RESEARCH PAPER

A Two-Hit Model of Cardiac Tamponade: Myxedema-Associated Pericardial Effusion Complicated by Bacterial Pericarditis

Evelyne Chandra[1], Firda Fitra Qolbina[1], Denny Suwanto[2], Yudi Her Oktaviono[1]

[1] Department of Cardiology and Vascular Medicine, Faculty of Medicine, Universitas Airlangga, Indonesia
[2] Department of Cardiology and Vascular Medicine, Universitas Prima, Indonesia

Received: 16th Dec, 2025; Revised: 30th Jan 2026; Accepted: 26th Feb, 2026; Available Online: 8th Mar, 2026

ABSTRACT

Background: Severe hypothyroidism may lead to large pericardial effusion; however, progression to cardiac tamponade and neurological deterioration is uncommon. Myxedema coma represents the extreme manifestation of thyroid hormone deficiency and may coexist with cardiovascular instability.

Case summary: A 61-year-old woman presented with progressive dyspnoea and decreased consciousness. Echocardiography demonstrated massive circumferential pericardial effusion with right atrial and right ventricular collapse consistent with cardiac tamponade. Thyroid function testing confirmed severe hypothyroidism (TSH 105.188 μIU/mL; FT4 0.05 ng/dL). Pericardial fluid culture grew Moraxella species. Altered mental status was attributed to combined low-output state and probable myxedema coma. Clinical improvement followed pericardiocentesis, thyroid hormone replacement, and targeted antibiotic therapy.

Discussion: This case highlights the interaction between endocrine failure, infection, and mechanical cardiac compromise, emphasizing the need for comprehensive evaluation in hypothyroid patients presenting with large effusions and neurological decline.

Keywords: myxedema coma; cardiac tamponade; hypothyroidism; bacterial pericarditis; pericardial effusion.

How to cite this article: Chandra E, Qolbina FF, Suwanto D, Oktaviono YH, A Two-Hit Model of Cardiac Tamponade: Myxedema-Associated Pericardial Effusion Complicated by Bacterial Pericarditis. In Vitro and In Silico Analysis..Int J Drug Deliv Technol. 2026;16 (5s): 506-509; DOI: 10.25258/ijddt.16.5s.67

Source of support:. None

Conflict of interest: None

INTRODUCTION

Hypothyroidism produces multisystem effects involving cardiovascular, respiratory, and neurological function. Pericardial effusion develops through altered capillary permeability and impaired lymphatic drainage, typically accumulating slowly and rarely causing tamponade. However, superimposed pathological processes may destabilize compensated physiology.

Myxedema coma represents decompensated hypothyroidism characterized by altered mental status and circulatory failure. Concurrent occurrence with infectious pericarditis is rarely reported and presents significant diagnostic complexity.

CASE PRESENTATION

A 61-year-old woman was referred to our tertiary cardiovascular center for evaluation of large pericardial effusion and planned pericardiocentesis after presenting with progressive dyspnoea for 10 days. Symptoms began insidiously and gradually worsened, limiting daily activities. There was no history of chest pain, fever, cough, or recent infection. Family members reported progressive somnolence and reduced responsiveness during the days preceding admission.

Her medical history was significant for hypertension and prior thyroid disease treated with surgery and radiation therapy in 2015. She had no known history of coronary artery disease, stroke, diabetes mellitus, chronic kidney disease, pulmonary disease, or malignancy.

Upon arrival, the patient appeared weak and lethargic, but alert, with a Glasgow Coma Scale score of E4V5M6. Vital signs showed borderline hypotension (blood pressure of 97/56 mmHg) and a normal heart rate of 69 beats per minute. The respiratory rate was 22 breaths per minute, and oxygen saturation was 98% on the nasal canule (4 L/min).

Physical examination revealed distant heart sounds without audible murmurs. Breath sounds were markedly decreased over the left hemithorax. Jugular venous pressure was not clearly elevated, and no peripheral oedema was observed. Peripheral perfusion remained preserved with warm extremities and normal capillary refill.

Electrocardiography demonstrated sinus rhythm. Chest radiography showed marked cardiomegaly with homogeneous opacity occupying the left hemithorax, suggesting concomitant pleural involvement. Transthoracic echocardiography revealed massive circumferential pericardial effusion, measuring up to 4.1 cm in the basal region. Classic features of cardiac tamponade were present, including right atrial and right ventricular diastolic collapse and pronounced respiratory variation of mitral (60%) and tricuspid (90%) inflow velocities. Left ventricular systolic function was reduced with an ejection fraction of 32%, accompanied by impaired right ventricular systolic function (TAPSE 1.1 cm). Hemodynamic assessment demonstrated

**Author for Correspondence: Evelyne Chandra*

markedly reduced cardiac output (cardiac index 1.07 L/min/m²), consistent with tamponade physiology.

Initial laboratory testing showed mild anemia and electrolyte imbalance without evidence of systemic infection. Thyroid function testing revealed profound hypothyroidism with thyroid-stimulating hormone (TSH) of 105.188 µIU/mL and free thyroxine (FT4) of 0.05 ng/dL.

Arterial blood gas analysis demonstrated compensated respiratory acidosis with hypercapnia, suggesting hypoventilation. In the context of severe hypothyroidism and altered mental status, these findings raised suspicion for impending myxedema coma.

The combination of massive pericardial effusion, hypotension, low cardiac output, and declining consciousness suggested multifactorial clinical deterioration. Cardiac tamponade was considered the primary cause of haemodynamic instability, while severe hypothyroidism was suspected as the underlying cause of effusion formation and contributor to neurological impairment.

Urgent pericardiocentesis was performed for both therapeutic decompression and diagnostic evaluation. Concurrent management included initiation of thyroid hormone replacement therapy and supportive care. Microbiological examination of pericardial fluid demonstrated Gram-negative bacilli, with culture confirming *Moraxella species* sensitive to multiple antibiotics, establishing the diagnosis of bacterial pericarditis complicating hypothyroid-associated effusion. Targeted antibiotic therapy was subsequently initiated.

Following pericardial drainage and combined endocrine and antimicrobial treatment, haemodynamic parameters improved progressively. Respiratory distress resolved, and the patient's level of consciousness gradually normalized over subsequent days. The parallel improvement in neurological and cardiovascular status supported the hypothesis that altered consciousness resulted from combined effects of tamponade-induced low cardiac output and severe hypothyroid metabolic depression.

DISCUSSION

Pericardial effusion remains a recognized cardiovascular manifestation of advanced hypothyroidism, although its clinical presentation has evolved with earlier detection of thyroid disease. Contemporary studies describe hypothyroid-associated effusions as resulting from increased capillary permeability, impaired lymphatic drainage, and accumulation of mucopolysaccharides within interstitial tissues, promoting retention of protein-rich fluid in serous cavities (1).

Unlike inflammatory pericarditis, hypothyroid effusions typically accumulate slowly and are frequently asymptomatic. Consequently, progression to cardiac tamponade is uncommon because gradual pericardial stretching allows compensatory adaptation (2). In the present case, the markedly elevated TSH and suppressed FT4 confirmed profound hormonal deficiency as the primary substrate for massive effusion formation.

The transition from compensated effusion to haemodynamic compromise suggested an additional precipitating factor. Identification of *Moraxella* species in pericardial fluid established bacterial pericarditis, a rare but clinically aggressive condition (3).

Modern epidemiological data indicate bacterial pericarditis accounts for <1% of pericardial disease in developed healthcare settings but remains associated with rapid progression and high mortality if untreated (4). Infection likely accelerated fluid accumulation and increased intrapericardial pressure beyond adaptive capacity, transforming a chronic endocrine effusion into acute tamponade physiology.

Hypothyroidism itself may predispose to infection through impaired innate immunity, altered cytokine signaling, and reduced respiratory clearance mechanisms. Recent endocrine-immunology research demonstrates thyroid hormone deficiency modulates macrophage activation and immune responsiveness, potentially increasing susceptibility to opportunistic pathogens (5). The respiratory tropism of *Moraxella* species supports a plausible pulmonary source with secondary pericardial involvement.

Haemodynamic findings reflected combined mechanical and metabolic cardiac depression. Cardiac tamponade restricts ventricular filling through equalization of diastolic pressures, reducing stroke volume and cardiac output (2). Experimental and clinical studies have demonstrated that hypothyroidism reduces myocardial contractility, heart rate responsiveness, and cardiac output through decreased β-adrenergic signaling and impaired calcium handling (6). The coexistence of metabolic myocardial suppression and mechanical preload restriction therefore produced compounded circulatory failure.

Neurological impairment represented another key diagnostic challenge. Myxedema coma is increasingly recognized as a spectrum rather than a strictly defined clinical state, with altered consciousness, hypoventilation, and cardiovascular instability are considered central features even in the absence of classic hypothermia or coma (7, 8). Hypercapnia observed in this patient suggested reduced ventilatory drive, a hallmark of severe thyroid hormone deficiency. Cerebral hypoperfusion resulting from tamponade likely amplified metabolic encephalopathy, explaining improvement following combined endocrine and haemodynamic correction.

This case underscores how seemingly distinct endocrine and cardiovascular disorders may converge to produce critical illness, reinforcing the importance of integrative physiological reasoning in the evaluation of complex clinical presentations.

CONCLUSION

Severe hypothyroidism should be recognized as a potentially reversible cause of massive pericardial effusion; however, clinical deterioration should prompt evaluation for superimposed pathology. This case demonstrates how infectious pericarditis may convert a chronically compensated hypothyroid effusion into cardiac tamponade,

resulting in circulatory failure and neurological impairment along the spectrum of myxedema coma.

Altered consciousness in hypothyroid patients is frequently multifactorial and requires simultaneous assessment of haemodynamic, metabolic, and respiratory contributors. Early pericardiocentesis with microbiological analysis is essential, providing both diagnostic clarification and lifesaving therapeutic benefit. Multidisciplinary management integrating cardiology, endocrinology, and infectious disease expertise is crucial for achieving favourable outcomes in complex cardio-endocrine presentations.

LIMITATION

Several limitations should be acknowledged. First, formal myxedema coma scoring systems were not retrospectively applied, limiting definitive classification. Second, long-term echocardiographic follow-up after thyroid normalization was not available at the time of reporting. Finally, causality between infection and rapid effusion progression cannot be conclusively proven, although temporal association strongly supports this relationship.

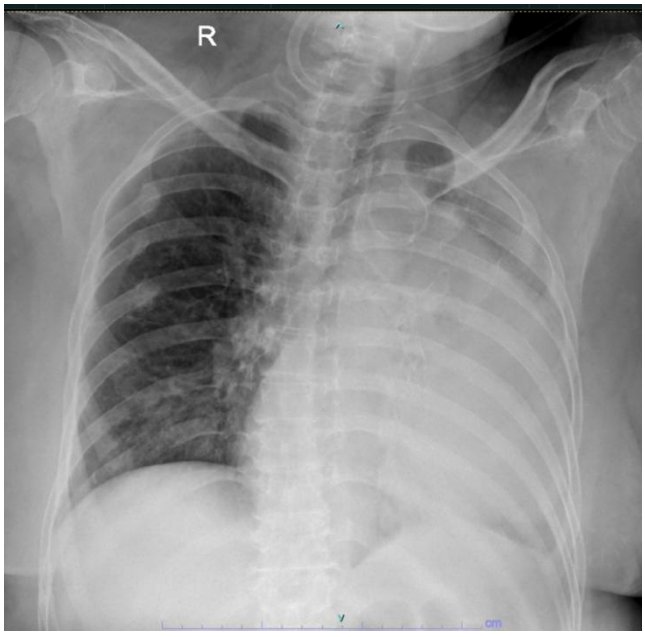

Figure 1. Anterior–posterior chest radiograph showing homogeneous opacity occupying the left hemithorax with obscuration of the left cardiac border and diaphragmatic silhouette, consistent with massive left-sided pleural effusion

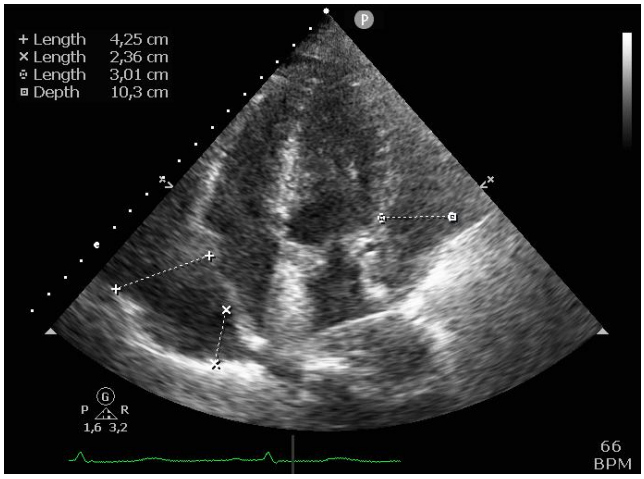

Figure 2. Transthoracic echocardiography revealing a large circumferential pericardial effusion causing diastolic collapse of the right atrium and right ventricle, illustrating tamponade physiology

REFERENCE

Dental caries in adults, adolescents, and children. JAMA 2023;330. https://doi.org/10.1001/jama.2023.18427.

[2] Pitts NB, Zero DT, Marsh PD, Ekstrand K, Weintraub JA, Ramos-Gomez F, et al. Dental caries. Nat Rev Dis Primers 2017;3:17030.

[3] Finucane D. Rationale for restoration of carious primary teeth: a review. Eur Arch Paediatr Dent 2012;13:281–92.

[4] Udagawa N, Koide M, Nakamura M, Nakamichi Y, Yamashita T, Uehara S, et al. Osteoclast differentiation by RANKL and OPG signaling pathways. J Bone Miner Metab 2021;39:19–26.

[5] Yasuda H, Shima N, Nakagawa N, Yamaguchi K, Kinosaki M, Mochizuki S, et al. Osteoclast differentiation factor is a ligand for osteoprotegerin/osteoclastogenesis-inhibitory factor and is identical to TRANCE/RANKL. Proc Natl Acad Sci U S A 1998;95:3597–602.

[6] Tang L, Lin Z, Li Y-M. Effects of different magnitudes of mechanical strain on Osteoblasts in vitro. Biochem Biophys Res Commun 2006;344:122–8.

[7] Graves DT, Corrêa JD, Silva TA. The oral Microbiota is modified by systemic diseases. J Dent Res 2019;98:148–56.

[8] Leone A, Spada A, Battezzati A, Schiraldi A, Aristil J, Bertoli S. Cultivation, genetic, ethnopharmacology, phytochemistry and pharmacology of Moringa oleifera leaves: An overview. Int J Mol Sci 2015;16:12791–835.

[9] Singh V, Singh N, Pal US, Dhasmana S, Mohammad S, Singh N. Clinical evaluation of cissus quadrangularis and moringa oleifera and osteoseal as osteogenic agents in mandibular fracture. Natl J Maxillofac

Surg 2011;2:132–6.
[10] Liu M, Ding H, Wang H. Moringa oleifera protects osteogenic differentiation via PI3K/Akt pathway. J Orthop Surg Res 2021;16. https://doi.org/10.1186/s13018-021-02284-x.
[11] Sruthi MA, Mani G, Ramakrishnan M, Selvaraj J. Dental caries as a source of Helicobacter pylori infection in children: An RT-PCR study. Int J Paediatr Dent 2023;33:82–8.
[12] Ravikumar R. Prevalence of early childhood caries in children post COVID-19: a retrospective study from 2021 to 2024 2025;54:4568–76.
[13] Kotian N, Mani G, Ramakrishnan M. Comparative Evaluation of Two Different Topical Anesthetic Agents in Controlling Pain during Intraoral Local Anesthetic Administration in children: A Split-mouth Triple-blinded Randomized Clinical Trial. Int J Clin Pediatr Dent 2021;14:180–2.
[14] Kumar AS, Ramakrishnan M. Prevalence of pain following single-visit pulpectomy with stainless steel crown done by postgraduate students in a university setting. J Adv Pharm Technol Res 2022;13:S177–80.
[15] Singh N, Sharma B. Osteogenic potential of Moringa oleifera leaf extract in SaOS-2 osteoblast-like cells: an in vitro and in silico approach. J Food Biochem 2022;46.
[16] Wang X, Wang Y. Quercetin regulates OPG/RANKL balance and attenuates inflammatory bone destruction in vivo. Int Immunopharmacol 2020;79.
[17] Chen Y, Li X. Quercetin suppresses osteoclast activation via modulation of the RANKL/RANK/OPG signaling pathway. Biomed Pharmacother 2020;121.
[18] Kim MH, Ryu SY. Kaempferol inhibits RANKL-induced osteoclast differentiation by suppressing MAPK signaling pathways. Biochem Pharmacol 2014;89:165–76.
[19] Choi SW, Son YJ. Kaempferol suppresses RANKL-induced osteoclastogenesis through modulation of autophagy and signaling pathways. Int J Mol Sci 2018;19.
[20] Wattel A, Kamel S. Flavonoid compounds kaempferol and quercetin inhibit osteoclastic differentiation and bone resorption activity. Biochem Pharmacol 2006;72:173–82.
[21] Kwak SC, Lee C. Chlorogenic acid inhibits osteoclast differentiation and bone resorption by suppressing RANKL signaling. Biochem Biophys Res Commun 2013;435:627–32.
[22] Zhang Y, Liu H. Chlorogenic acid prevents ovariectomy-induced bone loss and improves bone microarchitecture in vivo. Phytomedicine 2024;126.
[23] Casado-Díaz A. Quercitrin stimulates osteoblast differentiation and reduces Rankl expression, suppressing osteoclastogenesis. J Cell Biochem 2014;115:1203–13.
[24] Li X, Zhao Y. Chlorogenic acid promotes osteogenic differentiation of human dental pulp stem cells via regulation of osteogenic signaling pathways. J Cell Physiol 2021;236:6550–62.
[25] Sekar R, Jayaraman S, Veeraraghavan V, Varadarajan S, Alagumuthu M, Rajendran P, et al. Integrated in-silico and in-vitro analysis of lncRNA H19/miRNA-675/p53 in OSCC: Structural characterization and molecular docking insights. Diagn Pathol 2025;20:124.
[26] Aarthi., Ramesh, Mahesh. Assessment of general and local anaesthesia on respiratory health outcomes in children undergoing full mouth rehabilitation for early childhood caries: A randomized controlled trial. J Neonatal Surg 2025;14:407–17.