

# World Journal of *Clinical Cases*

*World J Clin Cases* 2022 May 6; 10(13): 3969-4326



**REVIEW**

- 3969 COVID-19 and liver diseases, what we know so far  
*Elnaggar M, Abomhaya A, Elkhattib I, Dawoud N, Doshi R*

**MINIREVIEWS**

- 3981 Amputation stump management: A narrative review  
*Choo YJ, Kim DH, Chang MC*

**ORIGINAL ARTICLE****Clinical and Translational Research**

- 3989 Solute carrier family 2 members 1 and 2 as prognostic biomarkers in hepatocellular carcinoma associated with immune infiltration  
*Peng Q, Hao LY, Guo YL, Zhang ZQ, Ji JM, Xue Y, Liu YW, Lu JL, Li CG, Shi XL*

**Retrospective Cohort Study**

- 4020 Role of clinical data and multidetector computed tomography findings in acute superior mesenteric artery embolism  
*Yang JS, Xu ZY, Chen FX, Wang MR, Cong RC, Fan XL, He BS, Xing W*

**Retrospective Study**

- 4033 Effect of calcium supplementation on severe hypocalcemia in patients with secondary hyperparathyroidism after total parathyroidectomy  
*Liu J, Fan XF, Yang M, Huang LP, Zhang L*
- 4042 Comparison of clinical efficacy and postoperative inflammatory response between laparoscopic and open radical resection of colorectal cancer  
*He LH, Yang B, Su XQ, Zhou Y, Zhang Z*
- 4050 Three-dimensional echocardiographic assessment of left ventricular volume in different heart diseases using a fully automated quantification software  
*Pan CK, Zhao BW, Zhang XX, Pan M, Mao YK, Yang Y*
- 4064 Clinical effect of ultrasound-guided nerve block and dexmedetomidine anesthesia on lower extremity operative fracture reduction  
*Ao CB, Wu PL, Shao L, Yu JY, Wu WG*
- 4072 Correlation between thrombopoietin and inflammatory factors, platelet indices, and thrombosis in patients with sepsis: A retrospective study  
*Xu WH, Mo LC, Shi MH, Rao H, Zhan XY, Yang M*

**Observational Study**

- 4084 High plasma CD40 ligand level is associated with more advanced stages and worse prognosis in colorectal cancer

*Herold Z, Herold M, Herczeg G, Fodor A, Szasz AM, Dank M, Somogyi A*

- 4097 Metabolic dysfunction is associated with steatosis but no other histologic features in nonalcoholic fatty liver disease

*Dai YN, Xu CF, Pan HY, Huang HJ, Chen MJ, Li YM, Yu CH*

**Randomized Controlled Trial**

- 4110 Effect of Xuebijing injection on myocardium during cardiopulmonary bypass: A prospective, randomized, double blind trial

*Jin ZH, Zhao XQ, Sun HB, Zhu JL, Gao W*

**META-ANALYSIS**

- 4119 Perioperative respiratory muscle training improves respiratory muscle strength and physical activity of patients receiving lung surgery: A meta-analysis

*Yang MX, Wang J, Zhang X, Luo ZR, Yu PM*

**CASE REPORT**

- 4131 Delayed diffuse lamellar keratitis after small-incision lenticule extraction related to immunoglobulin A nephropathy: A case report

*Dan TT, Liu TX, Liao YL, Li ZZ*

- 4137 Large vessel vasculitis with rare presentation of acute rhabdomyolysis: A case report and review of literature

*Fu LJ, Hu SC, Zhang W, Ye LQ, Chen HB, Xiang XJ*

- 4145 Primitive neuroectodermal tumor of the prostate in a 58-year-old man: A case report

*Tian DW, Wang XC, Zhang H, Tan Y*

- 4153 Bilateral superficial cervical plexus block for parathyroidectomy during pregnancy: A case report

*Chung JY, Lee YS, Pyeon SY, Han SA, Huh H*

- 4161 Primary myelofibrosis with thrombophilia as first symptom combined with thalassemia and Gilbert syndrome: A case report

*Wufuer G, Wufuer K, Ba T, Cui T, Tao L, Fu L, Mao M, Duan MH*

- 4171 Late contralateral recurrence of retinal detachment in incontinentia pigmenti: A case report

*Cai YR, Liang Y, Zhong X*

- 4177 Pregnancy and delivery after augmentation cystoplasty: A case report and review of literature

*Ruan J, Zhang L, Duan MF, Luo DY*

- 4185 Acute pancreatitis as a rare complication of gastrointestinal endoscopy: A case report

*Dai MG, Li LF, Cheng HY, Wang JB, Ye B, He FY*

- 4190** Paraneoplastic neurological syndrome with positive anti-Hu and anti-Yo antibodies: A case report  
*Li ZC, Cai HB, Fan ZZ, Zhai XB, Ge ZM*
- 4196** Primary pulmonary meningioma: A case report and review of the literature  
*Zhang DB, Chen T*
- 4207** Anesthesia of a patient with congenital cataract, facial dysmorphism, and neuropathy syndrome for posterior scoliosis: A case report  
*Hudec J, Kosinova M, Prokopova T, Filipovic M, Repko M, Stourac P*
- 4214** Extensive myocardial calcification in critically ill patients receiving extracorporeal membrane oxygenation: A case report  
*Sui ML, Wu CJ, Yang YD, Xia DM, Xu TJ, Tang WB*
- 4220** Trigeminal extracranial thermocoagulation along with patient-controlled analgesia with esketamine for refractory postherpetic neuralgia after herpes zoster ophthalmicus: A case report  
*Tao JC, Huang B, Luo G, Zhang ZQ, Xin BY, Yao M*
- 4226** Thrombotic pulmonary embolism of inferior vena cava during caesarean section: A case report and review of the literature  
*Jiang L, Liang WX, Yan Y, Wang SP, Dai L, Chen DJ*
- 4236** EchoNavigator virtual marker and Agilis NxT steerable introducer facilitate transseptal transcatheter closure of mitral paravalvular leak  
*Hsu JC, Khoi CS, Huang SH, Chang YY, Chen SL, Wu YW*
- 4242** Primary isolated central nervous system acute lymphoblastic leukemia with *BCR-ABL1* rearrangement: A case report  
*Chen Y, Lu QY, Lu JY, Hong XL*
- 4249** Coexistence of meningioma and other intracranial benign tumors in non-neurofibromatosis type 2 patients: A case report and review of literature  
*Hu TH, Wang R, Wang HY, Song YF, Yu JH, Wang ZX, Duan YZ, Liu T, Han S*
- 4264** Treatment of condylar osteophyte in temporomandibular joint osteoarthritis with muscle balance occlusal splint and long-term follow-up: A case report  
*Lan KW, Chen JM, Jiang LL, Feng YF, Yan Y*
- 4273** Hepatic perivascular epithelioid cell tumor: A case report  
*Li YF, Wang L, Xie YJ*
- 4280** Multiple stress fractures of unilateral femur: A case report  
*Tang MT, Liu CF, Liu JL, Saijilafu, Wang Z*
- 4288** Enigmatic rapid organization of subdural hematoma in a patient with epilepsy: A case report  
*Lv HT, Zhang LY, Wang XT*

- 4294 Spinal canal decompression for hypertrophic neuropathy of the cauda equina with chronic inflammatory demyelinating polyradiculoneuropathy: A case report  
*Ye L, Yu W, Liang NZ, Sun Y, Duan LF*
- 4301 Primary intracranial extraskeletal myxoid chondrosarcoma: A case report and review of literature  
*Zhu ZY, Wang YB, Li HY, Wu XM*
- 4314 Mass brain tissue lost after decompressive craniectomy: A case report  
*Li GG, Zhang ZQ, Mi YH*

**LETTER TO THE EDITOR**

- 4321 Improving outcomes in geriatric surgery: Is there more to the equation?  
*Goh SSN, Chia CL*
- 4324 Capillary leak syndrome: A rare cause of acute respiratory distress syndrome  
*Juneja D, Kataria S*

**ABOUT COVER**

Editorial Board Member of *World Journal of Clinical Cases*, Kai Zhang, PhD, Professor, Department of Psychiatry, Chaohu Hospital of Anhui Medical University, Hefei 238000, Anhui Province, China. zhangkai@ahmu.edu.cn

**AIMS AND SCOPE**

The primary aim of *World Journal of Clinical Cases* (*WJCC*, *World J Clin Cases*) is to provide scholars and readers from various fields of clinical medicine with a platform to publish high-quality clinical research articles and communicate their research findings online.

*WJCC* mainly publishes articles reporting research results and findings obtained in the field of clinical medicine and covering a wide range of topics, including case control studies, retrospective cohort studies, retrospective studies, clinical trials studies, observational studies, prospective studies, randomized controlled trials, randomized clinical trials, systematic reviews, meta-analysis, and case reports.

**INDEXING/ABSTRACTING**

The *WJCC* is now indexed in Science Citation Index Expanded (also known as SciSearch®), Journal Citation Reports/Science Edition, Scopus, PubMed, and PubMed Central. The 2021 Edition of Journal Citation Reports® cites the 2020 impact factor (IF) for *WJCC* as 1.337; IF without journal self cites: 1.301; 5-year IF: 1.742; Journal Citation Indicator: 0.33; Ranking: 119 among 169 journals in medicine, general and internal; and Quartile category: Q3. The *WJCC*'s CiteScore for 2020 is 0.8 and Scopus CiteScore rank 2020: General Medicine is 493/793.

**RESPONSIBLE EDITORS FOR THIS ISSUE**

Production Editor: *Xu Guo*; Production Department Director: *Xiang Li*; Editorial Office Director: *Jin-Lei Wang*.

**NAME OF JOURNAL**

*World Journal of Clinical Cases*

**ISSN**

ISSN 2307-8960 (online)

**LAUNCH DATE**

April 16, 2013

**FREQUENCY**

Thrice Monthly

**EDITORS-IN-CHIEF**

Bao-Gan Peng, Jerzy Tadeusz Chudek, George Kontogeorgos, Maurizio Serati, Ja Hyeon Ku

**EDITORIAL BOARD MEMBERS**

<https://www.wjgnet.com/2307-8960/editorialboard.htm>

**PUBLICATION DATE**

May 6, 2022

**COPYRIGHT**

© 2022 Baishideng Publishing Group Inc

**INSTRUCTIONS TO AUTHORS**

<https://www.wjgnet.com/bpg/gcrinfo/204>

**GUIDELINES FOR ETHICS DOCUMENTS**

<https://www.wjgnet.com/bpg/GerInfo/287>

**GUIDELINES FOR NON-NATIVE SPEAKERS OF ENGLISH**

<https://www.wjgnet.com/bpg/gcrinfo/240>

**PUBLICATION ETHICS**

<https://www.wjgnet.com/bpg/GerInfo/288>

**PUBLICATION MISCONDUCT**

<https://www.wjgnet.com/bpg/gcrinfo/208>

**ARTICLE PROCESSING CHARGE**

<https://www.wjgnet.com/bpg/gcrinfo/242>

**STEPS FOR SUBMITTING MANUSCRIPTS**

<https://www.wjgnet.com/bpg/GerInfo/239>

**ONLINE SUBMISSION**

<https://www.f6publishing.com>

## Extensive myocardial calcification in critically ill patients receiving extracorporeal membrane oxygenation: A case report

Ming-Liang Sui, Chang-Jiang Wu, Ya-Di Yang, Da-Mei Xia, Tian-Jie Xu, Wei-Bing Tang

**Specialty type:** Critical care medicine

**Provenance and peer review:**

Unsolicited article; Externally peer reviewed.

**Peer-review model:** Single blind

**Peer-review report's scientific quality classification**

Grade A (Excellent): 0  
Grade B (Very good): 0  
Grade C (Good): C, C  
Grade D (Fair): 0  
Grade E (Poor): 0

**P-Reviewer:** Horowitz JD, Australia; Pradhan A, India

**Received:** September 11, 2021

**Peer-review started:** September 11, 2021

**First decision:** October 25, 2021

**Revised:** November 3, 2021

**Accepted:** March 15, 2022

**Article in press:** March 15, 2022

**Published online:** May 6, 2022



**Ming-Liang Sui, Chang-Jiang Wu, Ya-Di Yang, Da-Mei Xia, Tian-Jie Xu, Wei-Bing Tang**, Department of Critical Care Medicine, Suzhou Kowloon Hospital, Shanghai Jiaotong University School of Medicine, Suzhou 215028, Jiangsu Province, China

**Corresponding author:** Ming-Liang Sui, MD, Chief Doctor, Department of Critical Care Medicine, Suzhou Kowloon Hospital, Shanghai Jiaotong University School of Medicine, Industrial Park, Suzhou 215028, Jiangsu Province, China. [sml13451648826@163.com](mailto:sml13451648826@163.com)

### Abstract

#### BACKGROUND

Myocardial calcification is a rare complication in critically ill patients. The prognosis of myocardial calcifications in critically ill patients is very poor if not treated in a timely manner. We describe a rare case of acute extensive myocardial calcifications due to acute myocarditis after receiving extracorporeal membrane oxygenation (ECMO) support.

#### CASE SUMMARY

We report a 17-year-old male patient who developed extensive myocardial calcifications while receiving prolonged ECMO support for severe myocarditis and cardiogenic shock. Extensive myocardial calcifications were confirmed by chest computed tomography (CT). Myocardial calcifications were observed in the left ventricle walls on CT examination 10 days after admission. The patient was then discharged with heart function class II on the NYHA classification. Two years later, the patient was still alive with adequate quality of life. We then included this patient and 7 other cases retrieved from the PubMed, Cochrane Library, EMBASE, and MEDLINE databases in our study, in order to provide a reference for the clinical diagnosis and treatment of this disease.

#### CONCLUSION

Multiple causes including prolonged hemodynamic failure, profound acidosis, high vasopressor doses, and acute renal failure may jointly lead to extensive myocardial calcifications. The precise role of ECMO support in the timing and frequency of acute myocardial calcifications deserves further investigation.

**Key Words:** Cardiogenic shock; Cardiac calcification; Extracorporeal membrane oxygenation; Case report

©The Author(s) 2022. Published by Baishideng Publishing Group Inc. All rights reserved.

**Core Tip:** We report a 17-year-old male patient who developed extensive myocardial calcifications while receiving prolonged extracorporeal membrane oxygenation (ECMO) support for severe myocarditis and cardiogenic shock. Extensive myocardial calcifications were confirmed by chest computed tomography. The precise role of ECMO support in the timing and frequency of acute myocardial calcifications deserves further investigation.

**Citation:** Sui ML, Wu CJ, Yang YD, Xia DM, Xu TJ, Tang WB. Extensive myocardial calcification in critically ill patients receiving extracorporeal membrane oxygenation: A case report. *World J Clin Cases* 2022; 10(13): 4214-4219

**URL:** <https://www.wjgnet.com/2307-8960/full/v10/i13/4214.htm>

**DOI:** <https://dx.doi.org/10.12998/wjcc.v10.i13.4214>

## INTRODUCTION

In recent years, extracorporeal membrane oxygenation (ECMO) technology has been increasingly used in the treatment of critically ill patients with severe myocarditis, cardiogenic shock, malignant arrhythmia, severe acute respiratory distress syndrome (ARDS), and other critical illnesses[1,2]. However, some rare complications have arisen due to ECMO support treatment. We here report a 17-year-old male patient with severe myocarditis who developed acute extensive myocardial calcifications while receiving ECMO support after successful treatment with intravenous arterial extracorporeal membrane oxygenation (VA-ECMO). This patient and 7 other patients retrieved from medical databases were reviewed. Patients' clinical characteristics, epidemiology, comorbid conditions, diagnostic methods, clinical course and outcomes were collected and analyzed, in order to provide a reference for the clinical diagnosis and treatment of this disease.

## CASE PRESENTATION

### Chief complaints

A 17-year-old man was admitted to our department with fever and chest tightness for 2 d.

### History of present illness

Two days previously, the patient developed fever, chest tightness, and tachypnea. Without treatment, there was gradual aggravation of his symptoms.

### History of past illness

The patient had no history of cardiac, renal, or other disorders.

### Personal and family history

The patient had no relevant personal and family history.

### Physical examination

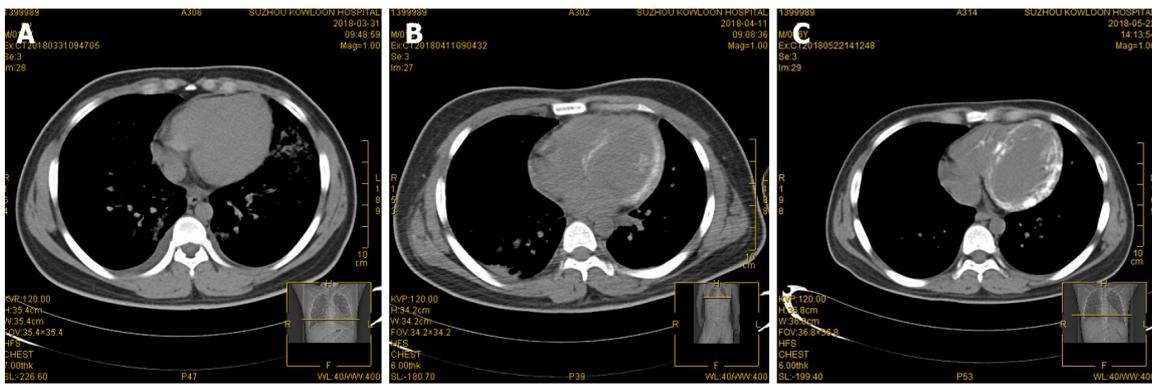
On admission, his temperature was 38.5°C, pulse rate was 139 bpm, respiratory rate was 33 breaths/min, and blood pressure was 89/56 mmHg. Heart sounds were scarcely audible.

### Laboratory examinations

Laboratory examination results were as follows: glutamic oxaloacetic transaminase 1080 U/L, glutamic pyruvate transaminase 1450 U/L, creatine kinase 12 000 U/L, creatine kinase isoenzyme 2880 U/L, lactic dehydrogenase 19300 U/L, serum myoglobin 1400 ng/mL, troponin I 4.01 mg/L, white blood cell count  $17.6 \times 10^9/L$ , plasma C-reactive protein 33.0 mg/L, serum procalcitonin 0.15 ng/mL, serum urea nitrogen 14.6 mmol/L, and serum creatinine 235 mmol/L. Immunoglobulin G (IgG) was 8 g/L, antinuclear and antismooth muscle antibodies were negative. Anti-Epstein-Barr virus antibodies IgG and IgM were positive.

### Imaging examinations

Chest computed tomography (CT) examination at admission showed no morphological abnormalities in the heart (Figure 1A).



DOI: 10.12998/wjcc.v10.i13.4214 Copyright ©The Author(s) 2022.

**Figure 1** Chest computed tomography findings. A: Chest computed tomography (CT) on the day of admission showed no morphological abnormalities in the heart; B: After 10 d, chest CT showed an increase in left ventricular wall density; C: 30 d later, CT showed obvious myocardial calcification in the left ventricle.

## FINAL DIAGNOSIS

The initial investigations showed elevated liver enzyme, creatine kinase and creatine kinase isoenzyme levels. Repeat echocardiography 1 d later demonstrated a left ventricular ejection fraction (LVEF) of 35% with moderate diastolic dysfunction, but the left ventricular end diastolic diameter showed no obvious change. Immunoglobulin M and IgG antibodies against Epstein-Barr virus were positive. There was no evidence of coronary artery abnormalities. These findings were consistent with fulminant myocarditis and cardiogenic shock.

## TREATMENT

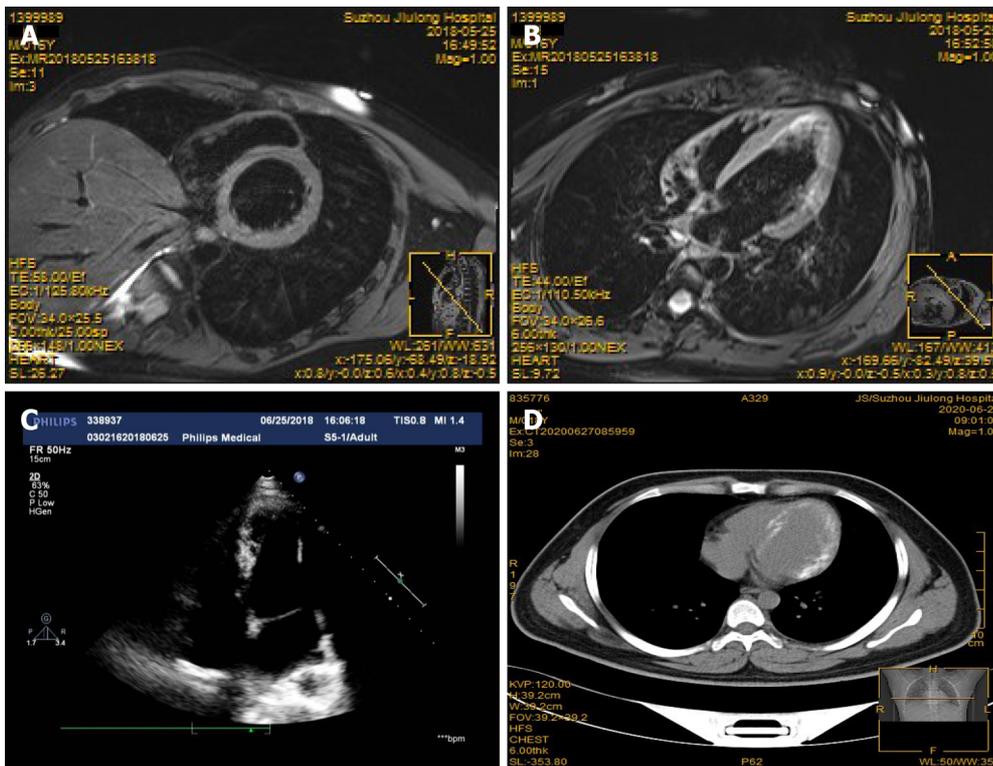
On the day after admission, the patient had a cardiac arrest due to acute left ventricular failure and malignant arrhythmia. He developed acute renal failure following cardiogenic shock. Emergency VA-ECMO was carried out and bedside continuous renal replacement therapy was performed to optimize fluid management. In addition, comprehensive treatment such as antiviral, myocardial nutrition, arrhythmia prevention and nutritional support were administered. The patient subsequently developed severe hypocalcemia due to cardiogenic shock, rhabdomyolysis, acute renal failure, and received approximately 1300 mg/d of calcium gluconate for the first 5 d. The patient did not receive warfarin or any other vitamin K analogue during hospitalization. There was no evidence of severe sepsis before myocardial calcification was found. An increase in the left ventricular wall density was observed on chest CT 10 d after admission (Figure 1B). Thirty days later, obvious myocardial calcifications were observed on CT images of the left ventricle, and the heart valve and right ventricle were not involved (Figure 1C). Follow-up delayed gadolinium enhanced magnetic resonance imaging (MRI) examination performed 50 d after admission showed high signal intensity in the left ventricular wall without evidence of persistent inflammation, suggesting myocardial fibrosis/scarring resulting from myocardial injury/necrosis (Figure 2A and B). Echocardiography (2 mo after hospital admission) showed a LVEF of 56%, and mild diastolic dysfunction. Echocardiography did not detect myocardial calcifications (Figure 2C).

## OUTCOME AND FOLLOW-UP

The patient was discharged with heart function class II on the NYHA classification. Two years later, the patient was still alive with adequate quality of life. Echocardiography showed a LVEF of 60%, and mild diastolic dysfunction. Follow-up chest CT still showed obvious myocardial calcification in the left ventricle (Figure 2D).

## DISCUSSION

Published medical literature on cardiac calcifications and ECMO were systematically retrieved from PubMed, Cochrane Library, EMBASE, and MEDLINE medical databases up to October 2020. We searched the databases using the following terms (MeSH), including "Calcification" AND "Noncalcification", and used the Boolean operators "AND", "OR", and the free word "ECMO" in combination.



DOI: 10.12998/wjcc.v10.i13.4214 Copyright ©The Author(s) 2022.

**Figure 2 Magnetic resonance imaging findings.** A magnetic resonance scan 50 d after admission [short-axis view (A) 4-chamber view (B)] showing high-signal intensity in the left ventricular wall; C: Echocardiography did not detect the myocardial calcifications; D: Two years later, computed tomography still showed obvious myocardial calcifications in the left ventricle.

Following elimination of duplicates and redundant articles, a total of 4 articles related to the case report, with 7 cases of ECMO-associated myocardial calcifications, were included for the final review and analysis[3-6]. The data on these 7 cases and the present case were collected and analyzed. The medical history, clinical features, comorbidities, diagnostic methods and outcomes of these patients are shown in supplemental digital content (Table 1).

Among the 8 patients in this review, there were 4 males and 4 females, aged from 1 wk to 66 yr. All of the patients were from intensive care units, and the main etiology was sepsis-induced ARDS or severe myocarditis. Six patients (75%) received venoarterial ECMO (VA-ECMO), and two patients (25%) received venovenous ECMO (VV-ECMO). Cardiac calcifications were detected 10 to 32 d after ECMO support. Six patients (75%) required renal replacement and exogenous calcium supplementation in the acute phase of the disease. Four of the eight patients died shortly after the acute phase while in hospital. In a long-term follow-up of the reported cases, one patient was discharged with ventilator support of an extended acute-care facility. Of the two patients followed up for more than 18 mo, one presented with persistent moderate diastolic dysfunction, the other with unrelenting mild diastolic dysfunction, but left ventricular systolic function was normal in both patients.

Complications of extensive cardiac calcifications following ECMO support therapy are rare, and the mechanism may be multifactorial. The decisive contributing factor may be that ECMO treatment prolonged the survival of patients. These patients all received ECMO (especially VA-ECMO) support, did not have myocardial infarction, and were suffering from hemodynamic instability, severe metabolic acidosis, acute renal failure, and required high doses of vasoactive drugs and exogenous calcium supplementation. Possible pathological mechanisms were as follows: First, sepsis or viral infection led to severe myocardial damage, making it easier for calcium to deposit in myocardial ischemia and necrotic areas[7]. Second, rhabdomyolysis combined with acute renal failure might result in severe calcium metabolic abnormalities[8]. Third, intravenous supplementation of a large amount of exogenous calcium possibly further aggravated calcium deposition in necrotic areas of the myocardium [9]. However, the direct role of ECMO support in myocardial calcifications remains to be confirmed.

This review showed that myocardial calcifications were mostly detected on chest CT occasionally after days to weeks of ECMO support, and most patients received no specific treatment for cardiac calcifications from the acute phase to the convalescence phase. It was speculated that the persistent myocardial calcifications might reduce elasticity of the myocardium, eventually giving rise to ventricular filling inability or diastolic dysfunction. In this study, restrictive cardiomyopathy was present in three patients who survived. However, there is little data on the long-term effects of these calcifications because few cases have been reported. The development of *in vitro* life support techno-

**Table 1 Literature review of the patients in medical history, clinical features, comorbidities, diagnostic methods and outcomes**

Ref.	Publication year	Country	Age/sex	Clinical presentation	Comorbid conditions	ECMO settings/duration (d)	Renal replacement duration (d)	Calcification detection time (d)	Diagnostic testing	Clinical course and outcome
Stallion <i>et al</i> [3]	1994	United States	2 wk/F	Severe myocarditis	None	V-A /7	Notreported	NA	Chest X-ray/TTE	Patient died due to severe myocardial damage
Stallion <i>et al</i> [3]	1994	United States	1 wk/F	Severe myocarditis	None	V-A /3.5	Notreported	NA	Chest X-ray/TTE	Patient died due to severe myocardial damage
Stallion <i>et al</i> [4]	2018	United States	29 yr/F	Postpartum toxic shock syndrome	Notreported	V-A/21	Need, durationnot reported	Several weeks	Chest CT	Discharged to extended acute-care facility on ventilator support
Kapandji <i>et al</i> [5]	2018	France	66 yr/M	Pneumonia leading to severe ARDS	None	V-V/24	34	32	TTEChest CTCardiac MRI	Patient recovered; TTE 18 mo after ICU discharge with LVEF of 55% and moderate diastolic dysfunction.
Kapandji <i>et al</i> [5]	2018	France	18 yr/M	Cardiogenicshock after cardiac arrest	None	V-A/22	21	16	Chest CT	Patient died due to septic shock
Kapandji <i>et al</i> [5]	2018	France	26 yr/F	Pneumonia leading to severe ARDS	None	V-V/94	40	24	CT chest	Patient died due to restrictive cardiomyopathy with severe left ventricular failure
Kimura <i>et al</i> [6]	2018	Japan	15 yr/M	Severe myocarditis	None	V-A/Notreported	Need, duration not reported	30	Chest CT	Patient was discharged; 2 mo after hearttransplantation
The present report	2020	China	17 yr/M	Severe myocarditis	None	V-A/3	28	10	Chest CT Cardiac MRI	Patient recovered; TTE 2 yr after ICU discharge with LVEF of 60% and mild diastolic dysfunction.

ECMO: Extracorporeal membrane oxygenation; ARDS: Acute respiratory distress syndrome; NA: Not available; CT: Computed tomography; MRI: Magnetic resonance imaging; ICU: Intensive care unit; LVEF: Left ventricular ejection fraction.

logies such as ECMO and the widespread use of renal replacement therapy are accompanied by an increasing incidence rate of acute myocardial calcifications as a complication. Therefore, for a small number of patients who have passed the acute phase of rehabilitation, it is necessary to monitor the symptoms of cardiomyopathy secondary to cardiac calcifications, and develop specific treatment and follow-up guidelines.

Clinicians should be aware that this rare but rapidly progressing complication may directly affect the clinical outcome of patients receiving ECMO support. Further research is warranted to clarify the exact pathophysiological mechanism of acute myocardial calcifications and their clinical significance in critically ill patients receiving ECMO support.

## CONCLUSION

Multiple causes including prolonged hemodynamic failure, profound acidosis, high vasopressor doses, and acute renal failure may jointly lead to extensive myocardial calcifications. The precise role of ECMO support in the timing and frequency of acute myocardial calcifications deserves further investigation.

## FOOTNOTES

**Author contributions:** Sui ML designed the study, performed the literature review, drafted the manuscript, formulated the data table and reviewed the manuscript; Tang WB performed the literature review, supervision,

writing-review and editing; Wu CJ contributed to the data curation, investigation, and writing-original draft; Yang YD and Xu TJ performed the literature review and suggested pertinent modification; Xia DM performed data analysis, reviewed the manuscript; and All authors have read and approved the final manuscript.

**Informed consent statement:** Informed written consent was obtained from the patient for publication of this report and any accompanying images.

**Conflict-of-interest statement:** All authors have nothing to disclose for this manuscript.

**CARE Checklist (2016) statement:** The authors have read the CARE Checklist (2016), and the manuscript was prepared and revised according to the CARE Checklist (2016).

**Open-Access:** This article is an open-access article that was selected by an in-house editor and fully peer-reviewed by external reviewers. It is distributed in accordance with the Creative Commons Attribution NonCommercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: <https://creativecommons.org/licenses/by-nc/4.0/>

**Country/Territory of origin:** China

**ORCID number:** Ming-Liang Sui 0000-0002-7857-5758; Chang-Jiang Wu 0000-0002-4887-0131; Ya-Di Yang 0000-0002-4126-450X; Da-Mei Xia 0000-0001-7059-4076; Tian-Jie Xu 0000-0002-1561-6292; Wei-Bing Tang 0000-0002-5736-4257.

**S-Editor:** Ma YJ

**L-Editor:** A

**P-Editor:** Ma YJ

## REFERENCES

- 1 **Paolone S.** Extracorporeal Membrane Oxygenation (ECMO) for Lung Injury in Severe Acute Respiratory Distress Syndrome (ARDS): Review of the Literature. *Clin Nurs Res* 2017; **26**: 747-762 [PMID: 27836935 DOI: 10.1177/1054773816677808]
- 2 **Smith M, Vukomanovic A, Brodie D, Thiagarajan R, Rycus P, Buscher H.** Duration of veno-arterial extracorporeal life support (VA ECMO) and outcome: an analysis of the Extracorporeal Life Support Organization (ELSO) registry. *Crit Care* 2017; **21**: 45 [PMID: 28264702 DOI: 10.1186/s13054-017-1633-1]
- 3 **Stallion A, Rafferty JF, Warner BW, Ziegler MM, Ryckman FC.** Myocardial calcification: a predictor of poor outcome for myocarditis treated with extracorporeal life support. *J Pediatr Surg* 1994; **29**: 492-494 [PMID: 8014800 DOI: 10.1016/0022-3468(94)90074-4]
- 4 **Pak S, Safadi Z, Markovic JP, Marein S.** Left ventricular calcification following postpartum toxic shock syndrome. *J Clin Prev Cardiol* 2018; **7**: 29 [DOI: 10.4103/JCPC.JCPC\_29\_17]
- 5 **Kapandji N, Redheuil A, Fouret P, Hékimian G, Lebreton G, Bréchet N, Luyt CE, Cluzel P, Combes A, Schmidt M.** Extensive Myocardial Calcification in Critically Ill Patients. *Crit Care Med* 2018; **46**: e702-e706 [PMID: 29570107 DOI: 10.1097/CCM.0000000000003130]
- 6 **Kimura Y, Seguchi O, K Kono A, Matsumoto M, Kumai Y, Kuroda K, Nakajima S, Watanabe T, Matsumoto Y, Fukushima S, Yanase M, Fujita T, Ishibashi-Ueda H, Kobayashi J, Fukushima N.** Massive Biventricular Myocardial Calcification in a Patient with Fulminant Myocarditis Requiring Ventricular Assist Device Support. *Intern Med* 2019; **58**: 1283-1286 [PMID: 30568151 DOI: 10.2169/internalmedicine.2039-18]
- 7 **Monnier-Cholley L, Roux A, Pacanowski J, Arrivé L.** Myocardial calcifications following sepsis. *Intensive Care Med* 2018; **44**: 981-982 [PMID: 29761215 DOI: 10.1007/s00134-018-5168-y]
- 8 **Wada A, Nakata T, Tsuchihashi K, Aoyama S, Nanba M, Murakami H, Shimamoto K, Iimura O.** Massive myocardial calcification of right and left ventricles following acute myocarditis complicated with rhabdomyolysis-induced acute renal failure. *Jpn Circ J* 1993; **57**: 567-572 [PMID: 8341004 DOI: 10.1253/jcj.57.567]
- 9 **Llach F, Felsenfeld AJ, Haussler MR.** The pathophysiology of altered calcium metabolism in rhabdomyolysis-induced acute renal failure. Interactions of parathyroid hormone, 25-hydroxycholecalciferol, and 1,25-dihydroxycholecalciferol. *N Engl J Med* 1981; **305**: 117-123 [PMID: 6894630 DOI: 10.1056/NEJM198107163050301]



Published by **Baishideng Publishing Group Inc**  
7041 Koll Center Parkway, Suite 160, Pleasanton, CA 94566, USA

**Telephone:** +1-925-3991568

**E-mail:** [bpgoffice@wjgnet.com](mailto:bpgoffice@wjgnet.com)

**Help Desk:** <https://www.f6publishing.com/helpdesk>

<https://www.wjgnet.com>

