Case report

Percutaneous coronary intervention-associated Actinomyces oris

Walaa Saeed\textsuperscript{a,b,}\textsuperscript{*}, Mohammad Adam\textsuperscript{a}, Tasneem A. Abdallah\textsuperscript{b,c}, Ali S. Omrani\textsuperscript{b,c}

\textsuperscript{a}Department of Medicine, Hamad General Hospital, Hamad Medical Corporation, Doha, Qatar
\textsuperscript{b}Division of Infectious Diseases, Department of Medicine, Hamad Medical Corporation, Doha, Qatar
\textsuperscript{c}Communicable Disease Center, Hamad Medical Corporation, Doha, Qatar

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A B S T R A C T

Coronary artery interventions are safe procedures yet have a risk of stent infection, bacteremia and sepsis, events that are rare but with high morbidity and mortality sequel. A few prior cases had reported post percutaneous coronary intervention (PCI) infections, abscesses and sepsis due to Staphylococcus aureus, followed by Pseudomonas aeruginosa. Cardiac Actinomyces infections are extremely rare. Here we report a case of a 50 year old patient who developed a post intervention Actinomyces oris epidermal abscess occluding right coronary artery with subsequent bacteremia eventually requiring open heart surgery. He was treated during and thereafter with IV penicillin and ceftriaxone for almost 8 weeks. We highlight during this review the available literature regarding risk factors, the possible theories of acquiring such bacterium at this unusual site as well as our patient’s course and treatment outcome.

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Introduction

Actinomyces species are anaerobic, Gram-positive, filamentous bacteria which are normal commensals of the human oral cavity, gut and female genital tract. More than 20 species have been described, with Actinomyces israelii being the species mostly commonly associated with human infections [1,2]. Actinomyces infections are usually the result of disruption of mucosal barriers secondary to trauma, surgical procedures or foreign bodies, leading to bacterial invasion of deeper tissues, and rarely, the blood stream [3,4]. Actinomycosis is usually categorized according to the body site affected as oro-cervico-facial, thoracic and abdominal-pelvic forms [1,4]. Typical clinical presentation is one of subacute progression with abscess formation and eventual fistulization into an internal anatomic space or external sinus drainage. Clinical and radiological presentation may mimic malignant diseases or chronic infections such as tuberculosis [4,5].

The risk of infective complications in association with percutaneous coronary interventions (PCI) is generally very low [6]. Though rare, PCI-associated infections result in high rates of morbidity and mortality [7]. Clinical presentation is usually in the form of recurrent stent thrombosis or abscess formation, or occasionally as blood stream infection or aneurysm [8]. Staphylococcus aureus and Pseudomonas aeruginosa are the bacteria most frequently implicated in coronary stent infections [9–12]. Such infections typically present within a few days or weeks from the procedure [10]. Late presentations are considered rare [13,14]. We herein report a case of iatrogenic pericardial actinomycosis presenting four months after percutaneous coronary artery stenting.

Case report

A 50 year old man with history of type 2 diabetes mellitus and past tobacco smoking underwent elective balloon angioplasty of the right coronary artery (RCA) in October 2018. The procedure was unsuccessful due to complete occlusion of the RCA lumen. A follow up elective procedure was performed 3 months later during which successful retrograde canalization of the RCA was achieved and three drug-eluting stents were placed.

Three months after the procedure, he presented with a history of left sided pleuritic chest pain radiating to the left arm. The pain was exaggerated by physical exertion and breathing, and was relieved by rest. A working diagnosis of unstable angina was made on the basis of ECG showing left axis deviation and poor R wave progression with stable serial troponin levels. Coronary angiography showed complete occlusion of the RCA stent, in addition to progression of coronary artery disease to involve three additional vessels including the left main trunk (Fig. 1A). Transthoracic echocardiography showed evidence of a 41 by 29 mm epicardial mass near the lateral annulus of the tricuspid

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valve (Fig. 1B). The lesion was not seen on previous echocardiography. Cardiac magnetic resonance imaging (MRI) showed the mass to be of cystic nature encasing the proximal to distal stented segments of the RCA (Fig. 2A and B). The patient subsequently developed recurrent nitrate-responsive chest pain with fever and rigors. His oral temperature was 38.7 degrees Celsius with stable blood pressure and pulse rate. ECG showed new ST segment elevation in the inferior lead with an associated rise in serum troponin T from 91 ng/L to 1140 ng/L. Blood work-up was also significant for C-reactive protein (CRP) 151 mg/L and procalcitonin 16.5 ng/mL.

Empirc therapy with intravenous piperacillin-tazobactam and vancomycin was started. Five days later, a provisional blood culture report described the presence of filamentous Gram-positive bacteria; later identified using automated Matrix Assisted Laser Desorption Ionization Time-of-Flight (MALDI-TOF) mass spectrometry (VITEK MS, bioMérieux, Marcy-l’Étoile, France) as *Actinomyces oris*. Antimicrobial therapy was switched to penicillin G 1.2 g 4 hourly. He was taken for surgery and had three vein grafts applied to the obtuse and marginal branches as well as a left internal mammary artery graft to the left anterior descending artery. In addition, an abscess around the RCA was de-roofed and a fistulous communication between the abscess cavity in the pericardium and the right atrium was closed. The initial RCA stent was hanging in the middle of the abscess cavity. Cultures of surgical tissues did not yield any growth. Unfortunately, no tissue material was submitted for histopathological examination. The post-operative course was unremarkable. The patient was discharged home with arrangements for outpatient daily intravenous ceftriaxone therapy for six weeks followed by oral amoxicillin to complete a total of six months of antimicrobial therapy. The patient remains well with no clinical, biochemical or radiological evidence of relapse of infection.

**Discussion**

We herein report an unusual case of cardiac actinomycosis presenting several months after PCI. It is believed that coronary
stent infection occur as a result of inoculation at the time of stent placement, or due to hematogenous spread from another source of infection [8]. Important risk factors for stent infection include older age, difficult vascular access, extended duration of the procedure and repeated catheterizations by the same vascular access site [6]. In this report, two PCI attempts, three months apart, were required to achieve successful recanalization. It is possible that excessive manipulation has contributed to the ensuing infective complication.

The final diagnosis of PCI-related cardiac actinomycosis is based on a combination of radiological, microbiological and intraoperative findings. Cultures of tissue obtained during surgery were negative. This is not surprising given that the patient received at least 4 days of intravenous piperacillin-tazobactam followed by 4 days of penicillin G prior to his surgery.

The clinical presentation of acute coronary syndrome and stent occlusion is common in patients with PCI-associated infections [6–8]. The presence of fever and high inflammatory markers, as reported here, should raise concern for infection as a rare but potentially serious complication of PCI [12]. The probable sequence of events in our patient is that a slowly growing actinomycotic abscess encasing the RCA eventually resulted in cardiac ischemia and clinical presentation with stable angina without evidence of infection. Subsequently, fistulization into the right atrium resulted

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**Table 1**

Reports of cardiac actinomycosis.

| Reference | Age (years) | Gender | Species | Sites involved | Notable medical history | Surgical Intervention | Antimicrobial therapy | Outcome |
|-----------|-------------|--------|---------|---------------|-------------------------|----------------------|----------------------|---------|
| Bellanti, 2017 [16] | 45 | Male | A. israelii | Pericardium | Recent percutaneous lung biopsy | Yes | Clindamycin | Alive |
| Broly, 2016 [17] | 52 | Female | A. odontolyticus | Pericardium | Asymptomatic dentigerous cyst | Yes | Doxycycline | Alive |
| Cole, 1982 [18] | 24 | Female | Actinomyces sp | Pericardium | None | Yes | Penicillin | Alive |
| Fife, 1991 [19] | 41 | Female | Actinomyces sp | Pericardium | None | Yes | Penicillin | Alive |
| Grundmann, 2010 [20] | 66 | Male | A. viscosus | Aortic valve | Prosthetic aortic valve | No | Penicillin | Alive |
| Hamed, 1998 [21] | 81 | Male | A. viscosus | Aortic valve | None | No | Ceftriaxone | Alive |
| Huang, 1995 [22] | 55 | Female | A. meyeri | Mitral valve | None | No | Ampicillin-sulbactam | Alive |
| Jánosuti, 2004 [23] | 48 | Male | A. israelii | Pericardium | None | Yes | Penicillin | Alive |
| Julian, 2005 [24] | 43 | Female | A. viscosus | Aortic valve | None | Yes | Ceftriaxone | Alive |
| Kottam, 2015 [25] | 30 | Female | A. turicensis | Eustachian valve and intra-abdominal | Intrauterine device insertion | Yes | Penicillin and imipenem | Alive |
| Litwin, 1999 [26] | 65 | Male | A. israelii | Mitral valve | Rheumatic heart disease | No | Penicillin | Alive |
| Litwin, 1999 [27] | 68 | Male | A. odontolyticus | Pericardium and pleura | Gastroentery for gastric carcinoma | Yes | Ceftriaxone | Alive |
| Llenar-Garcia, 2012 [28] | 20 | Male | A. israelii | Pericardium and liver | Esophagectomy and colonic interposition | Yes | Imipenem and amiakacin | Alive |
| Mack, 2014 [29] | 61 | Male | A. odontolyticus | Pericardium | Needle aspiration of Para tracheal lymph nodes | Yes | Piperacillin-tazobactam and ciprofloxacin | Died |
| Mac Neal, 1946 [30] | 39 | Male | A. septicus | Mitral valve | None | No | Penicillin | Alive |
| Makaryus, 2005 [31] | 75 | Male | A. israelii | Pericardium | Percutaneous coronary intervention and colectomy | Yes | Doxycycline | Alive |
| Moffatt, 1996 [32] | 48 | Male | A. meyeri | Aortic valve | Rheumatoid arthritis | Yes | Penicillin | Alive |
| Mohan, 1974 [33] | 51 | Female | A. israelii | Pericardium | None | Yes | Not reported | Alive |
| Nishizawa, 2018 [34] | 56 | Male | A. meyeri | Pericardium and lung | Parkinson’s disease with psychosis | Yes | Penicillin and doxycycline | Alive |
| Oddo, 2007 [35] | 34 | Male | Actinomyces sp | Mitral valve | Rheumatic heart disease | No | None | Died |
| Oh, 2005 [36] | 33 | Male | A. odontolyticus | Tricuspid valve | Intravenous drug use | No | Penicillin and metronidazole | Alive |
| Orloff, 1988 [37] | 43 | Male | A. israelii | Pericardium | Blunt chest trauma | Yes | Penicillin and clindamycin | Alive |
| Radu, 2018 [38] | 14 | Male | A. israelii | Lung and myocardium | None | No | None | Died |
| Sakaguchi, 2012 [39] | 60 | Male | A. druse | Pericardium and liver | None | Yes | Ampicillin-sulbactam | Alive |
| Shinagawa, 2002 [40] | 42 | Male | A. israelii | Pericardium and lung | None | Yes | Penicillin and minocycline | Alive |
| Slutzker, 1989 [41] | 36 | Male | Actinomyces sp | Pericardium | None | Yes | Penicillin | Alive |
| Stokes, 1951 [42] | 27 | Female | A. muris | Mitral and aortic valves | Rheumatic heart disease | No | Chloramphenicol | Alive |
| Toom, 2018 [43] | 55 | Female | A. israelii | Mitral and aortic valve | Hypertrophic obstructive cardiomyopathy | No | Penicillin | Alive |
| Westling, 2002 [44] | 40 | Female | A. funkei | Tricuspid valve | Intravenous drug use | No | Cefuroxime, clindamycin and rifampin | Alive |
in translocation of Actinomyces from the abscess cavity to the blood stream and was associated with systemic sepsis and the isolation of the bacteria from blood cultures.

We identified only one previous report of possible PCI-associated cardiac actinomycosis. The patient was a 75 year old man who had undergone PCI for coronary artery disease 4 months prior to his hospitalization, in addition to recent surgical intervention for bowel perforation. Echocardiogram showed evidence of a thickened pericardium and a large pericardial effusion. A. israelii was isolated from pericardial fluid cultures [15]. It is not clear this was related to the recent coronary intervention or from an intra-abdominal source.

Cardiac actinomycosis is generally rare. Our search of the literature yielded a total of 29 cases of cardiac actinomycosis (Table 1) [15–43]. The majority of cases were males and the median age was 45 years (range 14–81). The commonest site of involvement was the pericardium (15, 51.7 %) followed by one or more cardiac valves (12, 41.4 %). Right-sided valvular involvement was reported in two cases, both in association with intravenous drug use [35,43]. A. israelii (11, 37.9 %) and A. odontolyticus (4, 13.8 %) were the most frequently reported causative species, though speciation was not always available. Management involved surgical intervention in the majority (18, 62.1 %) of the reported cases. Moreover, beta-lactams were the most commonly used antimicrobial therapy agents, as single agents (14, 58.3 %) or in combination (8, 33.3 %). The main reason for use of beta-lactam alternatives was history of penicillin allergy [15,16] or in-vitro non-susceptibility of the isolated strains [17,41].

Overall survival was remarkably good (26, 89.7 %). Two young patients were diagnosed from post-mortem cultures. One was a 17-year old man with rheumatic heart disease who died with mitral valve endocarditis, while the second patient was a 14-year old boy without any significant past medical history [34,37]. The third death was reported in a 61 year old patient with pericardial actinomycosis in association with metastatic squamous cell lung cancer [30]. In this report, early appropriate antimicrobial therapy, timely surgical intervention, removal of the infected tissue and stent and closure of the fistula all contributed to prompt clinical and microbiological response and overall successful outcome.

In summary, PCI-associated infection should be suspected in patients with ischemic manifestations associated with signs of systemic sepsis. Clinical evaluation should include blood cultures and cardiac imaging. Cardiac actinomycosis is rare. However, early recognition, appropriate antimicrobial therapy and surgical intervention are associated with excellent clinical outcomes.

The first authors (Walaa Saeed, Mohamed Adam) contributed equally to the writing and preparation of this article. Walaa Saeed, and Mohamed Adam have written the initial draft of the manuscript and performed the literature review. The draft was revised and updated by WS, MA with supervision from Tasneem Abdullah and Ali Omrani. WS and AO were part of the medical treating team. All the authors critically reviewed the initial and the final draft of the manuscript and approved it for submission.

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Credit authorship contribution statement

Walaa Saeed: Writing - original draft, Data curation, Writing - review & editing, Visualization. Mohammad Adam: Writing - original draft, Data curation, Writing - review & editing, Visualization. Tasneem A. Abdullah: Data curation, Writing - review & editing. Ali S. Omrani: Conceptualization, Writing - review & editing, Supervision, Funding acquisition.

Declaration of competing Interest

The authors report no declarations of interest.

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