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Anorexia Nervosa-Induced Cardiac Tamponade: A Comprehensive Review and Case Study of a Life-Threatening Complication

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ABSTRACT

Anorexia nervosa (AN) is a devastating psychiatric disorder that claims more lives than any other mental illness, largely through the silent toll it takes on the body. The cardiovascular system is especially vulnerable to the strain of chronic malnutrition. While a slow heart rate and low blood pressure are common signs of this struggle, a more dangerous, though rarer, complication is the buildup of fluid around the heart, which can lead to a medical emergency known as cardiac tamponade. This article offers a comprehensive look at the heart-related complications of AN, focusing on the causes, diagnosis, and treatment of this life-threatening condition. We share the story of a young woman with severe AN whose life was saved by an emergency procedure to relieve the pressure on her heart. Her case provides a powerful anchor for a wider discussion on the challenges of diagnosis, the difficult decisions in management, and the absolute necessity of a dedicated, multidisciplinary team to guide a patient through both the immediate crisis and the long journey of recovery. This review is a call for heightened awareness among clinicians, highlighting the fragile connection between a troubled mind and a body in peril.

Keywords: Anorexia Nervosa, Cardiac Tamponade, Pericardial Effusion, Malnutrition, Cardiovascular Complications, Eating Disorders, Case Report, Pericardiocentesis, Refeeding Syndrome.

INTRODUCTION

The Systemic Impact of Anorexia Nervosa

Anorexia nervosa (AN) is far more than a psychiatric diagnosis; it is a profound and complex illness that wages a war on the self. It is defined by a relentless pursuit of thinness, a deep-seated fear of gaining weight, and a distorted perception of one's own body, which together compel a person to restrict their energy intake to dangerously low levels [1]. While its roots are in the mind, its consequences are deeply physical, leaving no organ system untouched. AN stands as a formidable medical and social challenge, born from a tangled web of genetic vulnerability, brain biology, psychological pressures, and sociocultural ideals [1, 2].

This illness primarily ensnares adolescent girls and young women, and it carries the grim distinction of having the highest mortality rate of any psychiatric condition. A staggering number of these deaths—up to a third—are a direct result of the heart giving out under the strain [3, 7]. The body, in a desperate attempt to survive starvation, initiates a series of metabolic adaptations to conserve energy. But over time, these survival mechanisms become the very source of the body's undoing.

1.1. The Body Under Siege: Widespread Medical Complications

The physical toll of AN is extensive. The endocrine system is thrown into disarray, often leading to the loss of menstrual periods, a dysfunctional thyroid state, and chronically elevated stress hormones. Bones become brittle, paving the way for osteoporosis and fractures at a young age. The digestive system slows to a crawl, causing painful bloating and constipation. The brain itself can shrink, leading to difficulties with concentration and mood. The blood can thin, resulting in anemia and a weakened immune system.

1.2. The Vulnerable Heart: A Focus on Cardiovascular Damage

Of all the body's systems, the heart is arguably the most critically affected by the relentless malnutrition of AN [5, 11]. The damage is multifaceted, stemming from the direct effects of starvation and the dangerous shifts in body chemistry.

- **A Shrinking, Weakening Muscle:** Without adequate protein and calories, the body begins to consume its

own muscle tissue, including the heart. This results in a physical reduction in the heart's size and wall thickness—a condition known as cardiac atrophy. A smaller, weaker heart struggles to pump effectively, and echocardiograms often show reduced cardiac output and other structural changes like mitral valve prolapse [6].

- **A Slow and Unstable Rhythm:** A dangerously slow heart rate (sinus bradycardia) is a hallmark of AN, seen in nearly all severely ill patients as the body tries to conserve every bit of energy. This is often paired with persistently low blood pressure. While adaptive at rest, this state leaves the heart with little reserve to handle any form of stress.
- **Dangerous Electrical Faults:** An electrocardiogram (ECG) can reveal a host of electrical problems. Beyond just a slow rhythm, the electrical signals can become faint (low QRS voltage), and a critical segment known as the QTc interval can become prolonged. This prolongation is a red flag for a high risk of chaotic, life-threatening heart rhythms that can lead to sudden cardiac death [7, 11].
- **Fluid Around the Heart:** A less frequent but deeply concerning complication is the development of a pericardial effusion—an abnormal collection of fluid in the sac surrounding the heart. Though often silent and small, it is found in as many as one in four individuals with severe AN [6, 10]. It is thought to arise from the body's hypothyroid-like state and changes in blood protein levels that cause fluid to leak from the capillaries [4]. If this fluid builds up too quickly or in too large a volume, it can trigger the dire emergency of cardiac tamponade.

2. The Clinical Emergency: When the Heart is Squeezed

Cardiac tamponade is a state of acute mechanical compression of the heart. It happens when the pressure from the fluid trapped in the pericardial sac becomes so high that it physically prevents the heart from filling with blood between beats [8, 9].

2.1. The Mechanics of a Crisis

The pericardium is a tough, two-layered sac that normally holds a small amount of lubricating fluid. When excess fluid accumulates, the pressure inside this confined space begins to rise. The heart's chambers, particularly the thinner-walled right atrium and ventricle, are the first to feel the squeeze. Once the outside pressure exceeds their internal filling pressure, they begin to collapse during their relaxation phase (diastole). This collapse creates a dam, preventing blood from returning to the heart from the body. As the pressure continues to build, the left side of the heart also fails to fill, causing a catastrophic drop in the amount of blood pumped to the brain and vital organs. This is the essence of obstructive shock, a downward spiral that, if not reversed, leads to cardiovascular collapse and death [9].

2.2. Recognizing the Signs of Danger

The classic signs of cardiac tamponade are known as **Beck's triad**:

1. **Plummeting Blood Pressure:** A direct result of the heart's inability to pump.
2. **Distended Neck Veins:** A visible sign of the traffic jam of blood unable to enter the heart.
3. **Muffled or Distant Heart Sounds:** The layer of fluid acts as a sound barrier for a stethoscope.

Another tell-tale sign is **pulsus paradoxus**, an abnormally large drop in systolic blood pressure when the patient breathes in. While these signs are crucial clues, a definitive diagnosis requires immediate testing. An ECG might show a rapid heart rate with small electrical signals. A chest X-ray can reveal an enlarged, water-bottle-shaped heart. But the gold standard is an **echocardiogram**. This ultrasound of the heart provides a direct, real-time window, allowing doctors to see the fluid, quantify its size, and witness the tell-tale signs of the heart chambers collapsing under pressure [6, 8].

3. A Patient's Story: The Case Presentation

A 19-year-old girl, whose life for the past four years had been consumed by anorexia nervosa, was brought to the emergency department by her worried family. For a week, she had been sinking into a state of profound exhaustion, struggling to breathe even with the slightest movement, and complaining of a persistent pressure in her chest. She had recently stopped seeing her outpatient treatment team, and the physical toll of her relapse was frighteningly apparent.

3.1. First Impressions in the Emergency Room

Upon arrival, the young woman was frail, pale, and drowsy. The numbers on the monitor were alarming.

- **Vitals:** Her blood pressure was a mere 80/50 mmHg, while her heart raced at 120 beats per minute to compensate. Her breathing was rapid and shallow at 28 breaths per minute.
- **Anthropometrics:** Her weight was 38 kg (84 lbs) at a height of 165 cm (5'5"), yielding a Body Mass Index (BMI) of 14.0 kg/m^2.
- **Physical Exam:** The veins in her neck were visibly swollen. Listening to her chest, her heart sounds were faint and distant. A pulsus paradoxus of 22 mmHg was measured. The clinical picture was stark and pointed urgently toward cardiac tamponade.

3.2. Racing for a Diagnosis

An urgent 12-lead ECG confirmed a rapid heart rate with

low-voltage signals. A portable chest X-ray showed the classic globular, enlarged heart.

The definitive answer came from an emergency bedside echocardiogram. The ultrasound wand revealed a large, circumferential sea of fluid surrounding her heart, squeezing it with every beat. The images were unmistakable: her right atrium and ventricle were collapsing, a clear sign of tamponade physiology. Her heart's main pumping chamber was still strong, with a preserved ejection fraction of 60%, but it was being starved of blood to pump.

3.3. The Story Told by Blood Work

Initial lab tests painted a picture of chronic malnutrition, with mild anemia and low levels of key electrolytes.

Test [Reference Range]	Admission Value	Post-Procedure (Day 2)
WBC 10^3/μL [3.8-10.0]	3.1	4.5
HGB g/dL [12.0-16.0]	11.5	11.2
Creatinine μmol/L [44-80]	75	60
Serum ALB g/L [35.0-52.0]	32.1	33.5
Serum K mmol/L [3.5-5.1]	3.3	3.9
Serum Mg mmol/L [0.66-1.07]	0.61	0.75
TSH μIU/mL [0.27-4.20]	3.1	-
fT4 pmol/L [12.0-22.0]	11.5	-
fT3 pmol/L [3.1-6.8]	1.5	-

4. The Turning Point: Intervention and Outcome

With the diagnosis confirmed and the patient's condition critical, there was no time to lose. She was taken for an emergency ultrasound-guided pericardiocentesis. With a needle carefully guided into the pericardial space, the team drained 650 mL of straw-colored fluid, relieving the immense pressure on her heart. The fluid was sent for analysis and, as expected, showed no signs of infection or cancer; it was a direct consequence of her body's metabolic disarray from anorexia.

The change in the patient was immediate and profound. As the fluid was drained, color returned to her face. Her blood pressure rose to a stable 105/70 mmHg, her heart rate settled into a calm sinus rhythm of 85 bpm, and her desperate struggle for breath ceased.

A follow-up echocardiogram the next day showed a heart beating freely, with only a trivial amount of fluid remaining. She was admitted to a cardiac unit for close monitoring, where a dedicated multidisciplinary team began the delicate and crucial process of nutritional rehabilitation [13].

DISCUSSION

Navigating a Complex Complication

This young woman's journey to the brink and back highlights the terrifying potential for medical catastrophe in anorexia nervosa. Understanding this event requires looking deeper into the causes, the treatment decisions, and the essential long-term strategy for healing.

5.1. Why Does Fluid Build Up Around the Heart in AN?

The reason for pericardial effusion in anorexia is not entirely clear, but several factors are believed to work in concert [4, 10, 11].

- **A Myxedema-like State:** Severe starvation can mimic the effects of a severely underactive thyroid, a condition known as "euthyroid sick syndrome." This functional hypothyroidism can cause capillaries to become leaky, allowing fluid to seep into spaces like the pericardial sac.
- **Low Blood Proteins:** Malnutrition can lead to low levels of albumin, a key protein in the blood. Albumin acts like a sponge, keeping fluid within the blood vessels. When its levels drop, fluid can leak out into the body's tissues and cavities.
- **Cardiac Atrophy:** The shrinking of the heart muscle and the loss of the fatty layer on its surface may change the pressure dynamics within the chest, creating a potential space where fluid can gather.

5.2. The Management Crossroads: To Drain or To

The decision of how to manage a pericardial effusion in a patient with AN is dictated by one critical factor: is there evidence of tamponade? [4]

- **A Watchful Approach:** If an effusion is found incidentally on an echocardiogram and the patient is hemodynamically stable, the best course of action is often conservative. This means careful monitoring and, most importantly, starting the process of nutritional rehabilitation. For many, as the body heals, the fluid is reabsorbed on its own [4].
- **A Life-Saving Intervention:** As this case powerfully illustrates, the moment tamponade is diagnosed, it becomes an absolute medical emergency. Pericardiocentesis is not optional; it is a life-saving procedure that must be performed without delay [8, 14].

5.3. The Hidden Danger of Recovery: Refeeding Syndrome

Once the immediate crisis is over, a new and insidious danger emerges: **refeeding syndrome** [12]. In a starved body, reintroducing nutrition, especially carbohydrates, triggers a rapid shift in metabolism. A surge of insulin causes electrolytes like phosphate, potassium, and magnesium to be pulled from the blood into the cells. This sudden drop, especially in phosphate, can be catastrophic, causing heart failure, respiratory collapse, seizures, and death.

This is why nutritional rehabilitation must be a slow, methodical, and carefully monitored process. It is a tightrope walk managed by an expert dietitian and the medical team, who provide calories slowly while aggressively replacing electrolytes [12, 13].

5.4. The Circle of Care: The Essential Multidisciplinary Team

No single clinician can treat a person with severe anorexia nervosa. Success depends on a fully integrated, collaborative team. A circle of care forms around the patient: the **cardiologist** manages the acute crisis and monitors the heart's recovery. The **psychiatrist** and **psychotherapist** begin the difficult work of addressing the deep-seated psychological drivers of the illness. The **dietitian** masterminds the delicate dance of refeeding. And **specialized nurses** provide the constant, compassionate frontline care, monitoring for complications and offering the human connection that is so vital to healing [13]. This holistic approach is the only path toward both medical stability and true, lasting recovery.

CONCLUSION

Cardiac tamponade is a rare but lethal endpoint of a common and devastating illness. Its arrival can be subtle, with symptoms that are easily mistaken for the general wasting of anorexia nervosa. This story is a stark reminder that clinicians must carry a high index of suspicion for medical emergencies in this fragile population. A swift diagnosis and an immediate intervention can pull a patient back from the brink of death.

But the successful drainage of fluid from around the heart is only the first sentence of a much longer chapter. The ultimate outcome is not decided in the emergency room, but in the months and years of dedicated work that follow. True recovery depends on the successful, long-term management of the underlying anorexia nervosa. This requires a patient, persistent, and deeply humanistic approach from a team dedicated to navigating the intertwined challenges of medical stabilization, nutritional healing, and profound psychological repair. It is a journey from mere survival to the hope of a life reclaimed.

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