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CASE REPORT

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Gemella morbillorum an underappreciated cause of endocarditis: Case report and review of 37 cases

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Abstract

Background: *Gemella morbillorum is a part of the human oral flora and associated with endocarditis. Gemella morbillorum is difficult to identify and is associated with but an underappreciated cause of endocarditis; Review of 37 such cases showed susceptibility data is generally anecdotal. Mortality was associated with the recommended combination (beta-lactam plus aminoglycoside) therapy.*
Methods*: Search of internet databases.*
Results: *We review data on 37 cases. Native valve involvement occurred in 43%, and 57% had predisposing cardiac conditions; the median age was 53 years and most were male (68%). Death occurred in 5 patients (5/37, 13.5%) who were treated with combination therapy of gentamicin plus penicillin/ampicillin.*
Conclusion*: G. morbillorum is a not infrequent cause of endocarditis. There was no correlation with susceptibility of the isolates and mortality. Optimal therapy remains to be defined.*

Keywords: *Gemella morbillorum; endocarditis; Gemella susceptibility*

Introduction

The genus *Gemella (Class, Bacilli, Order, Bacillales*) consists of nine species which are often difficult to identify. They are facultatively anaerobic, non-motile and non-spore-forming, gram positive cocci and can occur singly, in pairs, and in short chains. They give negative reactions for both oxidase and catalase, are inhibited by 6.5% sodium chloride (NaCl), do not grow in the presence of 40% bile and do not hydrolyze esculin. They are primarily found in the mucous membranes of humans and other animals, particularly in the oral cavity and upper digestive tract [1].

Gemella morbillorum, the most commonly isolated species, was first isolated from a patient with measles in 1917, and originally named *Diplococcus rubeolae*, since it was believed to be associated with measles [2]. Based on 16S rRNA studies, DNA filter hybridization, and biochemical activities, it was transferred to *Gemella* in 1988 [3,4]

It is an opportunistic pathogen, reported to cause severe localized and generalized infections such as endocarditis, meningitis, brain abscess, pleural empyema, nephritis, mediastinitis, and liver abscess [1], but its incidence may be underestimated due to being commonly misidentified or left unidentified.

Several *Gemella* species have been reported to cause endocarditis. Elsayed & Zhang [5] reported a case of *G. bergeriae* aortic valve endocarditis and reviewed the literature, finding 15 cases attributed to *G. morbillorum*, 14 to *G. haemolysans*, 4 to *G. bergeriae*, and 2 to *G. sanguinis*. In 2000, Mosquera et al. [6] reported on 15 cases of human *Gemella haemolysans* endocarditis; most had underlying valvular disease and/or poor dentition or dental manipulation. Most were treated with a combination of benzyl-penicillin and gentamicin and all patients survived.

We report a case of *G. morbillorum* endocarditis in an immunocompetent male and review the details of 36 other cases including valves involved, surgery required, antimicrobial therapy and clinical outcome.

Case Report

A 37-year-old white male with an unremarkable past medical history was admitted to the hospital on June 14, 2021 complaining of fever, drenching night sweats, rigors and malaise. Recent history was notable for 6 to 8 months of gradually worsening malaise, fatigue, weight loss, and intermittent fevers. His symptoms were felt to be from COVID even though he routinely tested negative. Care was delayed as the patient splits his time between the United States and Russia, and his hesitancy in pursing medical care to avoid severe acute respiratory syndrome coronavirus 2 (SARS CoV-2) exposure. He was given several courses of antibiotics in December 2020 for worsening of his "flu-like illness" associated with myalgias and rhinitis but without sore throat or adenopathy. He was prescribed amoxicillin-clavulanate (750/125 mg) orally twice daily for seven days but two days after discontinuation his symptoms relapsed. Azithromycin 500 mg daily for 10 days was prescribed, but the patient relapsed again two weeks after

discontinuation. He had continued malaise, fevers to 39.2° C and migratory myalgias.

He went to the Emergency Department on June 12, 2021 for evaluation of these persistent fevers. At the time, his white blood cell count was 6,200/uL.

SARS CoV-2 testing and a comprehensive respiratory viral panel done were negative. Blood cultures were drawn. Due to his stable clinical appearance, he was discharged home, but called for admission when his cultures turned positive for gram-positive cocci in two out of two sets.

BioFire (bioMerieux) identified the organism as *Streptococcus pyogenes* and he was started on ceftriaxone 2 gms intravenously every 12 hours. The next morning the identification was corrected to *Gemella morbillorum*. The isolate was sent to a reference laboratory where MICs (µg/ml) were penicillin 0.06, ceftriaxone 0.12, meropenem, 0.25, clindamycin, 0.12, erythromycin 0.25, levofloxacin 0.5 and vancomycin 0.5. Repeat blood cultures drawn on June 14, 2021 again grew *G. morbillorum* (misidentified as *Streptococcus sanguinis)* in 2 of 2 sets with a penicillin MIC of 0.12 ug/ml.

A transthoracic echocardiogram obtained on June 14, 2021 showed moderate mitral regurgitation and a large 14 mm linear density on the anterior leaflet of the mitral valve. This was confirmed on follow up transesophogeal echocardiography. On physical exam, there was a murmur but no embolic lesions (eyes, oral, nailbeds. Additional computed tomography (CT) scans of the chest, abdomen, and pelvis showed splenomegaly without infarcts. The patient denied any history of intravenous drug use, a drug screen was negative, no recent gastrointestinal or urologic procedures, but he did confirm recent dental work when he underwent a root canal in April 2020. No antibiotic prophylaxis was indicated. His symptoms started approximately 6 months after his endodontic procedure. On June 22, 2021, a mitral valve replacement with a 27 Mitral Magna Ease bioprosthetic valve was performed. Operative findings were an anterior leaflet mitral valve perforation with a torn cord and an A-3 15 x 7 mm vegetation. Tissue Gram stain showed rare Gram-positive cocci in pairs and chains but negative cultures. The patient's recovery was uneventful. He received ceftriaxone for 6 weeks post-operatively and fully recovered..

Literature review

Using several search engines (MEDLINE, PubMed, Embase, Web of Science: 8-30-21) with the terms of *Gemella* and endocarditis, 36 additional cases were identified. A summary of results for the 37 total cases are found in Table 1 [7-39]. Of these patients, 25 (68%) were male, 11 were female and one was not stated, with a patient median age of 53 years (range, 9 to 87 years**).** Native valves without predisposition were affected in 16/37 (43%) cases. Predisposing conditions included: bicuspid aortic valve, 3 cases; prior valve replacements, 7 cases (aortic valve (AV),3 mitral valve (MV) 3, MV & AV,1) prior endocarditis, 2 cases (1 MV 1 AV), congenital heart disease, 3 cases, hypertrophic obstructive cardiomyopathy (HOCM), 2 cases, aortic regurgitation, 2 cases, and mitral regurgitation, 2 cases.

The valve(s) affected were: mitral valve in 15/37 (41%) of cases, aortic valve in 8/37 (22 %), mitral and aortic valve in 5 (14%), tricuspid valve in 3 (1 %), pulmonic valve in one case. The pulmonic and tricuspid valve was both affected in one case each, and in one case the mitral, aortic and tricuspid valves were affected. This information was not stated in four cases. The presumed source of infection was oral in 18 cases; colon in 2; intravenous drug use (IVDU) in 2 and unknown in 15. Valve replacement was performed in 16 patients **(**8 aortic valve replacement (AVR), 5 mitral valve replacement (MVR) with 1 mechanical, 1 mitral valve repair with the perforated posterior leaflet sutured, 3 MVR & AVR, 1-removal of vegetation, 1 pulmonary valve replacement (PVR) and atrial septal defect (ASD) closure and, 1 pulmonary valve (PV)/tricuspid valve (TV) repair)

Data on antimicrobial treatment was available on 34 patients with 11 patients receiving monotherapy (penicillin, 4; ceftriaxone 4; vancomycin 2; and cefotiam, 1) and 23 receiving two or more agents (penicillin + gentamicin, 8; ampicillin + gentamicin 3; ceftriaxone + gentamicin, 2; penicillin + levofloxacin, 1; penicillin + rifampin 2; and other combination agents, 7). Twenty-nine patients were reported to be cured; five deaths occurred in two patients that were treated with penicillin + gentamicin and three that were treated with ampicillin + gentamicin..

Discussion

The incidence of endocarditis in the US has been increasing and is estimated to be 15 per 100,000 population in 2011 for native valve endocarditis [40,41] with ~ 70% being community acquired [42]. Prosthetic valve endocarditis represents ~ 20% of endocarditis cases and occurs in 1-6% of patients with a prosthetic valve [43] with equal frequency in aortic and mitral valves [44-49] As to etiology, Holland et al. [50] noted that streptococci and enterococci account for 80-90% of cases "in which a diagnosis is made" and that 80% have underlying heart disease. Only 57% (21/37) of our cases had underlying heart disease reported. Fowler et al. [51] summarized the etiological agents in 1,779 cases of confirmed endocarditis and reported that 42.1% were due to staphylococci, 29.6% were due to streptococci, 10.6% were due to enterococci, 3.8% due to *Haemophilus* species, *Aggregatibacter* species, *Cardiobacterium hominis*, *Eikenella corrodens,* and *Kingella* species **(** HACEK) and non-HACEK gram negative bacteria, 1.8% were due to fungi, 13% were polymicrobial, 3.1% were due to "other species" and 8.1 % were culture negative. While they note *Gemella haemolysans* as a causative agent in six cases, no mention was made of *G. morbillorum* [50].

Gemella morbillorum is part of the human oral, intestinal and female genital tract flora that can cause a variety of infections. Its true incidence in human infections is likely to be underestimated as it is difficult to identify and is often misidentified. As new technologies as matrix assisted laser desorption ionization-time of flight (MALDI TOF) become more prevalent it is likely to gain increasing pathogenic recognition. Additionally, its antimicrobial susceptibilities have been poorly studies and optimal antimicrobial therapy is ill-defined.

Our report and analysis of 37 cases of *G. morbillorum* endocarditis shows the median age of our patients as 53 years which is comparable to 57.9 years noted by Holland et al. [50] while our male to female ratio was ~ 2.5:1 comparted to 1.7:1 they reported. They [50] report valvular involvement 25-45% MV alone, 5-36% AV alone, 0-35% AV and MV and TV and PV rarely involved. In our series, mitral valve was affected in 15/37 (41%) of cases, aortic valve in 8/37 (22 %); our rates were similar with rare involvement of tricuspid valve in 3 (8%), pulmonic valve (one case) and the unusual involvement of the pulmonic and tricuspid valve in one case each, as well as one case of the trivalve (mitral, aortic and tricuspid) involvement, but we had a lower rate of mitral and aortic valve involvement (5 cases, 14%).

Therapy for *G. morbillorum* endocarditis is poorly defined. Holland et al. [50] suggest therapy similar for that of viridans streptococcal endocarditis. In their review, Elsayed and Zhang [5] did not analyze clinical data of their cases nor review their therapy.

Buu-Hoi et al. [52] reported the antimicrobial susceptibility of five strains of *G. haemolysans* to 21 antimicrobial agents and found that all strains were susceptible to penicillin G, ampicillin, and vancomycin but had low level resistance to aminoglycosides. They noted synergy between penicillin and gentamicin and recommended this combination for therapy.

Baghdadi et al. [53] collected 14 *Gemella* isolates (not speciated) and noted 7/8 (87.5%) blood culture isolates were susceptible to the beta-lactam agents tested (penicillin, ceftriaxone, cefotaxime, and meropenem). Vancomycin was active against 13/14 (93%) isolates, clindamycin and erythromycin against 12/14 (86%) and levofloxacin against 7/14 (50%) of isolates. Clinically, all patients treated with beta-lactam agents were cured. But they suggested susceptibility testing for individual patients to guide therapy.

Data on antimicrobial treatment of cases showed 8/11 patients received beta-lactam monotherapy and 23 received two or more agents (penicillin + gentamicin, 8; ampicillin + gentamicin 3; Twenty-nine patients were reported to be cured; five deaths occurred in 2/8 patients treated with penicillin + gentamicin and in all three that were treated with ampicillin + gentamicin. When data was available there was no correlation with susceptibility of the isolates and mortality. Most susceptibility data on *G. morbillorum* comes from the individual case reports that use diverse methods and criteria for susceptibility. Goldstein et al. (unpublished observation) studied the susceptibility of 11 *G. morbillorum* isolates and noted 36% metronidazole resistance (MIC >32 µg/ml), and occasional clindamycin and levofloxacin resistance. Otherwise, *G. morbillorum* was very susceptible in vitro to the beta-lactam agents tested except for cefoxitin where 5/11 isolates had MICs $\geq$ 4 µg/ml. No recommendations can be made based on such sparse data, however, the five deaths of our patients occurred with combined therapy of penicillin/ampicillin plus gentamicin.

Zolezzi et al. [54] studied 26 erythromycin-resistant *Gemella* spp (not speciated) isolates and reported all were linezolid susceptible but 46% were tetracycline resistant. Biavasco et al. [55] studied four strains of *Gemella* spp. and reported all were susceptible to oritavancin.

Gemella morbillorum is a rarely isolated bacterium with an oral and gastroenterological ecological niche. This pathogen is challenging to isolate in culture and there is no systematic, supportive susceptibility information. Clinicians and microbiologists need to be aware of its pathogenic potential to cause endocarditis and we await more data about this emerging pathogen.

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Conflict of interests

All authors have no conflicts of interest.

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