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CASE REPORT
Inherited cardiac conditions/cardiomyopathies

Myocarditis in a young male affected with monkeypox infection: a case report

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Background Concerns on monkeypox as a disease impacting global public health first emerged in May, 2022, and, since that time, has been identified in more than 50 countries. The condition mainly affects men who have sex with other men. Cardiac disease is a rare complication of monkeypox infection. Here, we describe a case of myocarditis in a young male subsequently diagnosed with monkeypox infection.

Case summary A 42-year-old male reported engaging in high-risk sexual behaviours with another male 10 days before presenting to the emergency department with chest pain, fever, maculopapular rash, and a necrotic chin lesion. Electrocardiography revealed diffuse concave ST-segment elevation associated with elevated cardiac biomarkers. Transthoracic echocardiography revealed normal biventricular systolic function without wall motion abnormalities. We excluded other sexually transmitted diseases or viral infections. Cardiac magnetic resonance imaging (MRI) findings suggested myopericarditis involving the lateral wall and adjacent pericardium. The results of polymerase chain reaction (PCR) tests of pharyngeal, urethral, and blood samples were positive for monkeypox. The patient was treated with high-dose non-steroidal anti-inflammatory drugs (NSAIDs) and colchicine and he recovered soon.

Discussion Monkeypox infections are generally self-limited, with most patients experiencing benign clinical outcomes, no hospitalizations, and few complications. This is a rare report of monkeypox complicated with myopericarditis. Management with high-dose NSAIDs and colchicine relieved our patient's symptoms, suggesting a similar clinical outcome as other idiopathic or virus-related myopericarditis.

Keywords Case report • Myocarditis • Myopericarditis • Monkeypox infection • Rash • Cardiac MRI

ESC Curriculum 2.3 Cardiac magnetic resonance • 6.6 Pericardial disease • 6.5 Cardiomyopathy

Learning points

- Monkeypox infection is generally self-limiting with low mortality.
- Scientific evidence suggests benign clinical outcomes with low rates of hospital admission and few serious complications.
- Pericardial and/or myocardial involvement can be found in patients with monkeypox infection.
- PCR positivity in multiple samples could predict a higher risk of the development of systemic complications.
- There is currently no specific treatment. NSAIDs and colchicine may be effective at relieving symptoms.

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Introduction

Since May 2022, the global monkeypox virus outbreak has spread to more than 50 countries, with males who have sex with other males being the most affected population.[1] This zoonotic DNA virus is transmitted through close contact with skin or mucosal lesions, large respiratory droplets, and fomites or is transmitted vertically. We do not know conclusively if transmission occurs through seminal and vaginal fluids. The most common clinical presentation involves maculopapular, vesicular, and ulcerative skin lesions. While cardiac involvement is unusual, a few cases of monkeypox-related myocarditis have been reported.[2,3] Herein, we present the case of a patient with myocarditis who was subsequently diagnosed with monkeypox infection.

Timeline

Day 1	• The patient presented with chest pain associated with fever, myalgias and diaphoresis • A pustular and necrotic lesion was found on the chin, besides a papular rash on the trunk and thighs • The patient was admitted to the cardiac intensive care unit (CICU) due to a suspicion of myocarditis
Day 2	• Treatment with colchicine 0.5 mg b.i.d., ibuprofen 600 mg t.i.d, and omeprazole 20 mg was started • Different samples were collected to rule out monkeypox and other possible infectious diseases • Preventive measures were carried out
Day 4	• PCR tests of skin lesion, pharyngeal, urethral, and blood samples for monkeypox turned out positive. • The patient was discharged from the CICU
Day 5	• All tests performed to rule out other infections turned out negative • New skin lesions (vesicles) emerged on the thighs
Day 6	• Cardiac MRI was performed, exhibiting findings consistent with myopericarditis
Day 7	• The patient was discharged from hospital

Case presentation: patient information, physical examination, diagnostic assessment, interventions, follow-up, and outcomes

A 42-year-old male presented to the emergency room with chest pain. His medical history was unremarkable except for a 4-month history of pre-exposure prophylaxis for HIV infection. Notably, the patient reported engaging in high-risk sexual behaviours with other males, most recently 10 days prior to presentation. His chest pain started 6 h before presentation, described as oppressive, enhanced with inspiration, without radiation, and not exercise-related. He had no clinical symptoms of heart failure. Moreover, he reported a 3-day history of fever (up to 38.5°C), diaphoresis, and myalgias.

The patient was haemodynamically stable, alert, and without dyspnoea. No abnormal heart sounds or murmurs were heard. During skin examination, a pustular, but not painful lesion with a necrotic centre was observed on his chin (*Figure 1*), and a maculopapular rash was observed on his trunk and proximal thighs. According to the patient, these lesions appeared within the preceding 5 days. Bilateral submandibular lymphadenopathy was also present.

Electrocardiography at admission showed sinus rhythm with diffuse ST-segment elevation in I, II, aVL, and V4–V6 associated with PR depression in those leads and PR elevation in aVR (*Figure 2*). Laboratory tests (*Table 1*) revealed mildly elevated C-reactive protein (9.3 mg/L; reference range 0–0.5 mg/L) without leukocytosis, elevated D-dimer (1957 ng/mL; reference range 0–500 ng/mL), and high-sensitivity troponin I (1072 ng/L; reference range 0–19.8 ng/L). Transthoracic echocardiography showed normal biventricular systolic function without wall motion abnormalities. We suspected myopericarditis, and the patient was admitted to the cardiac intensive care unit (CICU).

He was started on colchicine 0.5 mg b.i.d., ibuprofen 600 mg t.i.d., and omeprazole 20 mg. Given our patient's self-reported history of high-risk sexual behaviours, we investigated other potential infectious aetiologies. The chin lesion appeared highly suspicious for monkeypox, so the patient was isolated, and direct contact and droplet prevention measures were started. Skin, pharyngeal, urethral, anal, and blood samples were obtained and subjected to further testing. Two days later, all monkeypox PCR tests (except for the anal swab) showed positive results. We were also able to rule out syphilis, HIV, trichomoniasis, gonorrhoea, chlamydia, mycoplasma, Epstein–Barr virus, hepatitis B and C, cytomegalovirus, herpes simplex virus, and multiple respiratory viruses (enterovirus, adenovirus, influenza A, influenza B, measles, mumps, and parvovirus). Also, we performed a serological screening of autoimmune diseases often related to myopericarditis; here, all titres fell within normal ranges.

Cardiac MRI performed at admission revealed high T2 signal intensity on T2-STIR images with a patchy distribution on the basal and mid-lateral walls and mild thickening of the lateral pericardium (*Figure 3*). Increased T2 relaxation times (66–69 ms) were also present on the basal and mid-lateral segments (*Figure 4*). All the patient's cardiac signs were suggestive of myopericarditis. There was no increase of native T1 relaxation times (see Supplementary material online, *File S1*), increase of extracellular volume, nor early or late gadolinium enhancement (see Supplementary material online, *Files S2* and *S3*).

Three days after admission, the patient remained haemodynamically stable with resolved symptoms and progressively normalized myocardial biomarker levels. He was subsequently discharged from the CICU and transferred to an isolation room. Over the following days, some vesicles appeared on his skin, particularly his thighs (see Supplementary material online, *File S4*).

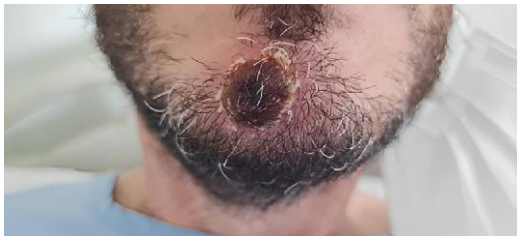

Figure 1 Pustular lesion with a necrotic centre on the patient's chin.

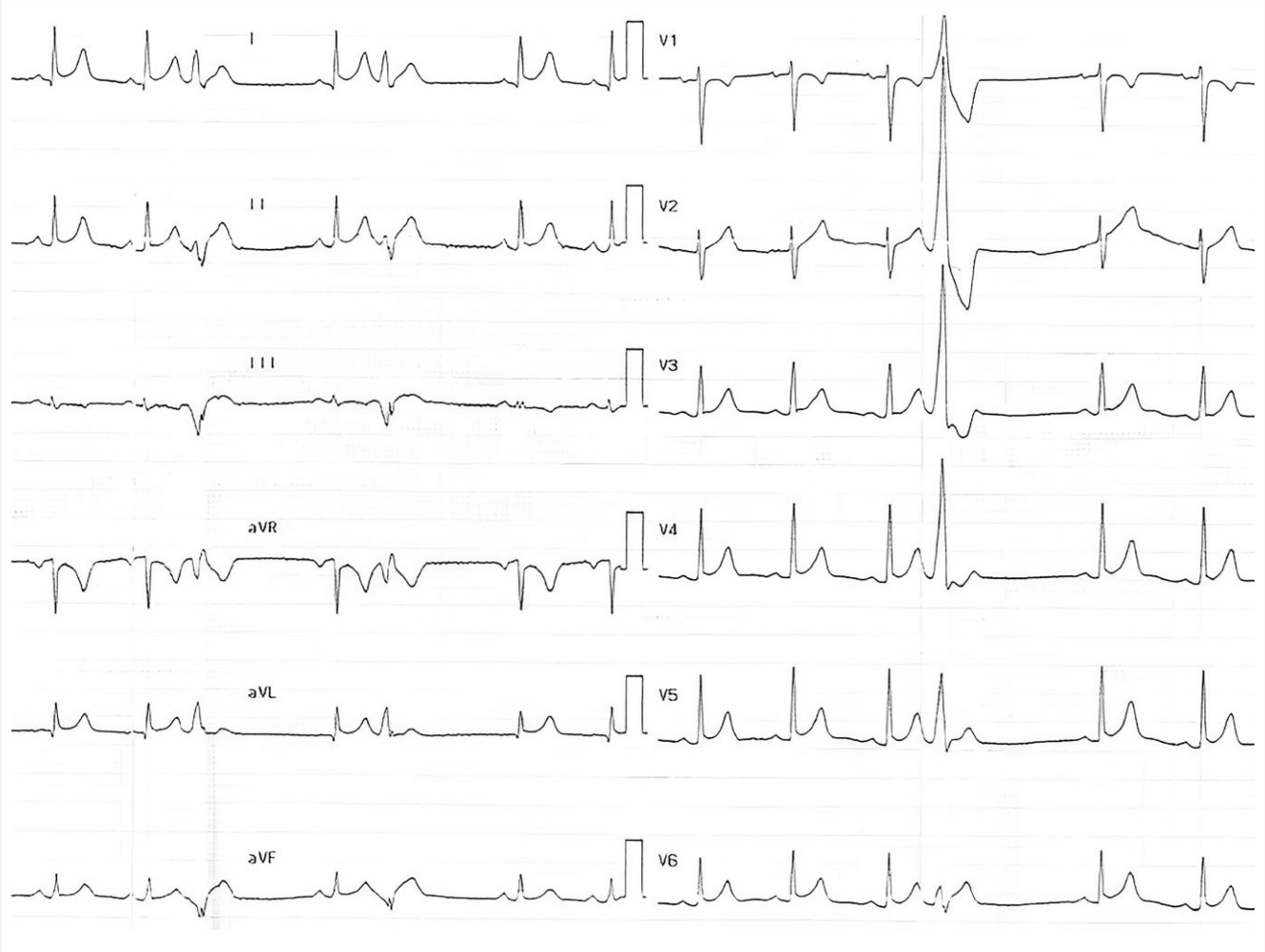

Figure 2 Diffuse ST-segment elevation in I, II, aVL, and V4–V6 associated with PR depression in those leads and PR elevation in aVR.

Given our patient's good condition, he was discharged home and subsequently followed up by the Cardiology and Infectious Disease Departments.

The patient received outpatient follow-up 1 month after admission. He had no cardiovascular symptoms, and we performed an echocardiographic control that showed good biventricular systolic function with no pericardial fluid. No follow-up cardiac MRI has been performed to this date.

Discussion

Endemic monkeypox infection is generally self-limited, with mortality rates going up to 10%.[4] The current outbreak, which started in May 2022, features a much lower case fatality ratio of ~0.07% of more than 81 000 cases diagnosed globally to date.[5] The largest international case series reported benign clinical outcomes with low hospitalization rates and no serious complications in most patients. Complications that required admission include pneumonitis, encephalitis, keratitis, and secondary bacterial infections. However, the presence of secondary myocarditis is rare, having been reported in only 0.4% of patients,[2] and there is only a single prior case report.[3]

Our patient presented with chest pain and diffuse ST-segment elevation in I, II, aVL, and V4–V6 associated with PR-segment depression in those leads and PR elevation in aVR. These signs suggested myopericarditis, with normal systolic function evidenced on echocardiography alongside increased cardiac biomarkers. The patient developed a maculopapular rash and necrotic chin lesion during admission. Cardiac MRI showed increased T2 signal intensity on STIR images and high T2 relaxation times on the basal and mid-lateral walls. Pharyngeal, blood, urethral, and skin lesion samples all tested positive for monkeypox. Autoimmune diseases, other sexually transmitted diseases, and viral infections were ruled out.

As with other observational monkeypox studies, our patient had an incubation period of 10 days and presented with skin lesions on his trunk and limbs that progressed in a typical manner. He also demonstrated regional lymphadenopathy near the pustular lesion.[1]

Our case also demonstrated several peculiarities. First, as described above, myopericarditis secondary to monkeypox infection is rare, although previously observed in some ACAM2000 vaccine trial participants.[6,7] Historically, this vaccine was used to prevent smallpox and was recently approved to prevent monkeypox infections. Unfortunately, ~1 in every 186 people develop myocardial and/or pericardial complications after the first dose of vaccine.[8] It should be noted that our patient was not recently vaccinated against smallpox or monkeypox.

Second, the patient presented a positive nucleic acid amplification by PCR in his blood sample. Serum testing is less common than skin or genital lesion tests, which can be carried out by swabbing, in patients potentially infected with monkeypox. In addition, ~7% of blood

Table 1 Laboratory testing

Variable	Patient's results	Reference ranges
Haemoglobin (g/L)	13.8	13.5–18
White blood cell count (10^9 cells/L)	6.9	4–10.5
Lymphocyte count (10^9 cells/L)	1.2	1.5–3.5
Creatinine (μmol/L)	85	59–103
D-dimer (ng/mL)	1957	0–500
Peak high-sensitivity troponin I (ng/L)	1072	0–19.8
C-reactive protein (mg/L)	9.3	0–0.5
NT-proBNP (pg/mL)	937	<450
Adenovirus antibodies (blood sample)	IgM–, IgG+	
Enterovirus antibodies (blood sample)	IgM–, IgG–	
Cytomegalovirus antibodies (blood sample)	IgM–, IgG+	
Toxoplasma gondii antibodies (blood sample)	IgM–, IgG+	
Rubella antibodies (blood sample)	IgM–, IgG+	
Influenza A virus (blood sample)	IgM–, IgG+	
Influenza B virus (blood sample)	IgM–, IgG+	
Chlamydia pneumophila antibodies (blood sample)	IgM–, IgG–	
Mycoplasma antibodies (blood sample)	IgM–, IgG+	
Epstein–Barr antibodies (blood sample)	IgM–, IgG+	
Measles antibodies (blood sample)	IgM–, IgG+	
Mumps virus antibodies (blood sample)	IgM–, IgG+	
Parvovirus antibodies (blood sample)	IgM–, IgG+	
Varicella-Zoster antibodies (blood sample)	IgM–, IgG+	
Reverse transcription PCR (RT–PCR) for SARS-CoV-2 RNA (nasopharyngeal swab)	Negative	
Hepatitis C virus antibodies (blood sample)	Negative	
HIV 1,2, antibodies and p24 antigen (blood sample)	Negative	
Reaginic treponema pallidum antibodies (blood sample)	Negative	
Total antibodies for treponema pallidum (blood sample)	Negative	
PCR for herpes simplex virus-1 (urethral swab)	Negative	
PCR for herpes simplex virus-2 (urethral swab)	Negative	
PCR for Epstein–Barr virus (urethral swab)	Negative	
PCR for cytomegalovirus (urethral swab)	Negative	
PCR for human herpesvirus-6 (urethral swab)	Negative	
PCR for *Neisseria gonorrhoeae* (urethral swab)	Negative	
PCR for *Chlamydia trachomatis* (urethral swab)	Negative	
PCR for *Mycoplasma* spp. (urethral swab)	Negative	
PCR for *Ureaplasma* spp. (urethral swab)	Negative	
Urine drug test	Negative	
PCR for monkeypox virus (skin lesions)	Positive	
PCR for monkeypox virus (nasopharyngeal swab)	Positive	
PCR for monkeypox virus (blood sample)	Positive	
PCR for monkeypox virus (uretral swab)	Positive	
PCR for monkeypox virus (rectal swab)	Negative	

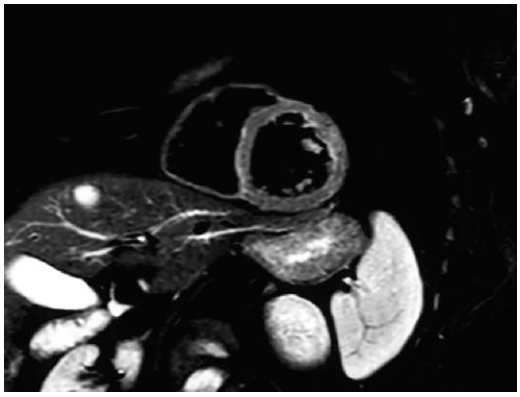

Figure 3 STIR sequence showing myocardial oedema on the basal and mid-lateral walls.

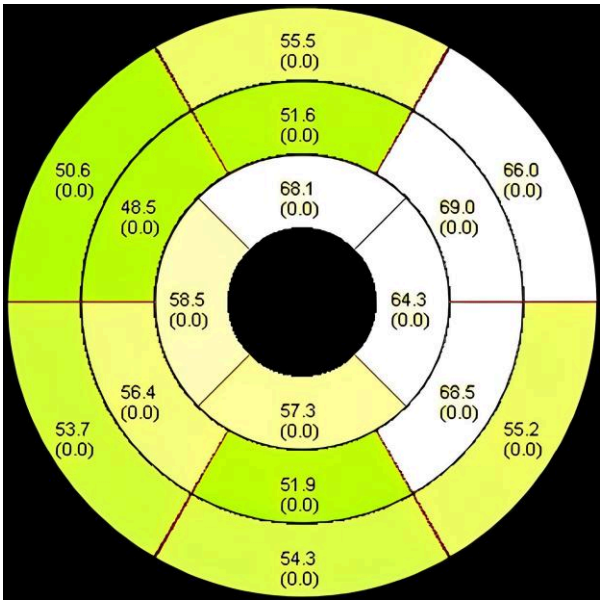

Figure 4 Increased T2 mapping values (66–69 ms) on the basal and mid-lateral segments.

samples produced positive PCR test results.[2] Although not yet supported by clinical evidence, we believe that patients with positive serum PCR tests might demonstrate higher viraemia and would therefore be at an increased risk of systemic complications like myocarditis.

To this date, there are no monkeypox-specific treatments. However, our patient improved remarkably following the administration of high-dose NSAIDs and colchicine. These clinical outcomes are similar to those of patients with other idiopathic or virus-related myopericarditis.

We remain in the early stages of the current outbreak, scientific data are scarce, and there has been little-to-no long-term follow-up of infected patients. Nevertheless, further reports and clinical trials can shed light on potential short- and long-term complications of monkeypox infections and their possible relationship to factors like viral load or the utility of serum PCR testing to predict systemic involvement.

Lead author biography

Julián Abdala Lizarraga is an attending cardiologist at Hospital General Universitario de Valencia, Spain. He has interests in clinical cardiology, electrophysiology, and acute cardiovascular care.

Supplementary material

Supplementary material is available at *European Heart Journal – Case Reports*.

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None.

Slide sets: A fully edited slide set detailing this case and suitable for local presentation is available online as Supplementary data.

Consent: The authors confirm that written consent for submission and publication of this case report, including image(s) and associated text, has been obtained from the patient in line with COPE guidance.

Conflict of interest: None declared.

Funding: None declared.

Data availability

The data underlying this article are available in the article and in its online supplementary material.

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