Case report

Gonococcal endocarditis with aortic root abscess and severe aortic insufficiency

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\begin{abstract}
Gonorrhea caused by \textit{Neisseria gonorrhoeae} is a very common sexually transmitted infection in the United States and World-wide (Kirkcaldy et al., 2019)\cite{1}. The population with highest prevalence is young sexually active adults aged 15–24 years. In a majority of cases, the presentation is asymptomatic however can range from vagnitis to pelvic inflammatory disease in women. Symptoms in men can include urethritis, epididymitis and proctitis. Disseminated disease is characterized by arthritis and tenosynovitis. Gonococcal endocarditis is a rare but life-threatening complication of disseminated gonococcal infection (DGI) occurring in 1–2% of patients with DGI (Shetty et al., 2004)\cite{3}. Gonococcal endocarditis has a predisposition for aortic valve involvement with formation of large vegetation and valvular ring abscess. Only a handful of cases have been reported in the literature since the advent of penicillin. This case highlights the importance of timely diagnosis and appropriate surgical evaluation to prevent mortality in young patients that may present with this rare complication.
\end{abstract}

\section*{Introduction}

According to the World Health Organization, there were approximately 87 million new gonococcal infections reported amongst 15–49 years old in 2016\cite{1}. The rates of gonococcal infections are rising here in the United States as well. In 2019, nearly 600,000 cases of gonorrhea were reported to the Center for Disease Control (CDC), making it the second most common notifiable condition in the United States for that year\cite{4}. Rates of reported gonorrhea have increased 92.0% since the historic low in 2009. This coupled with rising \textit{Neisseria gonorrhoeae} drug resistance in the United States and World-wide, patients are at risk for inadequate treatment and thus at an increased risk of disseminated gonococcal infections\cite{5}.

\section*{Case}

A 27-year-old man with a past medical history of unknown murmur as a teenager, presented to the hospital with exertional chest pain and associated dyspnea for three weeks. Review of other systems included 40-pound unintentional weight loss, malaise and joint pains for several months. He noticed swelling in his knees which later migrated to his wrists and various other joints. Furthermore, he developed a desquamative rash on both hands that compared to “peeling snake skin” which self-resolved. He denied any history of substance abuse. Patient was in a monogamous relationship with his girlfriend of three years and denied any other high-risk sexual exposures. He denied any family history of coronary artery disease or rheumatologic diseases.

The physical examination revealed a pale, uncomfortable appearing febrile patient (103F), with tachycardia, mild tachypnea, and normal oxygen saturation. An auscultation of his heart revealed systolic murmur. No rash was apparent, no palpable knee effusions was noted. Other stigmata of infective endocarditis such as conjunctival hemorrhage, petechiae, oslers nodes or janeway lesions were absent. On initial laboratory evaluation, his white blood cell count was 7.0 (reference value [RV]: 4.0–11.0 Thou/\text{uL}) with 69% neutrophilic predominance, Hemoglobin 7.5 (RV: 13.0–17.7 g/dL) with a Hematocrit of 23.6 (RV: 39.0–54.0%), Platelets 287 (RV: 150–450 Thou/\text{uL}) and CRP 16.89 (RV: 0–0.49 mg/dL).

Electrocardiogram revealed sinus tachycardia with heart rate of 105 and nonspecific T-wave abnormalities in anterior leads. Committed tomography (CT) angiography of chest was negative for...
pulmonary embolism. Troponin was unremarkable. He was started on empiric intravenous (IV) vancomycin and cefepime secondary to sepsis. A transthoracic echocardiogram (TTE) revealed moderate to severe aortic regurgitation without systolic dysfunction or wall motion abnormalities. Further evaluation with a transesophageal echocardiogram (TEE) revealed severe aortic valve destruction with evidence of valvular vegetations, incomplete coaptation and severe aortic insufficiency. There was a concern for aortic root abscess (Fig. 1). Other testing including HIV 4th generation antigen/antibody assay, hepatitis B surface antigen and hepatitis C antibody testing were non-reactive. Head CT scan showed punctate right cerebral infarcts but no gross neurologic findings.

One out of two sets of blood culture were positive for gram negative diplococci in aerobic media which was later identified as *Neisseria Gonorrhoeae*. The antibiotic regimen was changed to IV ceftriaxone 2 g every 24 h.

Patient was then transferred to a tertiary hospital for a cardiothoracic surgery evaluation. In the interim he developed a first-degree heart block with prolonged PR interval (330 ms). Patient then underwent mechanical aortic valve replacement, intra operative findings were suggestive of an extensive aortic root abscess with three abscess cavities. Two were located next to the left main coronary artery and under the commissure with a thickened aortic root. The third formed a separate fistula through the right atrium and right ventricle close to the membranous septum and the conduction system. A large patch of fresh autologous pericardium was used to repair the fistula and reconstruct the left ventricular outflow tract (LVOT), aortic annulus, and anterior mitral curtain. The patient underwent a radical debridement of the aortic root, aortic annulus, and LVOT. Homograft root replacement was performed using 24 mm homograft with reimplantation of both coronaries. Permanent epicardial right ventricular and right atrial pacer leads and a dual

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**Fig. 1.** (A) Severe deterioration of aortic valve and evidence for incomplete coaptation. Mobile echodensities that are present are likely consistent with valvular vegetations. (B) Severe aortic insufficiency. (C) Evidence of aortic root abscess.
chamber pacemaker-defibrillator were placed in the left upper chest. A post procedural TEE revealed an ejection fraction of 45% with inferior and septal hypokinesis with mild right ventricular dysfunction. His postoperative course remained stable. He was discharged to home to complete 6 weeks duration of IV ceftriaxone via a peripherally inserted central catheter line.

As part of the work up, Urine Neisseria gonorrhoeae and Chlamydia trachomatis nucleic acid amplification assay was negative. Intraoperative tissue culture of the aortic root abscess was no growth, however tissue 16S ribosomal subunit testing was positive for Neisseria gonorrhoeae DNA. Complement deficiency testing revealed normal C4 and C3 levels but low total complement levels with CH50 below 10 (RV 31–60 U/mL). Patient’s partner also tested positive for Neisseria gonorrhoeae and she was subsequently treated. Patient did well on follow up evaluation, he will remain on life-long anticoagulation.

Discussion

Neisseria gonorrhoeae was first discovered in 1879 by Albert Ludwig Neisser while studying patients with urethritis and ophthalmia neonatorum [6]. N. Gonorrhoeae is non-spore forming gram negative diplococci that have complex growth requirements. The modality of transmission is sexual encounter with an infected partner and majority affected are young adults age 15–35 years old. Certain populations such as gay, bisexual, men who have sex with men (MSM), sex workers, racial and ethnic minorities tend to have a disproportionately higher burden of gonococcal infections [1]. The incubation period can be up to 2 weeks and can present as non-specific symptoms of fever, chills and malaise.

The clinical manifestations of gonorrhea can range from uncomplicated genital infections such as urethritis in men to pelvic inflammatory disease and peri-hepatitis in women. The most common presentation of disseminated gonococcal infection is the arthritis-dermatitis syndrome which our patient experienced a few weeks before presentation. Gonococcal bacteremia is often intermittent. A minimum of three blood culture sets should be obtained to increase diagnostic yield [7]. Up to 13% of patients with disseminated gonococcal infections are reported to have complement deficiencies like in our patient. The disseminated infection is possibly related to decreased clearance of bacteria secondary to deficiencies in reticuloendothelial system or bacterial opsonization.

Gonococcal endocarditis is extremely rare and presents as subacute infective endocarditis. It has a predilection for left sided cardiac valves particularly the aortic valve causing rapid extensive valvular destruction [8]. Involvement of the mitral valve has also been reported in a young sexually active adult eventually requiring mitral valve replacement. [3]. In the pre-antibiotic era before 1940s, gonococcal endocarditis was responsible for up to 25% of all bacterial endocarditis and was nearly fatal in most cases [9]. The incidence is significantly decreased since introduction of penicillin [7]. Echocardiography remains the standard diagnostic modality and, in most cases, transesophageal echocardiogram is required for definitive diagnosis. It is important to involve the cardio thoracic surgical team early for valve replacement consideration as this is a rapidly destructive form of endocarditis [8,9]. More than half of the patients with gonococcal endocarditis require valve surgery, which is usually as a result of worsening congestive cardiac failure [10].

Although considered easily treatable during uncomplicated primary infection, gonococcal antimicrobial resistance is of growing concern. The proportion of gonococcal isolates for which the minimum inhibitory concentration (MIC) is elevated (≥0.25 µg/mL) has increased by a factor of 17 from 0.1 % in 2006 to 1.7 % in 2011. The reduced susceptibility to cephalosporins is due to various chromosomal gene mutations such as mutations in penA, the gene that encodes penicillin-binding protein 2 (PBP2); penB, which affects drug entry and mtrR, a repressor of the Mtr-CDE encoded pump [2]. Ceftriaxone remains the preferred regimen for treatment of gonococcal infections. Given the rising gonococcal minimum inhibitory concentrations a recent 2020 CDC’s treatment guidelines update recommends a single 500 mg intramuscular dose of ceftriaxone for uncomplicated gonorrhea [13].

Since 1980, there have been more than 38 cases of gonococcal endocarditis reported with a large majority of them with aortic valve involvement [11]. Despite major valvular destruction, a majority of the valve cultures are reported negative as in our case. Culture of the exudates from other locations can also be negative so it is vital to consider Neisseria gonorrhoeae in the differential diagnosis of infective endocarditis. Advanced testing methods such as 16S ribosomal RNA on the tissue can be helpful in confirming the diagnosis when cultures remain negative [14]. The mortality remains extremely high for non-surgically treated patients.

A high degree of clinical suspicion is prudent in making the diagnosis of gonococcal endocarditis in a young patient as it can have a similar presentation of sub-acute endocarditis.

In summary, gonorrhea endocarditis is extremely rare complication of N. gonorrhoeae infection. Recognition of this very common sexually transmitted infection and initiating early treatment with a third-generation cephalosporin will prevent complications of disseminated disease.

Ethical approval statement

The publication of this case report has been approved by the Ethics committee at Hartford Hospital in Hartford, Connecticut, United States. The patient provided written consent to use his clinical information including clinical findings, work up and diagnostic images for publication.

CRediT authorship contribution statement

Neelam Tailor: Contributor to the Introduction, Abstract, Discussion (Writing – original draft along with review of literature and submission) Contributor to case report (Writing – review & editing). Michelle Dellalana: Contribution to the case report (Writing – original draft, collection of relevant data and images). Matthew Dean: Contribution to the case report (Writing – original draft, collection of relevant data and images). Lavanya Jitendranath: Senior author, review & editing of the above all sections Assistant Director, Infectious disease department, Hartford Hospital, CT. Assistant Clinical Professor, UCONN School of Medicine.

Consent

Written informed consent was obtained from the patient for publication of this case report. A copy of the written consent is available for review by the Editor-in Chief of this journal on request.

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