearance. Multiple hematologic and metabolic abnormalities persisted during the course of his illness. When confronted with the gravity of the situation and the implications of his abnormalities, he promptly changed his eating habits, was compliant with taking multiple vitamins and minerals, and responded favorably to the therapy.

ACKNOWLEDGMENTS

The authors wish to thank Marshfield Clinic Research Foundation for its support through the assistance of

Linda Weis and Alice Stargardt in the preparation of this manuscript.

REFERENCES

1. Lucas AR, Beard CM, O'Fallon WM, Kurland LT. Anorexia nervosa in Rochester, Minnesota: a 45-year study. *Mayo Clinic Proc.* 1988;63:433-442.
2. Lucas AR, Beard CM, O'Fallon WM, Kurland LT. 50-year trends in the incidence of anorexia nervosa in Rochester, Minn.: a population-based study. *Am J Psychiatry.* 1991;148:917-922.
3. Moller-Madsen S, Nystrup J. Incidence of anorexia nervosa in Denmark. *Acta Psychiatr Scand.* 1992;86:197-200.
4. Hsu LK. Epidemiology of the eating disorders. *Psychiatr Clin North Am.* 1996;19:681-700.
5. Abella E, Feliu E, Granada I, et al. Bone marrow changes in anorexia nervosa are correlated with the amount of weight loss and not with other clinical findings. *Am J Clin Pathol.* 2002;118:582-588.
6. Rieger W, Brady JP, Weisberg E. Hematologic changes in anorexia nervosa. *Am J Psychiatry.* 1978;135:984-985.
7. Bowers TK, Eckert E. Leukopenia in anorexia nervosa. Lack of increased risk of infection. *Arch Intern Med.* 1978; 138:1520-1523.
8. Bhanji S, Mattingly D. Haematology and immunology. In Bhanji S, Mattingly D, eds. *Medical Aspects of Anorexia Nervosa.* 1st ed. London, Wright: 1988:55-62.
9. Palla B, Litt IF. Medical complications of eating disorders in adolescents. *Pediatrics.* 1988;81:613-623.
10. Smith RR, Spivak JL. Marrow cell necrosis in anorexia nervosa and involuntary starvation. *Br J Haematol.* 1985;60:525-530.
11. Bailly D, Lambin I, Garzon G, Parquet PJ. Bone marrow hypoplasia in anorexia nervosa: a case report. *Int J Eat Disord.* 1994;16:97-100.
12. Tavassoli M, Eastlund DT, Yam LT, Neiman RS, Finkel H. Gelatinous transformation of bone marrow in prolonged self-induced starvation. *Scand J Haematol.* 1976;16:311-319.
13. Kuwashima S, Nishimura G, Yamato M, Fujioka M. Magnetic resonance imaging of clival marrow in patients with anorexia nervosa. *Acta Paediatr Jpn.* 1996;38:114-117.
14. Vande Berg BC, Malghem J, Devuyt O, Maldague BE, Lambert MJ. Anorexia nervosa: correlation between MR appearance of bone marrow and severity of disease. *Radiology.* 1994;193:859-864.
15. Marechaud R, Abadie JC, Babin P, Lessart M, Sudre Y. [Reversible bone marrow hypoplasia in a case of male anorexia nervosa]. {Article in French}. *Ann Med Interne.* (Paris) 1985;136:36-40.
16. Steinberg SE, Nasraway S, Peterson L. Reversal of severe serous atrophy of the bone marrow in anorexia nervosa. *JPEN J Parenter Enteral Nutr.* 1987;11:422-423.
17. Brown JM, Mehler PS, Harris RH. Medical complications occurring in adolescents with anorexia nervosa. *West J Med.* 2000;172:189-193.
18. Sharp CW, Freeman CP. The medical complications of anorexia nervosa. *Br J Psychiatry.* 1993;162:452-462.
19. Misra M, Klibanski A. Evaluation and treatment of low bone density in anorexia nervosa. *Nutr Clin Care.* 2002;5:298-308.
20. Jacoangeli F, Zoli A, Taranto A, et al. Osteoporosis and anorexia nervosa: relative role of endocrine alterations and malnutrition. *Eat Weight Disord.* 2002;7:190-195.
21. Munoz MT, Argente J. Anorexia nervosa in female adolescents: endocrine and bone mineral density disturbances. *Eur J Endocrinol.* 2002;147:275-286.

Wisconsin Medical Journal

The mission of the *Wisconsin Medical Journal* is to provide a vehicle for professional communication and continuing education of Wisconsin physicians.

The *Wisconsin Medical Journal* (ISSN 1098-1861) is the official publication of the Wisconsin Medical Society and is devoted to the interests of the medical profession and health care in Wisconsin. The managing editor is responsible for overseeing the production, business operation and contents of *Wisconsin Medical Journal*. The editorial board, chaired by the medical editor, solicits and peer reviews all scientific articles; it does not screen public health, socioeconomic or organizational articles. Although letters to the editor are reviewed by the medical editor, all signed expressions of opinion belong to the author(s) for which neither the *Wisconsin Medical Journal* nor the Society take responsibility. The *Wisconsin Medical Journal* is indexed in Index Medicus, Hospital Literature Index and Cambridge Scientific Abstracts.

For reprints of this article, contact the *Wisconsin Medical Journal* at 866.442.3800 or e-mail wmj@wismed.org.

© 2004 Wisconsin Medical Society