**Clinical Librarian Service Search Results**

**Request:** What literature is available on management of cardiac arrest and outcomes for an infected patient (viral infection)?

**Summary**

A search of good quality resources has retrieved a small body of literature concerning cardiac arrest and cardiac complications of viral infections. However, it appears that this literature has focused primarily on risks and potential outcomes, rather than on management of cardiac arrests.

Where COVID-19 is concerned, US guidance (2020)1, indicates that cardiac complications, including cardiac arrest are not unheard of, but does not offer detailed indications as to how to manage cardiac arrest in infected patients. The guidance states that: *“Cardiac complications of COVID-19 are approximately commensurate with SARS, MERS, and influenza analogs”.*

Recent literature being published from China and Italy also indicates that COVID-19 may cause considerable cardiac damage, and also, that patients with cardiovascular comorbidities may be at increased risk of complications and/or poorer prognosis from COVID-19. However, again, there appears to be little indication as to best management options.2-9

Further literature concerning management of cardiac arrest, at-risk populations, cardiac damage and treatment outcomes in other influenza/coronavirus infections are also listed in the results below. It appears from this literature that cardiac arrest may be sudden and unexpected in infected patients, and in some cases cardiac symptoms have been the presenting symptoms for infection. Management depends on severity of event and underlying conditions and can include critical care stay and use of therapies such as ECMO. (See section 3).10-26

I hope that I have interpreted your request correctly. Please let me know if you would like me to search further.

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**Feedback**

Once you have read this report, I would appreciate it if you would complete our online literature search feedback form at:

<https://www.smartsurvey.co.uk/s/LiteratureSearchFeedback20192020/>

This relates to this specific search and will help us to monitor and improve our service. Many Thanks.

Lisa Lawrence

Clinical Librarian

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ext. 88155

**Current at:** 19th March 2020.

**Time taken for search:** 5 hours.

**Please acknowledge this work in any resulting paper or presentation as:**

Evidence Search: LS393 Management of cardiac arrest in infected patients. Lisa Lawrence. (19/03/2020). Derby, UK: University Hospitals of Derby & Burton NHS Foundation Trust Library and Knowledge Service.

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**Results: Guidance COVID-19**

1. **COVID-19 Clinical Guidance for the Cardiovascular Care Team.**

**Date:** March 2020.

**Extract:** *“Acute Cardiac Complications of COVID-19*

* *In a recent case report on 138 hospitalized COVID-19 patients, 16.7% of patients developed arrhythmia and 7.2% experience acute cardiac injury, in addition to other COVID-19 related complications.*
* *Published and anecdotal reports indicate cases of acute onset heart failure, myocardial infarction, myocarditis, and cardiac arrest; as with any acute illness higher cardiometabolic demand can precipitate cardiac complications.*
* *Current reporting does not yet describe prevalence of cardiac complications in CVD-naïve versus cardiac comorbid patients.*
* *Cardiac complications of COVID-19 are approximately commensurate with SARS, MERS, and influenza analogs.*
* *Cardiologists should be prepared to assist other clinical specialties in managing cardiac complications in severe cases of COVID-19.*
* *Critical care and cardiology teams should confer to guide care for patients requiring extracorporeal circulatory support with veno-venous (V-V) versus veno-arterial (V-A) ECMO.*
* *Patients demonstrating heart failure, arrhythmia, ECG changes or cardiomegaly should have echocardiography”.*

**Source:** American College of Cardiology – Clinical Bulletin.

**Available at:**

<https://www.acc.org/~/media/665AFA1E710B4B3293138D14BE8D1213.pdf>

**Results: COVID-19**

1. **Impact of Coronavirus Disease 2019 (COVID-19) Outbreak on ST Segment Elevation Myocardial Infarction Care in Hong Kong, China.**

**Citation:** Tam CCF, et al. Circ Cardiovasc Qual Outcomes / Research Letter. April 2020. 13:e006631. DOI: 10.1161/CIRCOUTCOMES.120.006631.

**Available at:**

<https://www.ahajournals.org/doi/pdf/10.1161/CIRCOUTCOMES.120.006631>

1. **COVID-19 and the cardiovascular system.**

**Author(s):** Zheng, Ying-Ying; Ma, Yi-Tong; Zhang, Jin-Ying; Xie, Xiang

**Source:** Nature reviews. Cardiology; Mar 2020 https://doi.org/10.1038/s41569-020-0360-5.

**Publication Type(s):** Journal Article

**PubMedID:** 32139904

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infects host cells through ACE2 receptors, leading to coronavirus disease (COVID-19)-related pneumonia, while also causing acute myocardial injury and chronic damage to the cardiovascular system. Therefore, particular attention should be given to cardiovascular protection during treatment for COVID-19

Available at [Nature reviews. Cardiology](https://www.nature.com/articles/s41569-020-0360-5.pdf) - from Unpaywall

<https://www.nature.com/articles/s41569-020-0360-5>

**Database:** Medline

1. **Cardiac troponin I in patients with coronavirus disease 2019 (COVID-19): Evidence from a meta-analysis.**

**Author(s):** Lippi, Giuseppe; Lavie, Carl J; Sanchis-Gomar, Fabian

**Source:** Progress in cardiovascular diseases; Mar 2020

**Publication Type(s):** Letter

**PubMedID:** 32169400

Available at [Progress in cardiovascular diseases](https://auth.elsevier.com/ShibAuth/institutionLogin?entityID=https://idp.eng.nhs.uk/openathens&appReturnURL=https%3A%2F%2Fwww.clinicalkey.com%2Fcontent%2FplayBy%2Fdoi%2F%3Fv%3D10.1016%2Fj.pcad.2020.03.001) - from ClinicalKey

[**https://www.sciencedirect.com/science/article/pii/S0033062020300554?via%3Dihub**](https://www.sciencedirect.com/science/article/pii/S0033062020300554?via%3Dihub)

**Database:** Medline

1. **Prevalence and impact of cardiovascular metabolic diseases on COVID-19 in China.**

**Author(s):** Li, Bo; Yang, Jing; Zhao, Faming; Zhi, Lili; Wang, Xiqian; Liu, Lin; Bi, Zhaohui; Zhao, Yunhe

**Source:** Clinical research in cardiology : official journal of the German Cardiac Society; Mar 2020

**Publication Type(s):** Journal Article Review

**PubMedID:** 32161990

Available at [Clinical research in cardiology : official journal of the German Cardiac Society](https://link.springer.com/content/pdf/10.1007/s00392-020-01626-9.pdf) - from Unpaywall

**Abstract:** BACKGROUND Studies have reminded that cardiovascular metabolic comorbidities made patients more susceptible to suffer 2019 novel corona virus (2019-nCoV) disease (COVID-19), and exacerbated the infection. The aim of this analysis is to determine the association of cardiovascular metabolic diseases with the development of COVID-19. METHODS A meta-analysis of eligible studies that summarized the prevalence of cardiovascular metabolic diseases in COVID-19 and compared the incidences of the comorbidities in ICU/severe and non-ICU/severe patients was performed. Embase and PubMed were searched for relevant studies. RESULTS A total of six studies with 1527 patients were included in this analysis. The proportions of hypertension, cardia-cerebrovascular disease and diabetes in patients with COVID-19 were 17.1%, 16.4% and 9.7%, respectively. The incidences of hypertension, cardia-cerebrovascular diseases and diabetes were about twofolds, threefolds and twofolds, respectively, higher in ICU/severe cases than in their non-ICU/severe counterparts. At least 8.0% patients with COVID-19 suffered the acute cardiac injury. The incidence of acute cardiac injury was about 13 folds higher in ICU/severe patients compared with the non-ICU/severe patients. CONCLUSION Patients with previous cardiovascular metabolic diseases may face a greater risk of developing into the severe condition and the comorbidities can also greatly affect the prognosis of the COVID-19. On the other hand, COVID-19 can, in turn, aggravate the damage to the heart.

**Database:** Medline

1. **[Analysis of myocardial injury in patients with COVID-19 and association between concomitant cardiovascular diseases and severity of COVID-19].**

**Author(s):** Chen, C; Yan, J T; Zhou, N; Zhao, J P; Wang, D W

**Source:** Zhonghua xin xue guan bing za zhi; Mar 2020; vol. 48 (no. 0); p. E008

**Publication Type(s):** English Abstract Journal Article

**PubMedID:** 32141280

**Abstract:** Objective: To evaluate the cardiovascular damage of patients with COVID-19, and determine the correlation of serum N-terminal pro B-type natriuretic peptide (NT-proBNP) and cardiac troponin-I (cTnI) with the severity of COVID-19, and the impact of concomitant cardiovascular disease on severity of COVID-19 was also evaluated. Methods: A cross-sectional study was designed on 150 consecutive patients with COVID-19 in the fever clinic of Tongji Hospital in Wuhan from January to February in 2020, including 126 mild cases and 24 cases in critical care. Both univariate and multivariate logistic regression were used to analyze the correlation of past medical history including hypertension, diabetes and coronary heart disease (CHD) , as well as the levels of serum NT-proBNP and cTnI to the disease severity of COVID-19 patients. Results: Age, hypersensitive C-reactive protein(hs-CRP) and serum creatinine levels of the patients were higher in critical care cases than in mild cases(all P<0.05). Prevalence of male, elevated NT-proBNP and cTnI, hypertension and coronary heart disease were significantly higher in critical cases care patients than in the mild cases(all P<0.05). Univariate logistic regression analysis showed that age, male, elevated NT-proBNP, elevated cTnI, elevated hs-CRP, elevated serum creatinine, hypertension, and CHD were significantly correlated with critical disease status(all P<0.05). Multivariate logistic regression analysis showed that elevated cTnI(OR=26.909, 95%CI 4.086-177.226, P=0.001) and CHD (OR=16.609, 95%CI 2.288-120.577, P=0.005) were the independent risk factors of critical disease status. Conclusions: COVID-19 can significantly affect the heart function and lead to myocardial injury. The past medical history of CHD and increased level of cTnI are two independent determinants of clinical disease status in patients with COVID-19.

**Database:** Medline

1. **[Comparison of heart failure and 2019 novel coronavirus pneumonia in chest CT features and clinical characteristics].**

**Author(s):** Zhu, Z W; Tang, J J; Chai, X P; Fang, Z F; Liu, Q M; Hu, X Q; Xu, D Y; Tang, L; Tai, S; Wu, Y Z; Zhou, S H

**Source:** Zhonghua xin xue guan bing za zhi; Mar 2020; vol. 48 (no. 0); p. E007

**Publication Type(s):** English Abstract Journal Article

**PubMedID:** 32129583

**Abstract:** Objective: To identify the characteristics including clinical features and pulmonary computed tomography (CT) features of heart failure and novel coronavirus pneumonia(COVID-19). Methods: This study was a retrospective study. A total of 7 patients with Heart failure and 12 patients with COVID-19 in the Second Xiangya Hospital of Central South University between December 1, 2019 and February 15, 2020 were enrolled. The baseline clinical and imaging features of the two groups were statistically analyzed. Results: There was no significant difference in age and sex between the two groups, but the incidence of epidemiological contact history, fever or respiratory symptoms in the COVID-19 group was significantly higher than that in the heart failure group (12/12 vs. 2/7, P=0.001; 12/12 vs. 4/7, P<0.001). While the proportion of cardiovascular diseases and impaired cardiac function was significantly less than that of the heart failure group(2/12 vs.7/7, P<0.001; 0/12 vs.7/7, P<0.001). For imaging features, both groups had ground-glass opacity and thickening of interlobular septum, but the ratio of central and gradient distribution was higher in patients with heart failure than that in patients with COVID-19 (4/7 vs. 1/12, P=0.04). In heart failure group, the ratio of the expansion of small pulmonary veins was also higher (3/7 vs. 0, P=0.013), and the lung lesions can be significantly improved after effective anti-heart failure treatment. Besides, there are more disease with rounded morphology in COVID-19 (9/12 vs. 2/7, P=0.048) . Conclusions: More patients with COVID-19 have epidemiological history and fever or respiratory symptoms. There are significant differences in chest CT features, such as enlargement of pulmonary veins, lesions distribution and morphology between heart failure and COVID-19.

**Database:** Medline

1. **[Impact of complicated myocardial injury on the clinical outcome of severe or critically ill COVID-19 patients].**

**Author(s):** He, X W; Lai, J S; Cheng, J; Wang, M W; Liu, Y J; Xiao, Z C; Xu, C; Li, S S; Zeng, H S

**Source:** Zhonghua xin xue guan bing za zhi; Mar 2020; vol. 48 (no. 0); p. E011

**Publication Type(s):** English Abstract Journal Article

**PubMedID:** 32171190

**Abstract:** Objective: To analyze the clinical characteristics of the severe or critically ill patients with novel coronavirus pneumonia (COVID-19), and evaluate the impact of complicated myocardial injury on the prognosis of these patients. Methods: A retrospective study was conducted in 54 patients who admitted to Tongji hospital from February 3, 2020 to February 24, 2020 and met the criteria of severe or critical conditions of COVID-19. The clinical characteristics and hospital mortality rate were analyzed and compared between the patients with or without myocardial injury, which was defined with 3 times higher serum cardiac troponin value. Results: The median age of the 54 patients was 68 (59.8, 74.3) years. Among all the patients, 24 (44.4%) patients were complicated with hypertension, 13 (24.1%) with diabetes, 8 (14.8%) with coronary heart disease, and 3 (5.6%) with previous cerebral infarction. During hospitalization, 24 (44.4%) of the patients were complicated with myocardial injury and 26 (48.1%) patients died in hospital. In-hospital mortality was significantly higher in patients with myocardial injury than in patients without myocardial injury (14 (60.9%) vs. 8 (25.8%), P=0.013). Moreover, the levels of C-reactive protein (153.6 (80.3, 240.7) ng/L vs. 49.8 (15.9, 101.9) ng/L) and N-terminal pro-B-type natriuretic peptide (852.0 (400.0, 2 315.3) ng/L vs. 197.0 (115.3, 631.0) ng/L) were significantly higher than patients without myocardial injury (all P<0.01). Conclusions: Prevalence of myocardial injury is high among severe or critically ill COVID-19 patients. Severe or critically ill COVID-19 patients with myocardial injury face a significantly higher risk of in-hospital mortality. The study suggests that it is important to monitor and manage the myocardial injury during hospitalization for severe or critically ill COVID-19 patients.

**Database:** Medline

1. **[Cardiac manifestations of patients with COVID-19 pneumonia and related treatment recommendations].**

**Author(s):** Tan, Z C; Fu, L H; Wang, D D; Hong, K

**Source:** Zhonghua xin xue guan bing za zhi; Mar 2020; vol. 48 (no. 0); p. E005

**Publication Type(s):** Journal Article

**PubMedID:** 32118392

**Database:** Medline

**Results: Other influenza infections**

1. **Venovenous Extracorporeal Membrane Oxygenation for Patients With Return of Spontaneous Circulation After Cardiac Arrest Owing to Acute Respiratory Distress Syndrome**

**Author(s):** Bhardwaj A.; Geller B.; Miano T.; Milewski R.C.; Williams M.; Bermudez C.; Vallabhajosyula P.; Patel P.; Mackay E.; Vernick W.; Lane-Fall M.; Raiten J.; McDonald M.; Gutsche J.; Haddle J.

**Source:** Journal of Cardiothoracic and Vascular Anesthesia; Aug 2019; vol. 33 (no. 8); p. 2216-2220

**Publication Type(s):** Article

**PubMedID:** 31182376

Available at [Journal of cardiothoracic and vascular anesthesia](https://auth.elsevier.com/ShibAuth/institutionLogin?entityID=https://idp.eng.nhs.uk/openathens&appReturnURL=https%3A%2F%2Fwww.clinicalkey.com%2Fcontent%2FplayBy%2Fdoi%2F%3Fv%3D10.1053%2Fj.jvca.2019.04.020) - from ClinicalKey

**Abstract:** Objective: The primary objective of this study was to determine the survival to hospital discharge of patients who were treated with venovenous (VV) extracorporeal membrane oxygenation (ECMO) for respiratory failure after cardiac arrest. Design(s): Retrospective chart review. Setting(s): University-affiliated tertiary care hospitals. Participant(s): The study comprised 21 patients. Intervention(s): Implementation of VV ECMO in patients with return of spontaneous circulation after cardiac arrest owing to respiratory insufficiency. Measurements and Main Results: The most common etiology of arrest was pneumonia-associated acute respiratory distress syndrome (8/21 [38%]). Overall, 12/21(57%) patients survived to hospital discharge. Two of 12 (17%) patients required hemodialysis upon discharge. Conclusion(s): VV ECMO may be an appropriate alternative to venoarterial ECMO in select patients with return of spontaneous circulation after cardiac arrest owing to profound respiratory failure.Copyright © 2019 Elsevier Inc.

**Database:** EMBASE

1. **Extreme influenza epidemics and out-of-hospital cardiac arrest.**

**Author(s):** Onozuka, Daisuke; Hagihara, Akihito

**Source:** International journal of cardiology; Jul 2018; vol. 263 ; p. 158-162

**Publication Type(s):** Journal Article

**PubMedID:** 29754914

Available at [International journal of cardiology](https://auth.elsevier.com/ShibAuth/institutionLogin?entityID=https://idp.eng.nhs.uk/openathens&appReturnURL=https%3A%2F%2Fwww.clinicalkey.com%2Fcontent%2FplayBy%2Fdoi%2F%3Fv%3D10.1016%2Fj.ijcard.2018.02.028) - from ClinicalKey

**Abstract:** INTRODUCTION There is compelling evidence for an association between influenza epidemics and major adverse cardiovascular events. However, the role of extreme influenza epidemics as a trigger of out-of-hospital cardiac arrest (OHCA) is unclear. Thus, we evaluated the potential association between extreme influenza epidemics and incidence of OHCA. METHODS We used a quasi-experimental design with time-series analysis of national registry data for cases of OHCA from all 47 prefectures of Japan during influenza seasons between 2005 and 2014. A Poisson regression time-series model with a distributed lag non-linear model was used to estimate prefecture-specific effects of influenza epidemics on OHCA. A multivariate meta-analysis was conducted for nationally pooled estimates. RESULTS In total, 481,516 OHCAs of presumed cardiac origin were reported during the study period. The minimum morbidity percentile (MMP) was estimated as the 0th percentile for influenza incidence. The overall cumulative relative risk versus the MMP was 1.25 (95% confidence interval, 1.16-1.34) for extreme influenza epidemics (at the 99th percentile of influenza incidence). The effect of extreme influenza epidemics was significant for lag periods of 1.5-7.1 and 17.9-21 days. Multivariate random-effects meta-analysis indicated significant spatial heterogeneity among prefectures (Cochran Q test, p = 0.011; I2 = 23.2%). CONCLUSION Extreme influenza epidemics are associated with higher risk of OHCA. Our findings suggest that several weeks' prevention for extreme influenza infections should be implemented to reduce the risk of OHCA.

**Database:** Medline

1. **Fatal Myopericarditis Following an Influenza A (H3N2) Infection.**

**Author(s):** Lefeuvre, Caroline; Behillil, Sylvie; Triau, Stéphane; Monteiro-Rodrigues, Antonio; Templier, François; Tran, Cong Tri; Le Guillou-Guillemette, Hélène; Lunel-Fabiani, Françoise; Enouf, Vincent; Ducancelle, Alexandra

**Source:** The American journal of case reports; May 2018; vol. 19 ; p. 540-544

**Publication Type(s):** Case Reports Journal Article

**PubMedID:** 29735962

Available at [The American journal of case reports](http://europepmc.org/search?query=(DOI:10.12659/AJCR.908314)) - from Europe PubMed Central - Open Access

Available at [The American journal of case reports](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5967290) - from Unpaywall

**Abstract:** BACKGROUND Influenza viruses induce uncomplicated infections in most cases in individuals with no known predisposing factors. Acute febrile illness is generally limited to upper respiratory symptoms and several constitutional symptoms, including headache, lethargy, and myalgia. However, influenza A virus is a cause of severe morbidity and mortality worldwide. Some patients are at risk for serious and fatal complications. Cardiac involvement is a well-known condition, but, clinically apparent influenza myocarditis is not common. Few reports exist regarding recurrent fulminant influenza myocarditis. CASE REPORT We report here a fatal case of heart failure following myocarditis in a 14-year-old female who had seasonal flu symptoms but was otherwise healthy. H3N2 influenza virus infection was detected by molecular analyses of throat and nasal swabs, suggesting damage to myocardial cells caused directly by the virus. CONCLUSIONS Pericardial effusion myopericarditis may occur during influenza virus infection in young individuals, even those with no known predisposing factors. Physicians need to be aware that acute myopericarditis can be a fatal complication of recent influenza virus infection in all patients with instable hemodynamics. Early diagnosis and treatment could reduce, in some cases, the risk of severe cardiac events. However, this sudden and fatal outcome was difficult to predict in a healthy young female with no known risk factors.

**Database:** Medline

1. **Severe capillary leak syndrome with cardiac arrest triggered by influenza virus infection.**

**Author(s):** Ebdrup, Lotte; Druey, Kirk M; Druey, Kirk; Mogensen, Trine Hyrup

**Source:** BMJ case reports; Aug 2018; vol. 2018

**Publication Type(s):** Case Reports Journal Article

**PubMedID:** 30158273

Available at [BMJ case reports](http://casereports.bmj.com/content/2018/bcr) - from BMJ Journals

Available at [BMJ case reports](http://europepmc.org/search?query=(DOI:10.1136/bcr-2018-226108)) - from Europe PubMed Central - Open Access

Available at [BMJ case reports](https://casereports.bmj.com/content/casereports/2018/bcr-2018-226108.full.pdf) - from Unpaywall

**Abstract:** Systemic capillary leak syndrome (SCLS), also known as Clarkson syndrome, is a rare disease with potential fatal outcome. The clinical picture involves leakage of fluid and protein from the bloodstream into peripheral tissues, resulting in hypoalbuminaemia, elevated haematocrit, oedema and hypotension. The spectrum of the symptoms ranges from discrete swelling/oedema of extremities to fulminant cardiogenic shock. We present a case with a 52-year-old man diagnosed with SCLS after being resuscitated from cardiac arrest, which was complicated by compartment syndrome. The severe episode of capillary leak was potentially triggered by influenza virus infection. With the benefit of hindsight, he presented with symptoms of SCLS 2 years prior the major acute episode. Here we describe this case and review some aspects of the literature on SCLS, with particular focus on the pathogenesis, treatment/prophylaxis and long-term physical and psychological complications.

**Database:** Medline

1. **Syncope and Influenza B: A Case of an Arresting Association.**

**Author(s):** Lucerna, Alan; Lee, James; Espinosa, James

**Source:** Case reports in emergency medicine; 2018; vol. 2018 ; p. 1853473

**Publication Type(s):** Case Reports

**PubMedID:** 30174963

Available at [Case reports in emergency medicine](http://europepmc.org/search?query=(DOI:10.1155/2018/1853473)) - from Europe PubMed Central - Open Access

Available at [Case reports in emergency medicine](https://www.hindawi.com/journals/criem/2018/1853473/) - from Hindawi Open Access Journals

Available at [Case reports in emergency medicine](http://downloads.hindawi.com/journals/criem/2018/1853473.pdf) - from Unpaywall

**Abstract:** Influenza is a contagious viral illness that usually presents with upper respiratory and pulmonary symptoms. While generally self-limited, pulmonary, renal, metabolic, neurologic, and cardiac complications have all been described in the literature. Here we describe a case of a 46-year-old male with multiple episodes of syncope, found to have severe bradycardia, sinus arrest, and positive influenza B, requiring permanent pacemaker placement. The viruses responsible for the flu can be differentiated into four types: A, B, C, and D. The two primary viruses responsible for the seasonal winter epidemic influenza in the United States are Human Influenza A and B viruses. It has been postulated that the influenza virus may be responsible for activating acute inflammatory cytokines, which then alter electrical conduction properties of endothelial cells. Although there have been cases of sinus arrest in association with influenza, some requiring pacemaker placement, our patient's presentation with multiple episodes of syncope with severe bradycardia and sinus arrest requiring permanent pacemaker placement, in association with influenza B, is very unusual and possibly unique. Since emergency physicians are at the forefront in the diagnosis, treatment, and disposition of these patients, awareness of influenza triggered cardiac events is essential and lifesaving, especially in unvaccinated patients.

**Database:** Medline

1. **Cardiac arrest among patients with infections: causes, clinical practice and research implications.**

**Author(s):** Leoni, D; Rello, J

**Source:** Clinical microbiology and infection : the official publication of the European Society of Clinical Microbiology and Infectious Diseases; Oct 2017; vol. 23 (no. 10); p. 730-735

**Publication Type(s):** Journal Article Review

**PubMedID:** 27903458

Available at [Clinical microbiology and infection : the official publication of the European Society of Clinical Microbiology and Infectious Diseases](http://www.ingentaconnect.com/openurl?genre=article&issn=1198-743X&volume=23&issue=10&spage=730) - from IngentaConnect - Open Access

Available at [Clinical microbiology and infection : the official publication of the European Society of Clinical Microbiology and Infectious Diseases](https://onlinelibrary.wiley.com/doi/full/10.1016/j.cmi.2016.11.018) - from Wiley Online Library Free Content - NHS

Available at [Clinical microbiology and infection : the official publication of the European Society of Clinical Microbiology and Infectious Diseases](http://www.clinicalmicrobiologyandinfection.com/article/S1198743X16306024/pdf) - from Unpaywall

**Abstract:** The incidence of sepsis is increasing, and the condition is now the leading cause of death in general intensive care units. Our review failed to identify studies of the causes of cardiac arrest among infected patients, even though non-cardiac causes represent 15% of out-of-hospital cardiac arrests and though one-third of events have positive blood cultures. Sudden cardiac arrest is the result of local damage to the heart and of the impact of systemic and pulmonary conditions on cardiac performance, and its danger is underestimated. Necropsy findings in sudden death often identify myocarditis as an unexpected cause. The role of hypoxaemia, severe pulmonary thromboembolism with subsequent pulseless cardiac activity, alterations of electrolytes and hydrogen concentrations, distort fluid distribution with reduced pre-load, direct myocyte damage and adverse cardiac effects related to antibiotic use need to be defined. Many cardiac arrests might be preventable. Because cardiopulmonary resuscitation is challenging and usually unsuccessful in patients with sepsis, research is needed to help predict which patients are at risk. Only half of pneumonia patients with cardiac arrest in the ward receive prior ECG monitoring. Telemedicine and non-invasive monitoring in the ward, avoidance of antibiotics associated with prolonged QT syndrome, and adequate haemodynamic resuscitation might be important in preventing in-hospital arrests among patients with infections.

**Database:** Medline

1. **Prolonged cardiac arrest: successful resuscitation with extracorporeal membrane oxygenation.**

**Author(s):** Chiu, Chun-Wen; Yen, Hsu-Heng; Chiu, Chun-Chieh; Chen, Ying-Cheng; Siao, Fu-Yuan

**Source:** The American journal of emergency medicine; Nov 2013; vol. 31 (no. 11); p. 1627

**Publication Type(s):** Case Reports Journal Article

**PubMedID:** 24055477

Available at [The American journal of emergency medicine](https://auth.elsevier.com/ShibAuth/institutionLogin?entityID=https://idp.eng.nhs.uk/openathens&appReturnURL=https%3A%2F%2Fwww.clinicalkey.com%2Fcontent%2FplayBy%2Fdoi%2F%3Fv%3D10.1016%2Fj.ajem.2013.06.040) - from ClinicalKey

Available at [The American journal of emergency medicine](http://search.ebscohost.com/login.aspx?direct=true&scope=site&site=ehost-live&db=mdc&AN=24055477) - from EBSCO (MEDLINE Complete)

Available at [The American journal of emergency medicine](http://gateway.proquest.com/openurl?ctx_ver=Z39.88-2004&res_id=xri:pqm&req_dat=xri:pqil:pq_clntid=145298&rft_val_fmt=ori/fmt:kev:mtx:journal&genre=article&issn=0735-6757&volume=31&issue=11&spage=1627.e5) - from ProQuest (Health Research Premium) - NHS Version

**Abstract:** Extracorporeal membrane oxygenation support can extend the duration of cardiopulmonary resuscitation (CPR), but prolonged CPR may develop multiple organ failure, and neurologic death is a major complication. We present a case of a 35-year-old woman with fulminant myocarditis secondary to H1N1 influenza A infection, in which cardiac arrest was refractory to prolonged conventional CPR. Extracorporeal membrane oxygenation was initiated 250 minutes after prolonged CPR. Extracorporeal membrane oxygenation provided cardiopulmonary life support for prolonged CPR, achieving a sustained return of spontaneous circulation, which allowed further treatment and made a good recovery with intact cerebral performance.

**Database:** Medline

1. **Unexpected cardiopulmonary arrest associated with influenza: our experience during the 2009 pandemic in Japan.**

**Author(s):** Okumura, Akihisa; Nakagawa, Satoshi; Kawashima, Hisashi; Muguruma, Takashi; Saito, Osamu; Fujimoto, Jun-ichi; Toida, Chiaki; Kuga, Shuji; Imamura, Toshihiro; Shimizu, Toshiaki; Kondo, Naomi; Morishima, Tsuneo

**Source:** Influenza and other respiratory viruses; Sep 2013; vol. 7 (no. 5); p. 759-760

**Publication Type(s):** Letter

**PubMedID:** 23122369

Available at [Influenza and other respiratory viruses](http://europepmc.org/search?query=(DOI:10.1111/irv.12032)) - from Europe PubMed Central - Open Access

Available at [Influenza and other respiratory viruses](https://onlinelibrary.wiley.com/doi/full/10.1111/irv.12032) - from Wiley Online Library Free Content - NHS

Available at [Influenza and other respiratory viruses](http://search.ebscohost.com/login.aspx?direct=true&scope=site&site=ehost-live&db=mdc&AN=23122369) - from EBSCO (MEDLINE Complete)

Available at [Influenza and other respiratory viruses](http://europepmc.org/articles/pmc5781208?pdf=render) - from Unpaywall

**Database:** Medline

1. **Sudden death of an immunocompetent young adult caused by novel (swine origin) influenza A/H1N1-associated myocarditis.**

**Author(s):** Gdynia, Georg; Schnitzler, Paul; Brunner, Eva; Kandolf, Reinhard; Bläker, Hendrik; Daum, Edith; Schnabel, Philipp; Schirmacher, Peter; Roth, Wilfried

**Source:** Virchows Archiv : an international journal of pathology; Mar 2011; vol. 458 (no. 3); p. 371-376

**Publication Type(s):** Case Reports Journal Article

**PubMedID:** 21234762

Available at [Virchows Archiv : an international journal of pathology](http://search.ebscohost.com/login.aspx?direct=true&scope=site&site=ehost-live&db=mdc&AN=21234762) - from EBSCO (MEDLINE Complete)

Available at [Virchows Archiv : an international journal of pathology](http://gateway.proquest.com/openurl?ctx_ver=Z39.88-2004&res_id=xri:pqm&req_dat=xri:pqil:pq_clntid=145298&rft_val_fmt=ori/fmt:kev:mtx:journal&genre=article&issn=0945-6317&volume=458&issue=3&spage=371) - from ProQuest (Health Research Premium) - NHS Version

**Abstract:** The main cause of death from novel (swine origin) influenza A/H1N1 infection is acute respiratory distress syndrome. Most fatal cases are immunocompromised patients or patients with a severe underlying disease. Here, we report a fatal case of acute interstitial myocarditis associated with novel influenza A/H1N1 infection in an immunocompetent young woman. A previously healthy 18-year-old woman experienced malaise, diarrhea, and fever for several days prior to a sudden collapse at home. Autopsy revealed a predominantly lymphocytic myocarditis in the absence of a significant respiratory tract infection. Infection with novel (swine origin) influenza A/H1N1 was confirmed by PCR analysis of blood as well as myocardial tissue. Influenza-caused diarrhea with consecutive hypokalemia potentially contributed to the fatal outcome of the myocarditis, characterized by ventricular fibrillation. In conclusion, sudden death by myocarditis may be a rare complication of novel influenza A/H1N1 infection in otherwise healthy individuals, even in the absence of significant respiratory tract infection.

**Database:** Medline

1. **Fatal fulminant myocarditis associated with novel influenza A (H1N1) infection.**

**Author(s):** Komai, Taichi; Nakazawa, Gaku; Asai, Satomi; Ikari, Yuji

**Source:** European heart journal; Feb 2011; vol. 32 (no. 3); p. 283

**Publication Type(s):** Case Reports Journal Article

**PubMedID:** 20861138

Available at [European heart journal](https://academic.oup.com/eurheartj/article-lookup/doi/10.1093/eurheartj/ehq359) - from HighWire - Free Full Text

Available at [European heart journal](https://academic.oup.com/eurheartj/article-pdf/32/3/283/7111100/ehq359.pdf) - from Unpaywall

**Database:** Medline

1. **Influenza A(H1N1) infection and severe cardiac dysfunction in adults: A case series.**

**Author(s):** Wiegand, Jan A; Torgersen, Christian; Bloechlinger, Stefan; Takala, Jukka; Dünser, Martin W

**Source:** Wiener klinische Wochenschrift; Feb 2011; vol. 123 (no. 3-4); p. 120-123

**Publication Type(s):** Case Reports Journal Article

**PubMedID:** 21240687

Available at [Wiener klinische Wochenschrift](http://search.ebscohost.com/login.aspx?direct=true&scope=site&site=ehost-live&db=mdc&AN=21240687) - from EBSCO (MEDLINE Complete)

Available at [Wiener klinische Wochenschrift](https://boris.unibe.ch/1101/1/508_2010_Article_1520.pdf) - from Unpaywall

**Abstract:** BACKGROUND While viral myocarditis and heart failure are recognized and feared complications of seasonal influenza A infection, only limited information is available for 2009 influenza A(H1N1)-induced heart failure. METHODS AND MAIN FINDINGS This case series summarizes the disease course of four patients with 2009 influenza A(H1N1) infection who were treated at our institution from November 2009 until September 2010. All patients presented with severe cardiac dysfunction (acute heart failure, cardiogenic shock or cardiac arrest due to ventricular fibrillation) as the leading symptom of influenza A(H1N1) infection. Two patients most likely had pre-existent cardiac pathologies, and three required catecholamine therapy to maintain hemodynamic function. Except for one patient who died before influenza A(H1N1) infection had been diagnosed, all patients received antiviral therapy with oseltamivir and supportive critical care. Acute respiratory distress syndrome due to influenza A(H1N1) infection developed in one patient. Heart function normalized in two of the three surviving patients but remained impaired in the other one at hospital discharge. CONCLUSIONS Influenza A(H1N1) infection may be associated with severe cardiac dysfunction which can even be the leading clinical symptom at presentation. During an influenza pandemic, a thorough history may reveal flu-like symptoms and should indicate testing for H1N1 infection also in critically ill patients with acute heart failure.

**Database:** Medline

1. **Fulminant myocarditis associated with novel H1N1 influenza A.**

**Author(s):** Khouzam, Rami N; Parizianu, Constantin; Hafiz, Abdul Moiz; Chawla, Shalinee; Schwartz, Richard

**Source:** Heart & lung : the journal of critical care; 2011; vol. 40 (no. 6); p. 566-568

**Publication Type(s):** Case Reports Journal Article

**PubMedID:** 21411147

Available at [Heart & lung : the journal of critical care](https://auth.elsevier.com/ShibAuth/institutionLogin?entityID=https://idp.eng.nhs.uk/openathens&appReturnURL=https%3A%2F%2Fwww.clinicalkey.com%2Fcontent%2FplayBy%2Fdoi%2F%3Fv%3D10.1016%2Fj.hrtlng.2011.01.004) - from ClinicalKey

**Abstract:** Myocarditis secondary to H1N1 influenza has been described in children, but only very rarely in adults. We describe a 36-year-old man with no significant medical history who presented with flu-like symptoms of 3-week duration. When he sought medical attention, he was already manifesting heart failure secondary to fulminant myocarditis, along with multiorgan failure. Despite aggressive management, including circulatory support with a catheter-based mechanical cardiac assist device (Impella 2.5 Cardiac Assist Device, Abiomed, Danvers, MA) as a bridge to cardiac transplant, and aggressive antiviral and antibacterial therapy, the patient died of cardiac arrest. An H1N1 polymerase chain reaction postmortem assay produced positive results, and a diagnosis of fulminant viral myocarditis and multiorgan system failure was established.

**Database:** Medline

1. **Awareness of the background rate of sudden cardiac death during mass immunization with pandemic H1N1 influenza vaccines increases the intended vaccination rate.**

**Author(s):** Wang, Youxin; Xiao, Zhongxin; Wang, Wei

**Source:** Preventive medicine; Nov 2010; vol. 51 (no. 5); p. 445-446

**Publication Type(s):** Research Support, Non-u.s. Gov't Letter

**PubMedID:** 20832419

Available at [Preventive medicine](https://auth.elsevier.com/ShibAuth/institutionLogin?entityID=https://idp.eng.nhs.uk/openathens&appReturnURL=https%3A%2F%2Fwww.clinicalkey.com%2Fcontent%2FplayBy%2Fdoi%2F%3Fv%3D10.1016%2Fj.ypmed.2010.08.019) - from ClinicalKey

**Database:** Medline

1. **Unusual nosocomial exposure to H1N1 influenza virus via open-chest cardiac massage.**

**Author(s):** Cunha, Burke A; Syed, Uzma; Thekkel, Valsamma; Davis, Marlene

**Source:** Infection control and hospital epidemiology; Jul 2010; vol. 31 (no. 7); p. 775-776

**Publication Type(s):** Letter

**PubMedID:** 20521960

Available at [Infection control and hospital epidemiology](https://www.cambridge.org/core/services/aop-cambridge-core/content/view/4C2C6AE44280F34BB12A4DA4AE4D337B/S0195941700086446a.pdf/div-class-title-unusual-nosocomial-exposure-to-hini-influenza-virus-via-open-chest-cardiac-massage-div.pdf) - from Unpaywall

**Database:** Medline

1. **Sudden unexpected cardiopulmonary arrest associated with influenza infection.**

**Author(s):** Kidokoro, Hiroyuki; Okumura, Akihisa; Suzuki, Motomasa; Kubota, Tetsuo; Kato, Toru; Hayakawa, Fumio; Watanabe, Kazuyoshi; Morishima, Tsuneo

**Source:** Pediatrics international : official journal of the Japan Pediatric Society; Oct 2009; vol. 51 (no. 5); p. 742-744

**Publication Type(s):** Research Support, Non-u.s. Gov't Case Reports Journal Article

**PubMedID:** 19799742

Available at [Pediatrics international : official journal of the Japan Pediatric Society](https://go.openathens.net/redirector/nhs?url=https%3A%2F%2Fonlinelibrary.wiley.com%2Fdoi%2Ffull%2F10.1111%2Fj.1442-200X.2009.02895.x) - from Wiley Online Library Medicine and Nursing Collection 2019 - NHS

**Database:** Medline

1. **Using simulation for training and to change protocol during the outbreak of severe acute respiratory syndrome.**

**Author(s):** Abrahamson, Simon D; Canzian, Sonya; Brunet, Fabrice

**Source:** Critical care (London, England); Feb 2006; vol. 10 (no. 1); p. R3

**Publication Date:** Feb 2006

**Publication Type(s):** Journal Article

**PubMedID:** 16356209

Available at [Critical care (London, England)](http://ccforum.biomedcentral.com/articles/10.1186/cc3916) - from BioMed Central

Available at [Critical care (London, England)](http://europepmc.org/search?query=(DOI:10.1186/cc3916)) - from Europe PubMed Central - Open Access

Available at [Critical care (London, England)](https://www.ncbi.nlm.nih.gov/pubmed/16356209) - from PubMed

Available at [Critical care (London, England)](https://ccforum.biomedcentral.com/track/pdf/10.1186/cc3916) - from Unpaywall

**Abstract:** INTRODUCTION During the 2003 severe acute respiratory syndrome (SARS) crisis, we proposed and tested a new protocol for cardiac arrest in a patient with SARS. The protocol was rapidly and effectively instituted by teamwork training using high-fidelity simulation. METHODS Phase 1 was a curriculum design of a SARS-specific cardiac arrest protocol in three steps: planning the new protocol, repeated simulations of this protocol in a classroom, and a subsequent simulation of a cardiac arrest on a hospital ward. Phase 2 was the training of 275 healthcare workers (HCWs) using the new protocol. Training involved a seminar, practice in wearing the mandatory personal protection system (PPS), and cardiac arrest simulations with subsequent debriefing. RESULTS Simulation provided insights that had not been considered in earlier phases of development. For example, a single person can don a PPS worn for the SARS patient in 1 1/2 minutes. However, when multiple members of a cardiac arrest team were dressing simultaneously, the time to don the PPS increased to between 3 1/2 and 5 1/2 minutes. Errors in infection control as well as in medical management of advanced cardiac life support (ACLS) were corrected. CONCLUSION During the SARS crisis, real-time use of a high-fidelity simulator allowed the training of 275 HCWs in 2 weeks, with debriefing and error management. HCWs were required to manage the SARS cardiac arrest wearing unfamiliar equipment and following a modified ACLS protocol. The insight gained from this experience will be valuable for future infectious disease challenges in critical care.

**Database:** Medline

1. **Sudden unexpected death of a 17-year-old male infected with the influenza virus.**

**Author(s):** Nishida, Naoki; Chiba, Takashi; Ohtani, Maki; Yoshioka, Naofumi

**Source:** Legal medicine (Tokyo, Japan); Jan 2005; vol. 7 (no. 1); p. 51-57

**Publication Type(s):** Case Reports Journal Article

**PubMedID:** 15556016

**Abstract:** We report a case of sudden unexpected death in a 17-year-old male student showing similar clinical background and pathological findings to Reye's syndrome. He was found following cardio-pulmonary arrest in his bed, and was immediately transferred to a hospital. However, resuscitation was not successful. He had a history of high fever of 38.3 degrees C, general malaise, myalgia, and gastrointestinal discomfort for the 2 days prior to his death, and an injection of pylazolon and medication comprising anti-emetics had been administered the day before he died. His biochemical findings showed almost normal levels of transaminase, electrolytes and protein fractions at the emergency room, but blood from the heart at autopsy revealed a high titer of the influenza A virus. Macroscopically, in addition to considerable fatty metamorphosis of the liver, concentric hypertrophy of the left ventricle, muscular bridge of left anterior descending artery, moderate coronary atherosclerosis, and mild downward displacement of the septal leaflet of the tricuspid valve were noted in the heart. Although panlobular microvesicular fatty infiltration of the liver was seen, deposition of lipid droplets was detected only in hepatocytes by frozen section of several organs. Serial sectioning of the epicardial coronary arteries showed about 50% stenosis at the distal site of the left circumflex artery, and diffuse interstitial fibrosis was evident in the bilateral ventricle and this was relatively severe for his age. In addition, the atrioventricular (AV) node artery showed severe narrowing just before entering the AV node, and downward displacement of the AV node with longitudinal elongation was also remarkable. We consider that the cause of death was sudden cardiac death rather than Reye's syndrome (RS), and that an arrhythmogenic event due to some preceding unusual cardiac lesions may have become overt due to the influenza infection and/or some related disorders. The present case would seem to suggest that a postmortem diagnosis of RS should be determined very carefully in cases of sudden death, even if the general circumstances would seem to be consistent with RS.

**Database:** Medline

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**Databases searched:**

* + **Evidence-Based Reviews/Point-of-Care:** Cochrane Library, UpToDate.
  + **Guidance:** NICE Guidance, selected International Guidelines.
  + **Healthcare Databases:** MEDLINE, EMBASE, PubMed, NICE Evidence Search.
  + **Other:** Google, Google Scholar, Public Heath England, World Health Organization.

**Local Guidance:** Local guidance has not been searched as part of this literature search. However, local guidelines, policies and procedures are available via the red button on the intranet.

**Search Terms:**

|  |  |
| --- | --- |
| ***Subject Headings*** | ***Free Text Words*** |
| Communicable Diseases | Cardiac arrest |
| Coronavirus | Coronavirus |
| Coronavirus Infections | COVID-19 |
| Heart Arrest | Infection |
| Influenza Virus | Influenza |
| Orthomyxoviridae | Manage\* |
| Treatment Outcome | MERS |
| Virus Diseases | Outcome\* |
| Virus Infection | SARS |
|  | Severe acute respiratory syndrome |

**Search Limits:** None applied.

**Search History:** Search examples:

|  |  |  |  |
| --- | --- | --- | --- |
| **#** | **Database** | **Search term** | **Results** |
| 1 | Medline | exp "HEART ARREST"/ | 46871 |
| 2 | Medline | exp "VIRUS DISEASES"/ | 881541 |
| 3 | Medline | (covid-19 OR coronavirus).ti,ab | 10519 |
| 4 | Medline | (1 AND 2) | 195 |
| 5 | Medline | (3 AND 4) | 1 |
| 6 | Medline | exp ORTHOMYXOVIRIDAE/ | 56179 |
| 7 | Medline | exp CORONAVIRUS/ | 11216 |
| 8 | Medline | (6 OR 7) | 67081 |
| 9 | Medline | (4 AND 8) | 13 |
| 10 | EMBASE | \*"HEART ARREST"/ | 23698 |
| 11 | EMBASE | (covid-19 OR coronavirus).ti,ab | 11140 |
| 12 | EMBASE | exp "INFLUENZA VIRUS"/ | 30981 |
| 13 | EMBASE | exp "VIRUS INFECTION"/ | 1102449 |
| 14 | EMBASE | (10 AND 11) | 0 |
| 15 | EMBASE | (12 OR 13) | 1116271 |
| 16 | EMBASE | (10 AND 15) | 92 |
| 17 | EMBASE | 16 [English language] | 88 |

|  |  |  |  |
| --- | --- | --- | --- |
| **#** | **Database** | **Search term** | **Results** |
| 1 | Medline | (cardiac arrest).ti,ab | 36414 |
| 2 | Medline | (SARS OR MERS OR influenza).ti,ab | 107432 |
| 3 | Medline | (1 AND 2) | 55 |
| 4 | Medline | exp "HEART ARREST"/ | 46871 |
| 5 | Medline | (manage\*).ti,ab | 1245931 |
| 6 | Medline | (outcome\*).ti,ab | 1653548 |
| 7 | Medline | exp "TREATMENT OUTCOME"/ | 1026387 |
| 8 | Medline | (severe acute respiratory syndrome).ti,ab | 1 |
| 9 | Medline | exp "CORONAVIRUS INFECTIONS"/ | 9498 |
| 10 | Medline | (5 OR 6 OR 7) | 3263798 |
| 11 | Medline | (4 AND 9 AND 10) | 1 |

**Search Date: 19/03/2020**

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