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CASE REPORT

Purulent Pericarditis and Septic Shock Caused by Nontypeable Haemophilus Influenzae in an Immunocompromised Patient: A Case Report

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Background: Haemophilus influenzae (H. influenzae) is a common commensal bacterium of the upper respiratory tract, with nontypeable H. influenzae (NTHi) increasingly recognized as a cause of invasive infections. Although purulent pericarditis itself is a rare but life-threatening condition, cases caused by NTHi are exceptionally rare, with only a few reported worldwide.

Case Presentation: We report a case of a 63-year-old immunocompromised woman with a history of hematologic malignancy and prior Hib vaccination who developed NTHi-associated purulent pericarditis and septic shock. She initially presented with dyspnea and fever and was found to have cardiac tamponade requiring emergency pericardiocentesis. Despite initial improvement, she deteriorated with septic shock and severe pneumonia, necessitating mechanical ventilation. Blood and pericardial fluid cultures confirmed NTHi infection. Given persistent systemic inflammation and high risk of constrictive pericarditis, she underwent surgical pericardiectomy, which led to clinical recovery and successful discharge.

Discussion: NTHi as a causative agent is exceedingly uncommon, with very few cases reported in the literature. The increasing incidence of invasive NTHi infections highlights the need for greater clinical awareness, particularly in immunocompromised patients. Pyogenic pericarditis has a high mortality rate, requiring prompt diagnosis and intervention. Our case supports prior observations that H. influenzae-associated pericarditis may be unresponsive to drainage alone, with pericardiectomy playing a critical role in infection control and prevention of constrictive pericarditis. This case underscores the importance of early recognition of invasive NTHi infections and highlights the potential necessity of early surgical intervention in H. influenzae-associated purulent pericarditis. Clinicians should consider H. influenzae as a causative agent in bacterial pericarditis and recognize the need for early, aggressive management to optimize patient outcomes.

Keywords: Haemophilus influenzae, nontypeable H. influenzae, (NTHi), purulent pericarditis, case report

Introduction

Haemophilus influenzae (H. influenzae) is a well-known commensal bacterium of the upper respiratory tract, frequently detected in healthy adults. Among its forms, nontypeable H. influenzae (NTHi) is commonly found colonizing the upper airway. While usually benign, H. influenzae can occasionally cause invasive infections. Historically, type b H. influenzae (Hib) was the predominant cause of severe infections; however, the widespread use of the Hib vaccine has dramatically reduced its incidence.[1] Recent epidemiological data indicate a rise in infections caused by non-type B H. influenzae, including NTHi.[2] Although infections caused by Hib have been successfully controlled through vaccination, invasive infections due to NTHi tend to be particularly severe in immunocompromised individuals and the elderly.[3] In Japan, invasive NTHi infections are frequently observed in the elderly population, and the associated high mortality rate highlights the increasing clinical relevance of this pathogen.[4]

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Purulent pericarditis is a rare but life-threatening condition that necessitates urgent diagnosis and intervention. Previously, Staphylococcus aureus and Streptococcus pneumoniae were the predominant causative organisms.[5] In recent years, the spectrum of pathogens responsible for purulent pericarditis has broadened beyond the traditional Gram-positive cocci. Gram-negative bacilli, including *Haemophilus influenzae*, have been increasingly reported as causative organisms, particularly in immunocompromised individuals or those with contiguous infections.[6–8] Moreover, anaerobic bacteria, often originating from the oral flora, have emerged as significant pathogens, accounting for a notable proportion of cases, especially in instances of polymicrobial or odontogenic origin.[8–10] While pericarditis caused by H. influenzae remains rare, reports of non-type B strains and NTHi causing pericarditis have emerged. To date, only a few cases of NTHi-associated pericarditis have been reported worldwide, making it an exceptionally rare condition.[10–12]

Here, we present a case of purulent pericarditis and septic shock caused by NTHi in a patient with a history of hematologic malignancy and prior Hib vaccination. Although extremely rare, NTHi-associated purulent pericarditis is a highly lethal condition that warrants clinical attention. This case underscores the importance of recognizing its epidemiological emergence and the need for timely diagnosis and intervention in immunocompromised patients.

Case Presentation

A 63-year-old woman with a history of angioimmunoblastic T-cell lymphoma underwent allogeneic hematopoietic stem cell transplantation six years ago and remained in remission. She had received Haemophilus influenzae type b conjugate vaccine (ActHIB®, Sanofi Pasteur Inc., Lyon, France) three and four years prior to admission. Two weeks before admission, she developed a productive cough and fever, which progressively worsened. One week prior to admission, she experienced increasing dyspnea and sought medical attention. Electrocardiogram revealed widespread ST-segment elevation, and echocardiography demonstrated a significant pericardial effusion, findings consistent with acute pericarditis. Due to concern for cardiac tamponade, the patient was transferred to our institution for further management. Upon arrival, her vital signs were significant for hypotension (systolic blood pressure in the 70s mmHg) and tachycardia (130 bpm). The initial ECG upon arrival at our institution demonstrated widespread ST-segment elevation (Figure 1A), consistent with acute pericarditis. Our echocardiographic assessment at our institution also identified a significant pericardial effusion, consistent with the findings of the previous hospital (Figure 1B). Heart sounds were diminished, but no pericardial friction rub was auscultated. Laboratory findings showed markedly elevated inflammatory markers (WBC 42800/μL, neutrophil count 40446/μL, CRP 32.4 mg/dL), and chest radiography revealed right lung infiltrates.

Emergency pericardiocentesis was performed, yielding purulent fluid (Figure 2A and B). Cytologic analysis demonstrated a predominance of neutrophils. Pericardial fluid and blood cultures subsequently grew Haemophilus influenzae (Figure 3A and B), which was later identified as NTHi upon further investigation. While the patient initially stabilized following pericardial drainage, she developed septic shock requiring norepinephrine. Broad-spectrum antibiotics (Meropenem 500 mg IV every 8 hours) were initiated. On hospital day 1, her respiratory status deteriorated due to worsening pneumonia and septic acute respiratory distress syndrome, necessitating intubation and mechanical

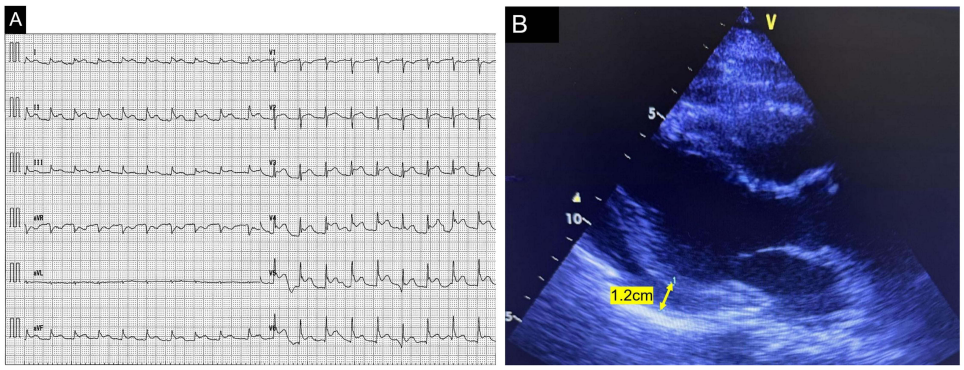

Figure 1 (**A**) Twelve-lead electrocardiogram obtained upon arrival at our hospital showing widespread ST-segment elevation, consistent with acute pericarditis. (**B**) A transthoracic echocardiogram performed on the day of admission revealed the presence of pericardial effusion.

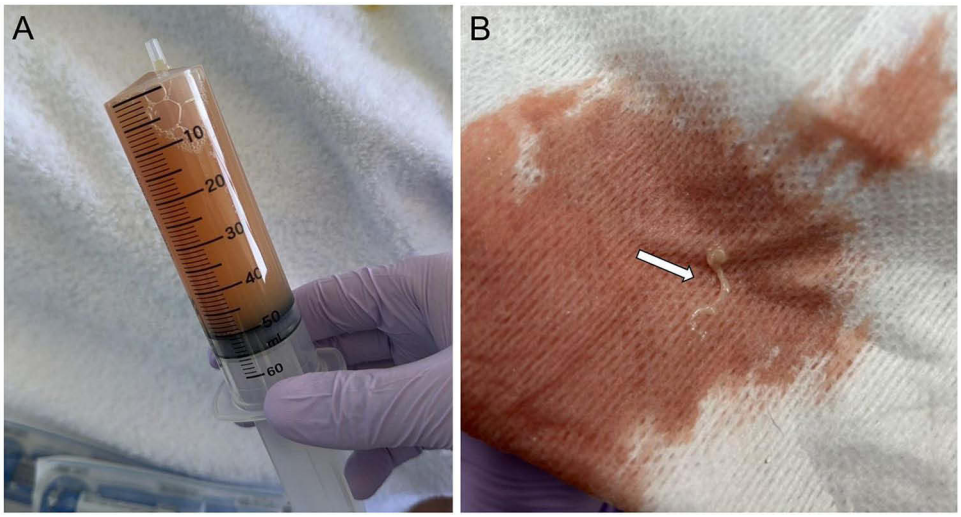

Figure 2 (**A**) Gross appearance of purulent pericardial fluid aspirated via pericardiocentesis, showing turbid, yellow-brown exudate.(**B**) Fibrinous clot observed within the pericardial fluid (arrow), suggestive of intense inflammatory activity.

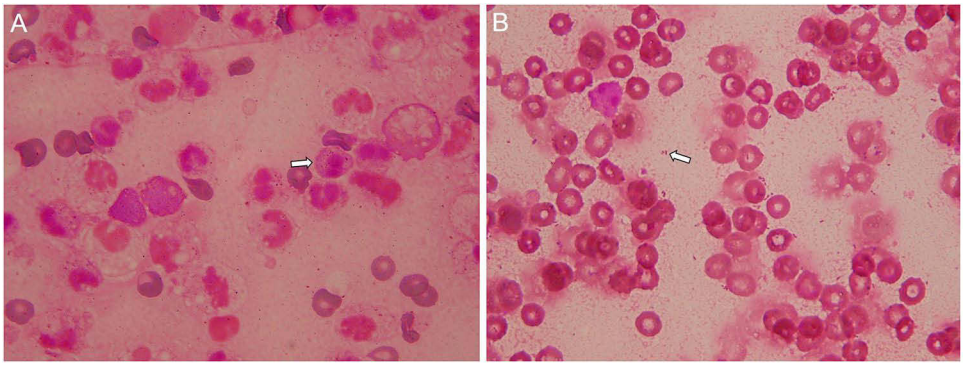

Figure 3 (**A**) Gram-stained pericardial fluid specimen showing numerous polymorphonuclear leukocytes and Gram-negative bacilli consistent with *Haemophilus influenzae*. The arrow indicates phagocytosed bacteria within a leukocyte. (**B**) Gram-stained blood culture specimen also showing numerous Gram-negative bacilli (arrow).

ventilation. Regarding pneumonia, discussions with the respiratory medicine and thoracic surgery teams concluded that continued antibiotic therapy was appropriate. Despite intensive antimicrobial therapy, systemic inflammation persisted. Furthermore, follow-up echocardiography on hospital day 12 revealed an early diastolic septal dip on M-mode (Figure 4), suggesting early progression to constrictive pericarditis. A heart team discussion was held to determine the management strategy for infection control of purulent pericarditis and treatment of constrictive pericarditis, leading to the decision to perform surgical pericardiectomy. The surgery was performed on hospital day 14, and intraoperative findings revealed fibrinous, highly viscous material adhered around the heart after pericardiectomy, necessitating lavage and drainage (Figure 5). The patient was extubated shortly after the surgery. We attributed her clinical improvement primarily to the pericardiectomy, as preoperative chest CT (Figure 6) showed localized pneumonia not severe enough to explain her systemic deterioration. Moreover, sputum cultures were negative for pathogens, supporting our assessment that purulent pericarditis was the main source of inflammation. The patient showed progressive clinical improvement, allowing for eventual discharge on hospital day 42.

Discussion

This case represents an exceptionally rare instance of NTHi-associated purulent pericarditis, even in the era of widespread antibiotic use in the 21st century, making it a significant addition to the growing body of literature on invasive Haemophilus influenzae infections. Only a few cases of NTHi-induced pericarditis have been reported worldwide,

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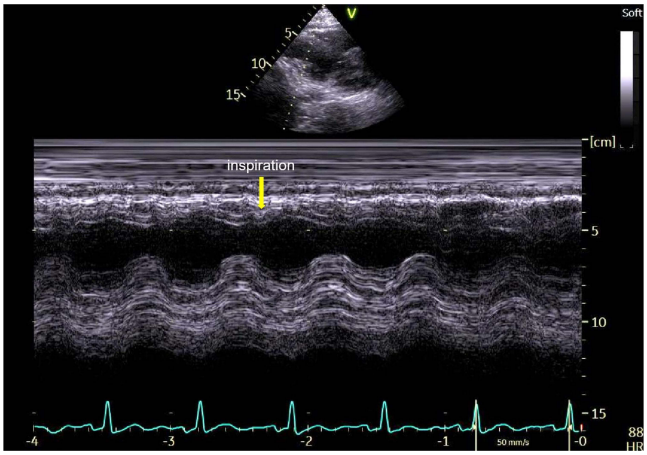

Figure 4 M-mode echocardiography showing an early diastolic septal "dip" (septal bounce) during inspiration (arrow), indicative of early constrictive physiology.

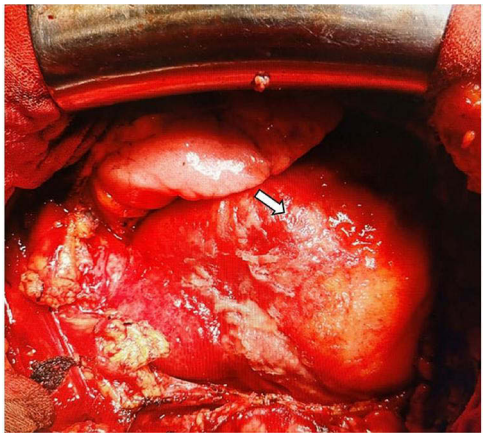

Figure 5 Intraoperative findings. Fibrin clots are visible on the surface of the heart following pericardial resection (arrow).

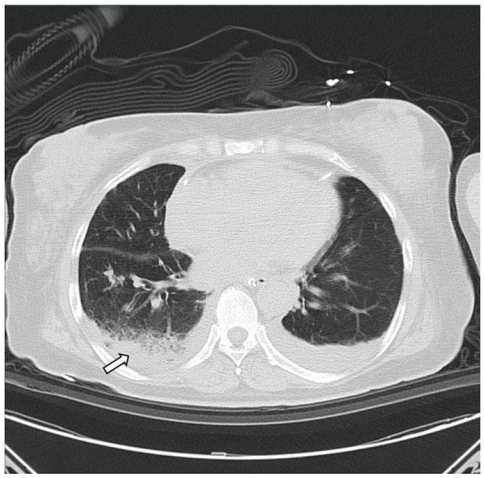

Figure 6 Chest computed tomography (CT) obtained prior to pericardiectomy reveals localized consolidation in the right lower lung field (arrow), suggestive of pneumonia.

highlighting the exceptional rarity of this condition.[10–12] This underscores the importance of continued surveillance and reporting of invasive NTHi infections, particularly given their potential to emerge in diverse geographic and clinical settings. An increase in invasive infections caused by NTHi has been reported in several studies, including those from

Canada and Sweden. For instance, in Ontario, Canada, the incidence rate rose by 5.6% between 2014 and 2018, with NTHi accounting for 74% of the cases. This case can therefore be regarded as an example of an invasive NTHi infection, the incidence of which has been increasing following the introduction of the Hib vaccine.[13,14]

While invasive H. influenzae infections remain rare, they can be life-threatening, particularly in immunocompromised individuals. The introduction of the Hib vaccine has drastically reduced invasive type b infections; however, NTHi remains unaffected by vaccination and is increasingly recognized as a cause of severe infections. The rising incidence of invasive NTHi cases may reflect both an actual increase in pathogenicity and improved microbiological detection techniques.[2] Following the successful introduction of the Hib vaccine, NTHi has become a predominant causative organism of invasive infections. This case is thought to have occurred within the context of this evolving epidemiological pattern.[13] This highlights the need for further research into the epidemiology and virulence factors of NTHi. This shift is partly explained by a phenomenon known as *serotype replacement*, in which the ecological niche previously occupied by *H. influenzae* type b is filled by other strains such as nontypeable *H. influenzae* (NTHi) following successful Hib vaccination. As a result, the relative incidence of NTHi infections has increased, particularly in vulnerable populations such as immunocompromised patients. In parallel, the development of effective vaccines targeting NTHi is also warranted, particularly to protect vulnerable populations such as immunocompromised individuals from severe and potentially fatal complications.

Purulent pericarditis progresses rapidly and carries a high mortality rate, reaching nearly 100% if left untreated. Even with appropriate therapy, mortality rates remain significant at 20–40%.[15] Due to its rapid progression, early diagnosis and intervention are critical. The classic triad of acute pericarditis (chest pain, pericardial friction rub, and widespread ST elevation) is often incomplete, as seen in our case, where the patient exhibited neither chest pain nor a friction rub.[16] Echocardiography is essential for detecting pericardial effusion, and pericardiocentesis with microbiological analysis is crucial for confirming the diagnosis.[17] Given the immunocompromised status of our patient, her predisposition to invasive infections further emphasizes the need for aggressive diagnostic and therapeutic strategies. Although the patient was not on immunosuppressive therapy and more than six years had passed since her allogeneic hematopoietic stem cell transplantation, she was considered functionally immunocompromised. According to CDC and ECIL guidelines, allogeneic transplant recipients—even years after transplantation—may remain at increased risk of invasive infections, depending on immune reconstitution and underlying hematologic malignancy. Based on this, we described her as immunocompromised in a broad clinical sense, reflecting her susceptibility to severe infection with NTHi.[18,19]

Although percutaneous drainage is the primary treatment for pyogenic pericarditis, cases refractory to medical management may require surgical intervention. According to Morgan et al, reports suggest that *H. influenzae*-induced pericarditis is frequently unresponsive to drainage alone, necessitating pericardiectomy for infection control and prevention of constrictive pericarditis.[20] Early surgical intervention is also recommended in cases of persistent fever, recurrence of cardiac tamponade or signs of constrictive pericarditis.[21] In this case, early surgery was undertaken due to ongoing fever and progression of findings suggestive of constrictive pericarditis, in alignment with current literature-based recommendations.[22] A previously reported case involved an immunocompetent adult with community-acquired pneumonia complicated by NTHi pericarditis.[11] In contrast, our patient was immunocompromised and developed constrictive physiology requiring pericardiectomy, highlighting the need for individualized management based on immune status. In our case, follow-up echocardiography on hospital day 12 newly revealed an early diastolic septal dip (Figure 4), suggesting early onset of constrictive pericarditis. Intraoperative findings showed fibrinous, clay-like high-viscosity material adhered around the heart upon opening the epicardium (Figure 5), indicating that without lavage and drainage, the condition could potentially progress to refractory constrictive pericarditis. Our case reinforces this observation, demonstrating that early surgical intervention may be essential for favorable patient outcomes. Notably, compared to other bacterial etiologies such as Staphylococcus aureus or Streptococcus pneumoniae, H. influenzae pericarditis may have a greater propensity for persistent inflammation, making surgery a more definitive therapeutic option.[23,24]

Considering the increasing number of reported invasive NTHi infections and the potential for poor outcomes with conservative management, we suggest that H. influenzae-associated pyogenic pericarditis should be promptly considered for surgical pericardiectomy, particularly in cases demonstrating persistent systemic inflammation or

inadequate response to drainage and antimicrobial therapy or signs of early progression to constrictive pericarditis. Future studies and case reports will be essential in determining optimal management strategies for this rare but serious condition.

Conclusion

We report an exceptionally rare case of purulent pericarditis and septic shock due to NTHi. Despite the widespread use of antibiotics in the 21st century, such cases remain exceedingly uncommon. This report underscores the importance of early recognition of invasive NTHi infections, particularly in immunocompromised patients—even in those who have received the Hib vaccine. Additionally, it highlights the potential necessity of early surgical intervention in H. influenzae pericarditis to optimize outcomes. Clinicians should remain vigilant for emerging trends in H. influenzae infections and their evolving clinical implications. Given the increasing incidence of invasive NTHi infections and its potentially severe consequences, the development of effective vaccines targeting NTHi is also of great importance, particularly for protecting high-risk populations such as immunocompromised patients.

Data Sharing Statement

The data underlying this article are available in the article.

Statement of Consent

Written informed consent was obtained from the patient for publication of this case report. Institutional review board approval was not required for this single-patient case report, and all identifying details have been removed to maintain confidentiality.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

KH received an honorarium from Asahi Intecc Co., Ltd. The authors declare no other competing interests relevant to this manuscript.

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