Korean Journal of Pediatrics Vol. 51, No. 2, 2008
DOI : 10.3345/kjp.2008.51.2.209 □ Case Report □

Pericardial effusion in three cases of anorexia nervosa

Young Kuk Cho, M.D., Su Jin Yang, M.D.* and Jae Sook Ma, M.D.

Department of Pediatrics and Psychiatry*, Chonnam National University Medical School and Research Institute of Medical Sciences, Gwangju, Korea

In young adolescent girls, anorexia nervosa is a significant cause of weight loss, and hospital admissions among children and adolescents. Anorexia nervosa is a life-threatening disorder, with about one-third of deaths caused by cardiac complications. A high rate of pericardial effusion has been recently reported in patients with anorexia nervosa, although relatively few cases require pericardiocentesis. Here, we describe three patients with anorexia nervosa who were diagnosed with large pericardial effusions. To prevent cardiac tamponade, pericardiocentesis was performed in two girls. (Korean J Pediatr 2008;51:209-213)

Key Words : Pericardial effusion, Anorexia nervosa, Cardiac tamponade

Introduction

Anorexia nervosa is an eating disorder that is characterized by an intense fear of gaining weight, placing undue emphasis on body shape, having a body weight less than 85% of the predicted weight, and amenorrhea for three consecutive periods[1]. It is the main cause of weight loss in children and adolescents and accounts for numerous hospital admissions. The prevalence is about 0.3% in young women and it is two times more common in teenage girls[2]. It is a life-threatening disorder, with about one-third of deaths, in adults, caused by cardiac complications[3]. After suicide, cardiac complications are the most common cause of death associated with anorexia nervosa[4]. Cardiac dysfunction, especially arrhythmias, often result from electrolyte and acid-base imbalance[5]. Serious congestive heart failure may occur, especially during unrestricted hypercaloric refeeding[6]. Mitral valve prolapse is another complication that can result from atrophy of the heart muscle[7]. In addition, recently there have been reports of a high incidence of pericardial effusion in patients with anorexia nervosa;[8, 9] in several of these cases, pericardiocentesis was required[10]. Here, we describe the cases of three girls with anorexia nervosa and large pericardial effusions. Among them, two girls required pericardiocentesis to prevent cardiac tamponade.

접수 : 2007년 12월 15일, 승인 : 2008년 1월 14일
책임저자 : 마재숙, 전남대학교 의과대학 소아과학교실
Correspondence : Jae Sook Ma, M.D.
Tel : 062)220-6646 Fax : 062)222-6103
E-mail : cardiol@jnu.ac.kr

Case Report

Case 1

A 14-year-old girl with anorexia nervosa was admitted for clinical evaluation and treatment. She began her restrictive eating behavior 6 months prior to this visit, which resulted in a weight loss of 13 kg. Her weight at the time of the examination was 33 kg and her body mass index (BMI) was 13.22 kg/m^2. The patient was amenorrheic for the past 6 months. On physical examination, the blood pressure was 110/70 mmHg and the heart rate was 49 bpm (Table 1). Neither edema nor other signs of heart failure were observed. The laboratory data were as follows: total protein 7.4 g/dL, albumin 5.1 g/dL, sodium 138 mEq/L, potassium 4.3 mEq/L, total calcium 4.7 mEq/L, glucose 111 mg/dL, RBC 397×10^4/μL, hemoglobin 12.8 g/dL, and WBC 4,100/μL. The thyroid function showed signs of the low T3 syndrome: T3 45 ng/dL, T4 6.2 μg/dL and TSH 1.15 μU/mL (Table 2). The electrocardiogram revealed a sinus bradycardia. The chest x-ray did not show cardiomegaly, but the echocardiography revealed a diffuse pericardial effusion around the anterior and lateral wall, with diastolic collapse of the right atrial and ventricular walls (Fig. 1). To prevent cardiac tamponade, pericardiocentesis was performed via a subxiphoid puncture and 100 mL of pericardial fluid was drained. No residual effusion was detectable at the end of

the procedure. Pericardial fluid analyses were as follows: total protein 1.4 g/dL, glucose 79 mg/dL, lactate dehydrogenase (LDH) 134 U/L, amylase 11 U/L, pH 7.50, and a WBC 200/uL with 50% lymphocytes (Table 2). Culture of the pericardial fluid was negative. After controlled hypercaloric refeeding, the patients weight gradually increased to 39 kg and the BMI was 15.62 kg/m^2 (Table 1). After this weight gain, follow-up echocardiograms did not reveal a recurrent pericardial effusion and the T3 levels increased to 82 ng/dL.

Table 1. Patient Characteristics

	Case 1	Case 2	Case 3
Age, (years)	14.9	14.4	13.2
Body weight loss (kg)	13	12	13
Body weight (kg)			
Admission	33	22	31
Discharge	39	30	38
weight change(kg)	6	8	7
Height (cm)	158	151	159
BMI (kg/m^2)			
Admission	13.22	9.65	12.26
Discharge	15.62	13.16	15.03
Heart rate at admission (bpm)	49	62	110
BP at admission (mm Hg)			
Systolic	110	80	100
Diastolic	70	60	70
Electrocardiographic findings	Sinus bradycardia	NSR	NSR
Recovery time (weeks)	3	10	4

Abbreviations : BMI, body mass index; NSR, normal sinus rhythm

Table 2. Laboratory Findings Associated with the Anorexia Nervosa

	Case 1	Case 2	Case 3
Total protein (g/dL)	7.4	6.3	5.8
Albumin (g/dL)	5.1	4.3	3.7
Sodium (mEq/L)	138	133	136
Potassium (mEq/L)	4.3	3.7	4.5
Calcium (mEq/L)	4.7	4.1	4.6
Glucose (mg/dL)	111	84	109
RBC ($10^4/\mu L$)	397	406	410
Hemoglobin (g/dL)	12.8	13.1	13.2
WBC (/μL)	4,100	5,700	5,100
T3 (ng/dL)	45	ND	42
T4 (μg/dL)	6.2	ND	4.8
TSH (μU/mL)	1.15	6.51	3.92
Free T4 (ng/dL)	ND	0.75	ND
Total cholesterol (mg/dL)	ND	209	263
HDL cholesterol (mg/dL)	ND	85	ND
LDL cholesterol (mg/dL)	ND	117	ND
Triglyceride (mg/dL)	ND	130	34
Pericardial fluid analyses			
pH	7.50	7.69	ND
Total protein (g/dL)	1.4	2.1	ND
Glucose (mg/dL)	79	94	ND
LDH, (U/L)	134	112	ND
Amylase (U/L)	11	11	ND
WBC (/μL)	200	100	ND
	lymphocytes 50%	monocytes 55%	

Abbreviations: ND, not done; HDL, high density lipoprotein; LDL, low density lipoprotein; LDH, lactate dehydrogenase

Case 2

A 14-year-old girl was admitted to our hospital for weight loss and limited physical activity. In the 4 months preceding hospitalization, she refused food and demonstrated a disturbed body image with the fear of becoming fat. The patient lost 12 kg during this period, going from 34 kg to 22 kg, and her BMI was 9.65 kg/m^2, which fulfilled the diagnostic criteria for anorexia nervosa. On physical examination, her general appearance was pale; she was hypotensive (blood pressure, 80/60 mmHg) and her heart rate was 62 bpm (Table 1). Neither edema nor other signs of heart failure were observed. The laboratory data were as follows: total protein 6.3 g/dL, albumin 4.3 g/dL, sodium 133 mEq/L, potassium 3.7 mEq/L, total calcium 4.1 mEq/L, glucose 84 mg/dL, RBC 406×10^4 /μL, hemoglobin 13.1 g/dL, and a WBC 5,700 /μL. The cholesterol profile was as follows: total cholesterol 209 mg/dL, high-density lipoprotein cholesterol 85 mg/dL, low-density lipoprotein cholesterol 117 mg/dL and triglycerides 130 mg/dL. The thyroid function

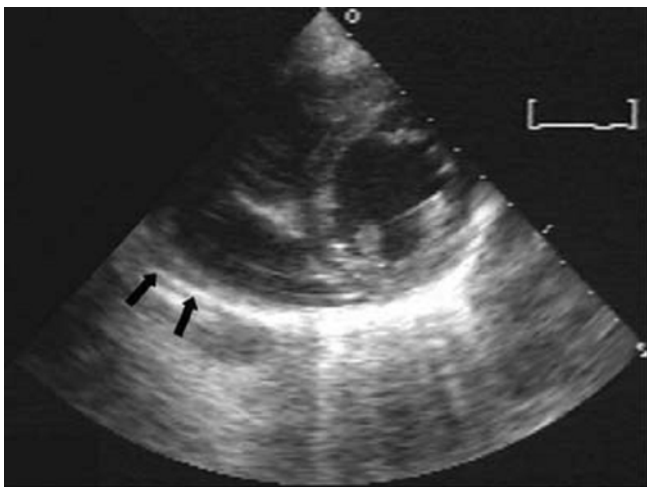

Fig. 1. On the parasternal short-axis view, echocardiography showed diffuse pericardial effusion (arrows) with diastolic collapse of the right ventricular wall.

showed signs of primary hypothyroidism: free T4 0.75 ng/dL and TSH 6.51 μU/mL (Table 2). The chest x-ray did not show cardiomegaly, but the echocardiography revealed a diffuse pericardial effusion around the anterior and lateral wall and with diastolic collapse of the right atrial and ventricular walls (Fig. 2). To prevent cardiac tamponade, a pericardiocentesis was performed via a subxiphoid puncture and about 100 mL of pericardial fluid was drained. No residual effusion was detectable at the end of the procedure. The pericardial fluid analysis was as follows: total protein 2.1 g/dL, glucose 94 mg/dL, LDH 112 U/L, amylase 11 U/L, pH 7.69, and a WBC 100 /μL with 55% monocytes

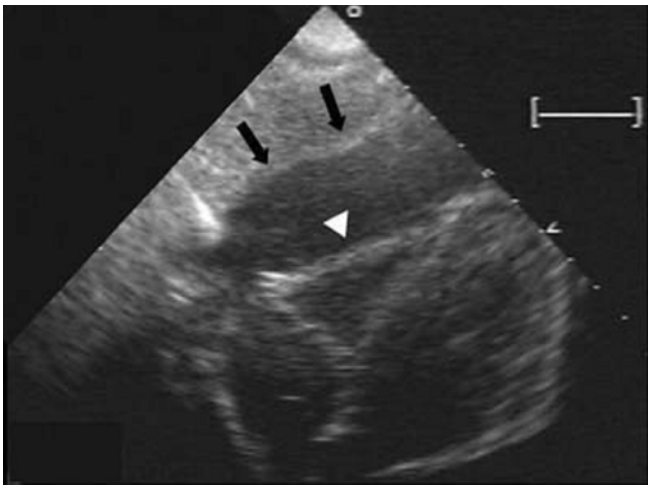

Fig. 2. On the subcostal view, echocardiography showed diffuse pericardial effusion around the anterior and lateral wall (arrows) and with diastolic collapse of the right ventricular wall (white arrowhead).

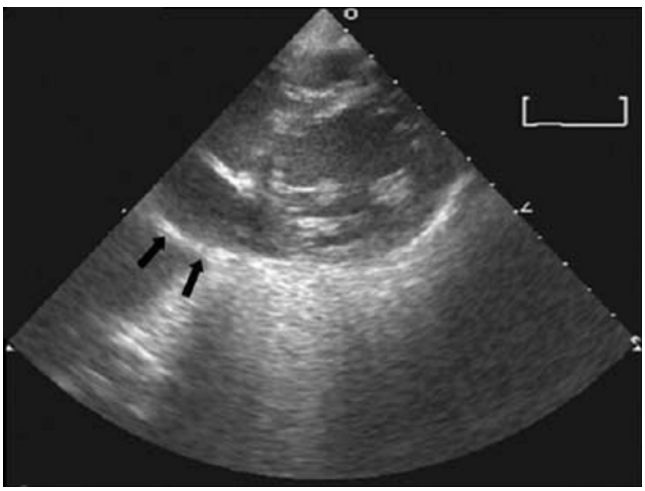

Fig. 3. On the parasternal short-axis view, echocardiography showed a large amount of anterior pericardial effusion (arrows) without diastolic right ventricular compression.

(Table 2). Culture of the pericardial fluid was negative. Two weeks later, a new pericardial effusion was detected that remained for an additional 2 weeks, although we found no indication of diastolic right atrial or ventricular compression. After controlled hypercaloric refeeding, the patients weight gradually increased from 22 to 30 kg and the BMI was 13.16 kg/m^2 (Table 1). The follow-up echocardiogram did not detect a pericardial effusion. In addition, the weight gain normalized the patients thyroid function (free T4 1.02 ng/dL, TSH 3.39 μU/mL).

Case 3

A 13-year-old girl had the chief complaint of a 3-month history of weight loss and was transferred to our hospital. The patient had become obsessed with food and exercise and amenorrhea for the past 3-months; she had an intense fear of becoming fat, The patient subsequently lost 13 kg of body weight, going from 44 to 31 kg and her BMI was 12.26 kg/m^2. On the physical examination, the blood pressure was 100/70 mmHg and the heart rate was 110 bpm (Table 1). The patient showed no signs of heart failure. The laboratory data were as follows: total proteins 5.8 g/dL, albumin 3.7 g/dL, sodium 136 mEq/L, potassium 4.5 mEq/L, total calcium 4.6 mEq/L, glucose 109 mg/dL, RBC 410×10^4 /μL, hemoglobin 13.2 g/dL, and a WBC 5,100 /μL. The cholesterol profile was as follows: total cholesterol 263 mg/dL triglycerides 34 mg/dL. The thyroid function showed signs of the low T3 syndrome: T3 42 ng/dL, T4 4.8 μg/dL and TSH 3.92 μU/mL (Table 2). Auscultation of the chest revealed normal breathing sounds and the cardiac rhythm was normal without murmur. The chest x-ray did not reveal cardiomegaly, but the echocardiogram showed a large anterior pericardial effusion (1.4 cm) without diastolic right chamber compression (Fig. 3). After controlled hypercaloric refeeding, her weight gradually increased from 31 to 38 kg and the BMI was 15.03 kg/m^2 (Table 1). Follow-up echocardiograms did not detect a recurrent pericardial effusion. In addition, the patients T3 level increased to 93 ng/dL.

Discussion

The most common cardiac abnormalities reported in patients with anorexia nervosa are sinus bradycardia, hypotension[11], increased vagal tone[12], and electrocardiographic abnormalities, including decreased voltage and prolongation of the QT interval[13]. Diminished wall thickness, due to the

loss of cardiac muscle, has also been observed[14], and is associated with reduced cardiac output. Patients with severe anorexia nervosa also exhibit decreased exercise capacity[15]. However, previous research has shown that these adverse effects on cardiac structure and function in adolescents with anorexia nervosa are reversible with weight gain[16]. One of our patients, who presented with sinus bradycardia, at the initial examination, recovered to within normal limits after gaining weight and another patient presented with reversible hypotension.

Recently the finding of pericardial effusions has been reported as a complication of anorexia nervosa, although the pathophysiological mechanisms remain unclear[9, 17]. Although we were unable to identify the cause of the pericardial effusions in our patients, our examination of the pericardial fluid and laboratory findings allowed us to rule out inflammatory factors. The protein concentration in the drained fluid was within the normal range and no electrolyte alterations were detected in our patients. Several previous reports have suggested a correlation between weight gain and the resolution of pericardial effusions in patients with anorexia nervosa[9]. Case 1 exhibited a resolved pericardial effusion after the pericardiocentesis, but case 2 showed a more gradual reduction of the effusion after pericardiocentesis with pericardial effusions recurring in association with weight gain. In case 3, the pericardial effusion resolved after the patient gained weight.

Only a few cases of life-threatening pericardial effusion have been described in patients with anorexia nervosa[9, 10]. The accumulation of fluid in the pericardial sac, with a 0.3-cm distance between the pericardial leaflets, is still considered a non-pathological finding[8]. Larger effusions have been described in 15 to 20% of patients with anorexia nervosa, with a distance of 0.3-2.24 cm between the leaflets[9]. All of our patients had large pericardial effusions and among them two patients showed rapidly increasing pericardial effusions that required pericardiocentesis to prevent cardiac tamponade.

Pericardial effusions and an increased risk of heart failure can occur during the refeeding period, in patients with anorexia nervosa, as result of the inappropriately high protein-calorie supply and sodium repletion with the resulting expansion of the extracellular space. Hypophosphatemia during the refeeding phase can also contribute to the development of acute heart failure[18]. Our patients did not show any signs of heart failure during the refeeding period.

The low T3 syndrome is characterized by decreased serum concentrations of free T3 and increased concentrations of reverse T3, without a compensatory increase in TSH[19]. Several studies have reported that transient primary hypothyroidsm and the low T3 syndrome are due to malnutrition, and can be corrected by restoring the body weight in patients with anorexia nervosa[20]. Furthermore Inagaki et al.[17] reported that the reduction of the pericardial effusion might be correlated with both weight gain and T3 normalization. Our observations indicate that the pericardial effusion decreased with the normalization of the low T3 syndrome in two patients and with the normalization of primary hypothyroidism in the remaining patient.

In conclusion, three girls with anorexia nervosa developed large pericardial effusions. Among them, two patients had rapidly increasing pericardial effusions that required pericardiocentesis to prevent cardiac tamponade. Although pericardial effusion is not a significant finding in the majority of patients with anorexia nervosa, others may have rapid and potentially life-threatening progression of pericardial effusions. Therefore, serial echocardiograms are recommended for all patients with anorexia nervosa.

한 글 요 약

심장막삼출을 동반한 신경성 식욕부진 3예

전남대학교 의과대학 의과학 연구소 소아과학 교실
*정신과학 교실**

조영국 · 양수진* · 마재숙

신경성 식욕부진은 여자 청소년에 있어서 체중 감소의 주된 원인임과 동시에 소아와 청소년에 있어서 입원의 주된 원인 중의 하나이다. 이는 생명을 위협할 수 있는 장애로서 약 1/3에서 심장 합병증으로 사망한다. 신경성 식욕부진 환자에서 심장막삼출이 높은 발생빈도를 보인다고 최근에 보고되고 있으나 심장막천자술이 필요한 경우는 흔하지 않다. 저자들은 많은 양의 심장막삼출을 동반한 3명의 신경성 식욕부진 여아를 경험하였기에 보고하고자 한다. 이 중 2명은 심낭압전의 가능성이 있어서 심장막천자술이 필요하였다.

References

1) Pryor T. Diagnostic criteria for eating disorders: DSM-IV revision. Psychiatry Annual 1995;25:40-9.
2) Morris J, Twaddle S. Anorexia nervosa. BMJ 2007;334:894-8.
3) Isner JM, Roberts WC, Heymsfield SB, Yager J. Anorexia nervosa and sudden death. Ann Intern Med 1985;102:49-52.

4) American Psychiatric Association. Practice and guideline for eating disorders. Am J Psychiatry 1993;150:212-8.
5) Warren SE, Steinberg SM. Acid-base and electrolyte disturbances in anorexia nervosa. Am J Psychiatry 1979;136:415-8.
6) Shocken DD, Holloway JD, Powers PS. Weight loss and the heart. Effects of anorexia nervosa and starvation. Arch Intern Med 1989;149:877-81.
7) Meyers DG, Starke H, Pearson PH, Wilken MK. Mitral valve prolapse in anorexia nervosa. Ann Intern Med 1986;105:384-6.
8) Ramacciotti CE, Coli E, Biadi O, DellOsso L. Silent pericardial effusion in a sample of anorexic patients. Eat Weight Disord 2003;8:68-71.
9) Frolich J, von Gontard A, Lehmkuhl G, Pfeiffer E, Lehmkuhl U. Pericardial effusion in anorexia nervosa. Eur Child Adolesc Psychiatry 2001;10:54-7.
10) Polli N, Blengino S, Moro M, Zappulli D, Scacchi M, Cavagnini F. Pericardial effusion requiring pericardiocentesis in a girl with anorexia nervosa. Int J Eat Disord 2006;39:609-11.
11) Herzog W, Deter HC, Fiehn W, Petzold E. Medical findings and predictors of long-term physical outcome in anorexia nervosa: a prospective, 12-year follow-up study. Psychol Med 1997;27:269-79.
12) Petretta M, Bonaduce D, Scalfi L, de Filippo E, Marciano F, Migaux ML, et al. Heart rate variability as a measure of autonomic nervous system function in anorexia nervosa. Clin Cardiol 1997;20:219-24.
13) Panagiotopoulos C, McCrindle BW, Hick K, Katzman DK. Electrocardiographic findings in adolescents with eating disorders. Pediatrics 2000;105:1100-5.
14) Powers PS, Schocken DD, Feld J, Holloway JD, Boyd F. Cardiac function during weight restoration in anorexia nervosa. Int J Eat Disord 1991;10:521-30.
15) St John Sutton MG, Plappert T, Crosby L, Douglas P, Mullen J, Reichek N. Effects of reduced left ventricular mass on chamber architecture, load and function: a study of anorexia nervosa. Circulation 1985;72:991-1000.
16) Mont L, Castro J, Herreros B, Pare C, Azqueta M, Magrina J, et al. Reversibility of cardiac abnormalities in adolescents with anorexia nervosa after weight recovery. J Am Acad Child Adolesc Psychiatry 2003;42:808-13.
17) Inagaki T, Yamamoto M, Tsubouchi K, Miyaoka T, Uegaki J, Maeda T, et al. Echocardiographic investigation of pericardial effusion in a case of anorexia nervosa. Int J Eat Disord 2003;33:364-6.
18) Birmingham CL, Alothman AF, Goldner EM. Anorexia nervosa: refeeding and hypophosphatemia. Int J Eat Disord 1996;20:211-3.
19) Chopra IJ. Euthyroid sick syndrome: is it a misnomer? J Clin Endocrinol Metab 1997;82:329-34.
20) Matsubayashi S, Tamai H, Uehata S, Kobayashi N, Mori K, Nakagawa T, et al. Anorexia nervosa with elevated serum TSH. Psychosom Med 1988;50:600-6.