



# Fatal myocardial microabscesses caused by methicillin-resistant *Staphylococcus aureus* in a burn patient

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**Abstract** Bacteremia- or sepsis-associated myocardial abscess is often an incidental postmortem diagnosis in patients who die of overwhelming septicemia. Myocardial abscess is more rarely the immediate cause of death as a consequence of abscess rupture or the cause of arrhythmia. We report a 66-year-old female who succumbed to sudden cardiac death with a hemodynamically stable methicillin-resistant *Staphylococcus aureus* (MRSA) bacteremia, while in recovery after an accidental thermal burn. Autopsy revealed extensive myocardial abscesses and an abscess in the pineal gland. Myocardial microabscesses should be considered a rare cause of sudden cardiac death in patients with hemodynamically stable MRSA bacteremia.

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## 1. Introduction

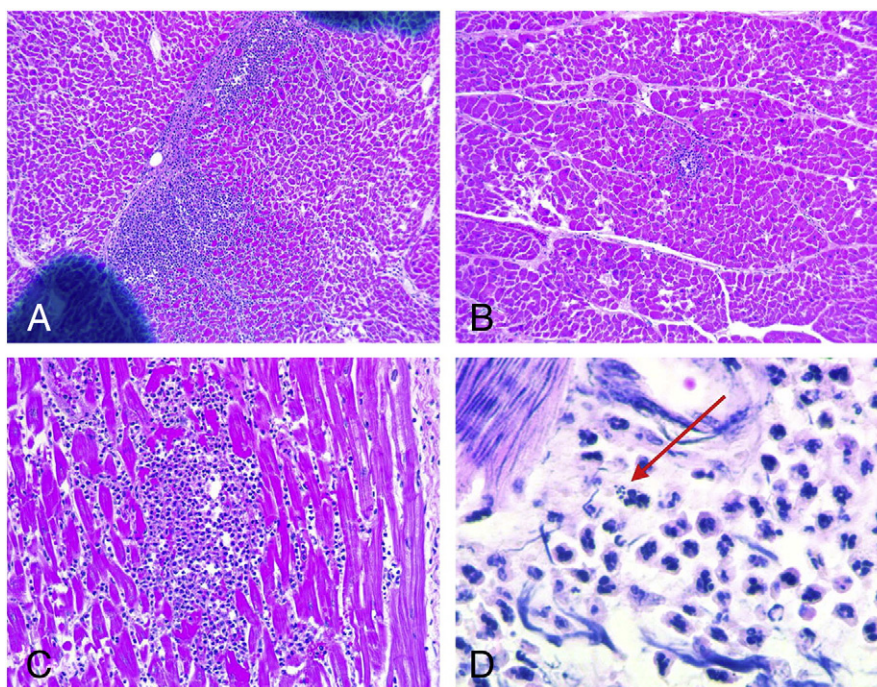
Severe burn injury conveys a significant risk for methicillin-resistant *Staphylococcus aureus* (MRSA) infection [1–3]. This can rarely result in an MRSA myocardial abscess found at autopsy [4–7]. Most patients with sepsis-associated myocardial infection die of the overwhelming systemic infection however in very rare circumstances death may be directly related to myocardial abscesses [8–11]. We described a case of sudden cardiac death in a burn patient with hemodynamically stable MRSA-bacteremia. Complete autopsy revealed extensive myocardial microabscesses with no evidence of endocarditis.

## 2. Case report

A 66-year-old female was admitted to the burn intensive care unit for an accidental thermal burn covering 50% body surface area. The past medical history was significant for type II diabetes mellitus and a 50-pack-year history of smoking. Results of blood biochemistry and hemogram were unremarkable. Chest radiography showed emphysematous changes. On days 6 and 8 of admission, she underwent surgical excision of burn wounds and skin grafting. Electrocardiogram showed normal sinus rhythm with frequent premature atrial contractions on day 8 and on day 11 a transthoracic echocardiography revealed a mild to moderate aortic stenosis and grade II ventricular diastolic dysfunction. The patient had a temperature up to 39.5 °C on day 13. Vancomycin was started for empiric treatment of positive blood cultures with *S. aureus* on day 14. The

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**Fig. 1** Myocardial microabscesses. A–C. Hematoxylin and eosin images of representative abscesses (original magnification 100 $\times$ , A and B; 200 $\times$ , C). D. Gram positive cocci within a microabscess (Gram Weigert stain, 400 $\times$ ).

speciation was subsequently reported to be vancomycin-sensitive MRSA. The patient remained hemodynamically stable and was afebrile after the first dose of vancomycin. Later that afternoon on day 14, she was unexpectedly found unresponsive with pulseless electrical activity arrest in her hospital room. Despite multiple rounds of resuscitation, the patient was pronounced dead one and half hours later. An autopsy was requested after obtaining consent from the next of kin.

Gross examination of the 340 gram heart revealed a bicuspid aortic valve with thickening and calcification of the leaflets. There was mild atherosclerosis of the left anterior descending artery and right coronary artery with focal eccentric narrowing of less than 50%. Valvular vegetations and abscesses were not grossly identified. Random sections of the septum and anterior, posterior and lateral walls of the left ventricle at both the apex and base of the heart revealed extensive microabscesses of 2 mm or less in size within the myocardium (Fig. 1A–C). Two or more microabscesses were observed in 7 of the 8 sections taken of myocardium. Gram Weigert stains showed Gram positive cocci within microabscesses (Fig. 1D), consistent with MRSA infection in the circulation. Serial sections of the atrial-ventricular node, however, did not reveal microabscesses. Histologically, there was no evidence of valvular endocarditis. A microabscess was also seen in the pineal gland, but not in other organs including the lungs, liver, and kidneys.

Other significant autopsy findings include extensive thermal burns status post allografts to the upper extremities, back and face; microvascular disease of the coronary

arteries; small (<0.5 cm) remote scars within the left ventricle; a remote microinfarct in the frontal lobe of the brain; acute splenitis; and emphysematous change of lungs with focal edema and hemorrhage. An unexpected combined squamous cell and small cell carcinoma (2.5 cm) with metastasis to two of four peribronchial lymph nodes in the left upper lung was also observed.

### 3. Discussion

Myocardial abscess is a rare clinical entity and rarely seen outside of the autopsy setting. The incidences of myocardial abscess reported in several large autopsy series prior to 1970 were 0.2% of 14,160 cases between 1929 and 1942, 0.24% of 1646 cases between 1940 to 1954, 1.52% of 1251 cases between 1955 and 1961, and 0.18% of 4,560 cases between 1953 and 1964 [4–6]. Patients usually died of the overwhelming septicemia without clinical cardiac symptoms. Sepsis-associated myocardial abscesses were often multiple and minute and were commonly associated with disseminated abscesses of the other internal organs, most frequently in lungs, kidneys and the brain. A later large series of autopsies between 1967 and 1977 reported 0.45% of 3084 cases had myocardial abscesses unassociated with infective endocarditis [7]. Over the past few decades, myocardial abscesses were most commonly found in conjunction with infective endocarditis of native or prosthetic valves [12–14]. Perivalvular areas, therefore, are the most common site of involvement. Despite the calcified congenital bicuspid aortic

valve being at higher risk of secondary bacteremic seeding, endocarditis was not grossly or microscopically identified in the cardiac valves of this patient. The widespread microabscesses within the myocardium are consistent with blood-stream dissemination of MRSA infection. Interestingly, these microabscesses were only seen in the myocardium of heart and the pineal body of brain. The reason for such a restricted bacteria-associated dissemination of MRSA infection in this case is not known.

*Staphylococcus* is one of the most common microorganisms causing cardiac infection [5,7,15]. Given the propensity for *S. aureus* to invade damaged skin and cause bacteremia, MRSA infection, found in 1–24% in hospitalized patients with burn wounds, has become a significant risk factor for morbidity and mortality in the intensive care burn unit [1–3]. Bacteremia- or sepsis-associated cardiac infections convey a high mortality rate in patients with burn injury [15,16]. In an early study of cardiac infection in 3064 patients with burn injury, the incidence of cardiac infection involving endocardium and/or myocardium declined from 3.3% between 1953 and 1963 to 1.1% between 1964 and 1970 with an overall 95% mortality rate [15]. With the advance of antibiotics therapy, endocarditis was reported in only 0.4% of 1250 patients with a burn injury between 2003 and 2006 [16].

Because myocardial abscesses are most frequently found at autopsy, it suggests an opportunity for imaging to identify these earlier in the process. In fact, transesophageal or transthoracic echocardiography, computed tomography scan, magnetic resonance imaging and indium-111 leukocyte scintigraphy have been applied to improve the detection of cardiac infection, mainly focusing on perivalvular abscesses associated with endocarditis [13,14,17–20]. However, these imaging modalities are unlikely to identify disseminated minute microabscesses of 1–2 mm in size as seen in our patient.

In only rare case reports, myocardial abscess was the immediate cause of death as a consequence of rupture of a large abscess or intractable arrhythmia [8–11]. Tanaka et al. reported a burn patient who died of rupture of a myocardial abscess within the left ventricular free wall [8]. Khan et al. reported a patient with myocardial abscesses and fatal cardiac arrhythmia in the presence of MRSA bacteremia but absence of infective endocarditis [11]. Our patient, was most similar to this reported cause of death. Specifically, although the immediate cause of death cannot be definitively ascertained, it is most likely due to arrhythmia induced by extensive myocardial microabscesses as a consequence of MRSA bacteremia, a complication from thermal injury.

In summary, we present an unusual case of MRSA bacteremia-associated myocardial microabscesses resulting in sudden cardiac death in the absence of overwhelming sepsis or endocarditis. Myocardial microabscesses

should be considered as one of the immediate causes of sudden cardiac death in patients with hemodynamically stable MRSA bacteremia.

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