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LETTER TO THE EDITORS

Cardiac melanoma metastases as a cause of sudden cardiac death

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Sirs:

Secondary, metastatic cardiac tumors are defined as spread of distant tumor cells to any structure of the heart including peri-, epi-, myo- and endocardium as well as coronary vessels [1–3]. While these masses are rarely found ante mortem, they are identified in 0.7–3.5% of autopsies [3]. The vast majority of them remains clinically silent [1–3]. We present a case of cardiac melanoma as a rare cause of sudden cardiac death.

A man in his 80s with a past medical history of hypertension collapsed while having breakfast with his wife, who immediately initiated cardiopulmonary resuscitation (CPR) and called emergency medical services (EMS). Upon EMS arrival after 15 min, his Glasgow Coma Scale was 3 and initial electrocardiography revealed asystole. Under continuous CPR, the patient was transferred to our institution. Upon arrival, after a total of 1 h of CPR (15 min bystander, 35 min EMS, 10 min intrahospital) and persisting asystole, arterial blood gas testing revealed a severe lactic acidosis (pH 6.7; base excess − 32.7 mmol/l; lactate 23 mmol/l; anion gap 33.3 mmol/l; pCO_2 30.9 mmHg) and hyperkalemia of 6.7 mmol/l. CPR was discontinued and the patient finally died. During inspection of the corpse, a pigmented, left plantar mass alongside multiple smaller satellite lesions was noted (Fig. 1a). Due to its asymmetry, irregular borders, color, diameter of 40 × 38 mm and ulcerations, a melanoma was suspected. Clinical cause of death was cardiogenic shock in the setting of a suspected melanoma. On autopsy, the left plantar lesion showed melanocytes infiltration of the entire cutis and subcutis (Clark Level V, Breslow depth 27 mm) with invasion of blood and lymphatic vessels, confirming the diagnosis of left plantar melanoma (Fig. 1b, c).

When inspecting the heart macroscopically, multifocal pigmented masses, up to 20 mm in size, suspicious of cardiac metastases in both atria and ventricles infiltrating epi-, myo- and endocardium were identified (Fig. 1d). Microscopically, nests of atypical melanocytes infiltrating the myocardium with associated necrosis as well as lymphocyte and macrophage infiltrates were noted and a diagnosis of cardiac metastases of melanoma was established (Fig. 1e, f). Additionally, widespread melanoma metastases were found in lymph nodes, lungs, the entire gastrointestinal tract, thyroid and adrenal glands, pleura and peritoneum. Coronary sclerosis was moderate without significant stenosis or signs of a recent myocardial infarction. Cardiac hypertrophy was classified as low grade with left and right ventricular thickness of 12 and 4 mm, respectively. Per autopsy, cause of death was acute left and right heart failure in the setting of cardiac metastases of a left plantar melanoma (pT4a pN1c pM1c L1 V1 Pn0, UICC stage IV). According to his wife, the plantar ulceration had been noted for months but he had not seen his primary care physician for 7 years prior to his death. Within the last month, the wife had witnessed four episodes of unprovoked syncopes without prodromal symptoms, indicative of a rhythmogenic cause. Otherwise he had been in his usual state of health and was able to carry out all activities of daily living independently.

We here present a case of a sudden unexplained death with post-mortem evidence of melanoma and intracardiac metastases. Although not verified electrocardiographically (possibly due to insufficient bystander CPR), the abruptness of the index event and the history of syncope make an arrhythmia related sudden cardiac death most likely. Indeed, cardiac mestatasis have been described as the substrate for malignant arrhythmias [4, 5]. However, sudden cardiac death seems to represent a rare complication of heart metastases [1]. Glancy et al. noted a single case of sudden cardiac death in 70 patients with metastatic melanoma [6]. With regard to absolute numbers, cardiac metastases are most common in lung cancer (36–39%), followed by hematological

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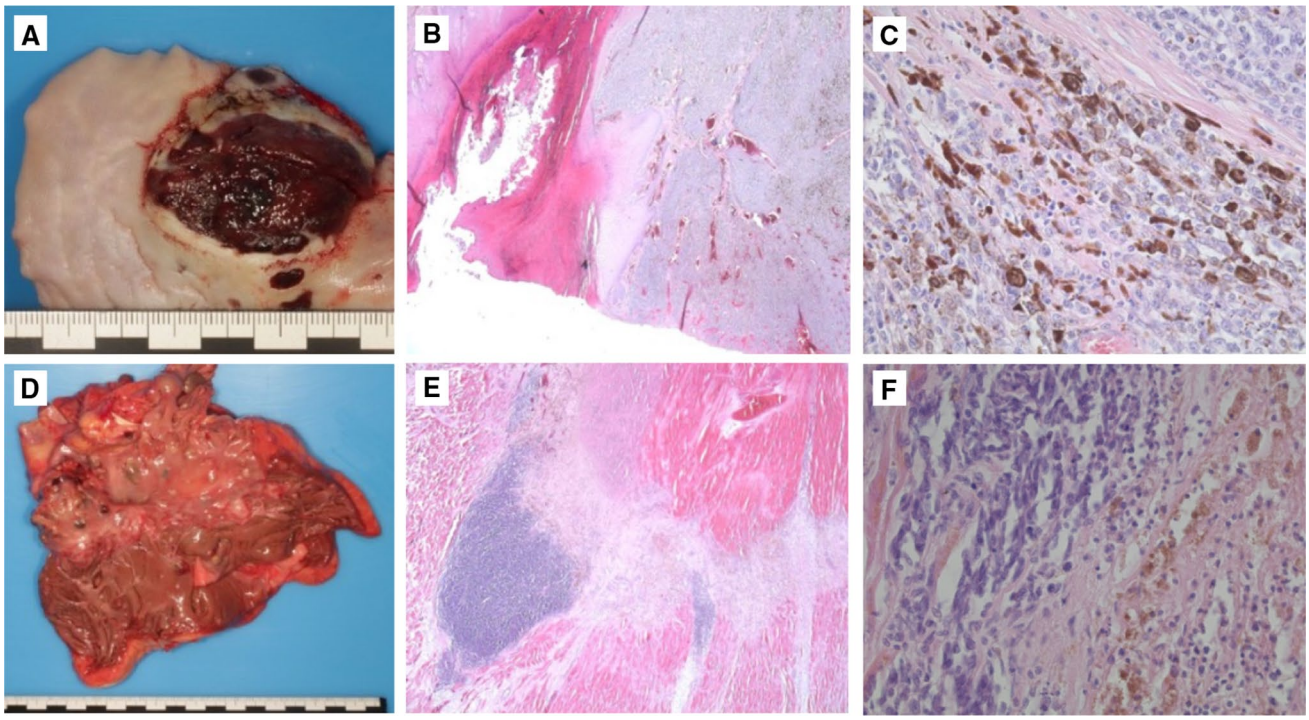

Fig. 1 **a** Macroscopic image of the left plantar foot shows a pigmented mass (40×38 mm) alongside multiple smaller satellite lesions fulfilling all ABCDE criteria (Asymmetry, irregular Borders, multiple Colors, Diameter > 6 mm, Evolution). **b, c** Stains demonstrate nests of atypical melanocytes infiltrating the entire cutis and subcutis. **d** Macroscopic image of the right atrium and ventricle shows multiple, pigmented lesions. **e, f** Stains demonstrate nests of atypical melanocytes infiltrating the myocardium, accompanied by necrosis, and lymphocyte and macrophage infiltrates. **b, c, e, f** Hematoxylin and eosin stains. **b, e** Original magnification ×2.5. **c, f** Original magnification ×40

(10–21%) and breast (10–12%) neoplasms [3]. Reflecting its lower overall prevalence, malignant melanoma accounts for only 4.4% of secondary cardiac tumors [7]. However, on autopsy, cardiac lesions were observed in 64% of patients who died of melanoma, which constitutes the highest rate among all neoplasms [6]. Cardiac infiltration may result from lymphatic or hematogenous spread as well as direct or transvenous extension [1–3]. For topographic reasons, lymphatic spread or direct extension first target the pericardium, whereas involvement of the myo- and endocardium is more common in hematogenous metastases [1–3]. Metastases of melanoma, therefore, most frequently occur in the myo- (98%), followed by the epi- (78%) and endocardium (73%) [6]. Most cardiac metastases are clinically silent (90%), which explains why very few of them are diagnosed ante-mortem [8]. If symptoms are present, they reflect tumor burden and layer of involvement. Pericardial infiltration can present as pericarditis or malignant pericardial effusion, whereas epi- or myocardial involvement can mimic acute coronary syndrome or result in arrhythmias and congestive heart failure. Intracavitary and endocardial lesions may cause out- and inflow tract obstruction or cardiac embolism. Rarely, compression or embolism of coronary arteries can lead to myocardial infarction [1, 2]. The plantar location of the primary lesion in our patient is uncommon and only found in 7% of melanomas. Diagnosis in these patients is often delayed resulting in more frequent systemic spread and poorer prognosis [9].

In conclusion, our case illustrates a rare cause of sudden cardiac death, namely cardiac metastases of melanoma. Myocardial metastases likely resulted in lethal tachyarrhythmias. With the present report, we aim to raise awareness for the clinically underdiagnosed condition of metastatic cardiac tumors. In addition, our case underlines the importance of an autopsy as well as a thorough post-mortem inspection of the corpse.

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Compliance with ethical standards

Conflict of interest Leon D. Kaulen: reports no disclosures. Franziska Tietz: reports no disclosures. Tanja Gradistanac: reports no disclo-

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