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Original Article

A Histopathological Study of Spectrum of Myocarditis in Autopsy Cases of Sudden Cardiac Death

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ABSTRACT

INTRODUCTION: The prevalence of myocarditis has been estimated to range from 10.2 to 105.6 per 100,000 people worldwide showing its rare occurrence. It is characterized by heterogeneous aetiology, complex histopathology, variable clinical manifestations like chest pain, dyspnoea, palpitations to cardiogenic shock and sudden death. Histopathology examination plays important role in categorization of myocarditis into predominantly lymphocytic, neutrophilic, eosinophilic, giant cell and granulomatous myocarditis depending upon presence of inflammatory infiltrate.

AIMS AND OBJECTIVES: To find out the histopathological spectrum of myocarditis in different age and gender groups in autopsy cases of sudden cardiac death.

MATERIALS AND METHODS: Out of total 726 autopsy cases received during period of July 2023 to July 2024,23 cases show features of myocarditis. Their histopathological examination is done. The cases are categorized into various types of myocarditis and its correlation with different age and sex is made.

RESULT: Out of total 726 autopsy, 23 (3%) cases show histopathological features of myocarditis. Among them, Lymphocytic Myocarditis is a major cause of sudden unexpected death in adults less than 40 years of age, mostly in male gender followed by giant cell myocarditis.

CONCLUSION: This study shows the histopathological spectrum of of myocarditis in sudden death cases at autopsy. In future, knowledge of it can help in understanding the course of the disease and implementing new therapeutic strategies for prevention of sudden cardiac death in young individuals.

Keywords: *Myocarditis; Sudden cardiac death; Autopsy cases*

Introduction

Myocarditis is an inflammatory involvement of the myocardium that can occur alone in the primary form or be part of systemic, immune, autoimmune, and infectious diseases, representing the secondary localization. It is characterized by heterogeneous aetiology, complex histopathology, variable clinical manifestations like chest pain, dyspnoea, palpitations to cardiogenic shock and sudden death. Although the outcome is favourable in half of the patients (50%), the other half may develop severe hemodynamic, electrical instability, acute heart failure, progressive dilated cardiomyopathy, or even sudden cardiac death. [1–3]

In 45-50% of sudden death cases, the cause is usually cardiovascular system [4] which include myocarditis, hypertrophic cardiomyopathy, congenital heart disease, arrhythmia and coronary artery disease. The incidence of myocarditis amongst autopsy cases ranges from 0.12-12%[5,6]

Various etiology of myocarditis includes infections due to virus and bacteria, immune mediated causes, idiopathic giant cell myocarditis and toxic myocarditis. Bacterial infections include infections due to Corneybacterium Diphtheria, Neisseria, meningococcus, Borrelia, etc. Viral infections like Coxsackie virus, Influenza, HIV, Cytomegalovirus, etc. also cause myocarditis. Other causes include fungi like Candida infection, parasitic Infections, immune mediated causes like sarcoidosis, Systemic lupus erythematous, toxic causes due to drugs, ethanol, heavy metal and Idiopathic giant cell myocarditis. [7,8]

However, the scarcity of autopsy-based studies addressing myocarditis has resulted in limited availability of histopathological data, as mentioned in the review conducted by Falleti et al. [9] Myocarditis is strictly a histological diagnosis made by pathologists who can accurately identify this disease and its underlying causes. [10] The limited forensic pathology literature on myocarditis may be due to the relative rarity of fatal cases [11]. Additionally, the global decline in autopsy rates presents another barrier that complicates pathological investigations of cases of sudden cardiac death (SCD). [12]

The current study conducted in tertiary care hospital outlines the various pathological features of fatal myocarditis in 23 autopsy cases of sudden cardiac death along with its age and gender wise distribution. This study could benefit clinicians and forensic medicine practitioners.

AIM:

To study the histopathological spectrum of myocarditis and its types in hospital-based autopsy cases

OBJECTIVES:

1. To study the histopathological spectrum of myocarditis in autopsy cases
2. To find out the age and gender wise distribution of myocarditis in autopsy cases

INCLUSION CRITERIA:

1. Autopsy cases of all age group
2. All histopathologically diagnosed autopsy cases of myocarditis.

EXCLUSION CRITERIA: Autolysed organs

MATERIALS AND METHODS

Study design: Hospital based observational study.

- Total 726 autopsy are received during period of July 2023 to July 2024, in pathology department from forensic department. Out of total 726 autopsy cases,23 cases (3% cases) show histopathological features of myocarditis.
- This study is conducted on 23 autopsy cases of sudden cardiac death due to myocarditis. After post-mortem examination, organs of the autopsy cases like heart, kidneys, lung, spleen, brain are received from the forensic medicine department to the autopsy section of pathology department in tertiary care hospital.
- The organs are kept in formalin filled jars for overnight fixation. After measuring weight of each organ, grossing of received organs is done according to standard protocol. Grossing of heart is done by inflow and out flow method and short axis method. If any pathological findings are found, they are noted and sections are taken from representative area. Same protocol is applied to other organs. Tissue processing is done in tissue processor Epredia AS and slides are stained with Hematoxylin and Eosin staining. Histopathological examination of each slide of various organs is done and findings are noted.
- The cases which show sudden cardiac death due to myocarditis are studied on the basis of histopathological findings. Myocarditis is defined as a myocardial process characterized by the presence of both an inflammatory infiltrate and myocyte damage according to the Dallas criteria or necrosis not typical of the myocardial damage of ischemic heart disease. To confirm the diagnosis at least two inflammatory cell foci, with at least 5-10 inflammatory cells associated with individual myocyte necrosis, per histologic section should be seen. Based on the type of cellular infiltrates, the cases of myocarditis are categorized into Predominant Lymphocytic myocarditis, Idiopathic giant cell myocarditis, Granulomatous myocarditis and Predominantly Neutrophilic myocarditis. Age wise and gender wise distribution of different type of myocarditis is done.

RESULTS

Total 23 autopsy cases of sudden cardiac death show histopathological features of myocarditis. They are categorized into various type of myocarditis depending upon inflammatory cell infiltrates on microscopic examination and their correlation with age and gender group is shown hereby. Among the 23 cases studied, the age-group more affected is 31-40 years of age i.e. 34.7% of the study population, followed by 21-30 year and 41-50 years of age group, each show 21.7% of the study population. The youngest patient was 3years old female child and oldest patient was a 63year old male. This study also shows that male gender is more affected than the female with the Male: Female ratio of 10.5:1.

- **Table-1: Cases of myocarditis and its correlation with age and gender groups**

Age group in years	Male	Female	Total
1-20	0	1	1(4.3%)

21-30	4	1	5(21.7%)
31-40	8	0	8(34.7%)
41-50	5	0	5(21.7%)
51-60	2	0	2(8.6%)
>60	2	0	2(8.6%)
Total	21	2	23

- **Table-2: Histopathological spectrum of myocarditis and its frequency**

Histopathological spectrum of myocarditis	No. of cases
Predominant Lymphocytic myocarditis	17 (73.9%)
Idiopathic giant cell myocarditis	3 (13.04%)
Granulomatous myocarditis	01(4.3%)
Predominantly Neutrophilic Myocarditis	02(8.6%)
Total	23

Out of 23 cases, Lymphocytic myocarditis is the commonest histopathological finding accounting 73.9% cases. The second most common myocarditis is the Idiopathic giant cell myocarditis (13.04%) followed by Predominantly Neutrophilic Myocarditis (8.6%).

- **Table-3: Gender wise distribution of various myocarditis**

	Predominant Lymphocytic myocarditis	Idiopathic giant cell myocarditis	Granulomatous myocarditis	Predominantly Neutrophilic myocarditis	Total cases
Male	15	3	1	2	21(91.3%)
Female	2	0	0	0	2(8.7%)
Total	17	3	1	2	23

Among males, various types of myocarditis are seen, but most common is the lymphocytic myocarditis followed by Idiopathic giant cell myocarditis and predominantly neutrophilic myocarditis. In females, only lymphocytic myocarditis is seen.

- **Table-4: Age-groupwise distribution of various myocarditis**

Age group in years	Predominant Lymphocytic myocarditis	Idiopathic giant cell myocarditis	Granulomatous myocarditis	Predominantly Neutrophilic myocarditis	Total cases
1-20	1	-	-	-	1
21-30	4	1	-	-	5
31-40	4	1	1	2	8
41-50	4	1	-	-	5
51-60	2	-	-	-	2
>60	2	-	-	-	2
Total	17	3	1	2	23

In age group 1-20 years, mainly lymphocytic myocarditis is predominant, while in age group 21-30 years and 41-50 years, lymphocytic myocarditis cases are more followed by cases of idiopathic giant cell myocarditis. In age group 31-40 years, in addition to lymphocytic myocarditis and idiopathic giant cell myocarditis, the cases of granulomatous myocarditis and predominantly neutrophilic myocarditis are also found. Lymphocytic myocarditis is again the commonest finding in age >50 years.

Lymphocytic Myocarditis

- Out of 23 cases, 17(73.9%) cases on histopathological examination of heart show mononuclear cell infiltrate, predominantly lymphocytes in stroma and myocytolysis, showing possibility of Viral Myocarditis. Two out of 17 cases have additional finding of arteritis of coronary artery.
- On gross examination of these 17 cases, 2 cases show foci of hemorrhagic spots in apex and left ventricular wall, rest are unremarkable.
- Sections from other organs like lungs, liver, kidney, spleen and brain show no remarkable feature.

Idiopathic Giant cell myocarditis

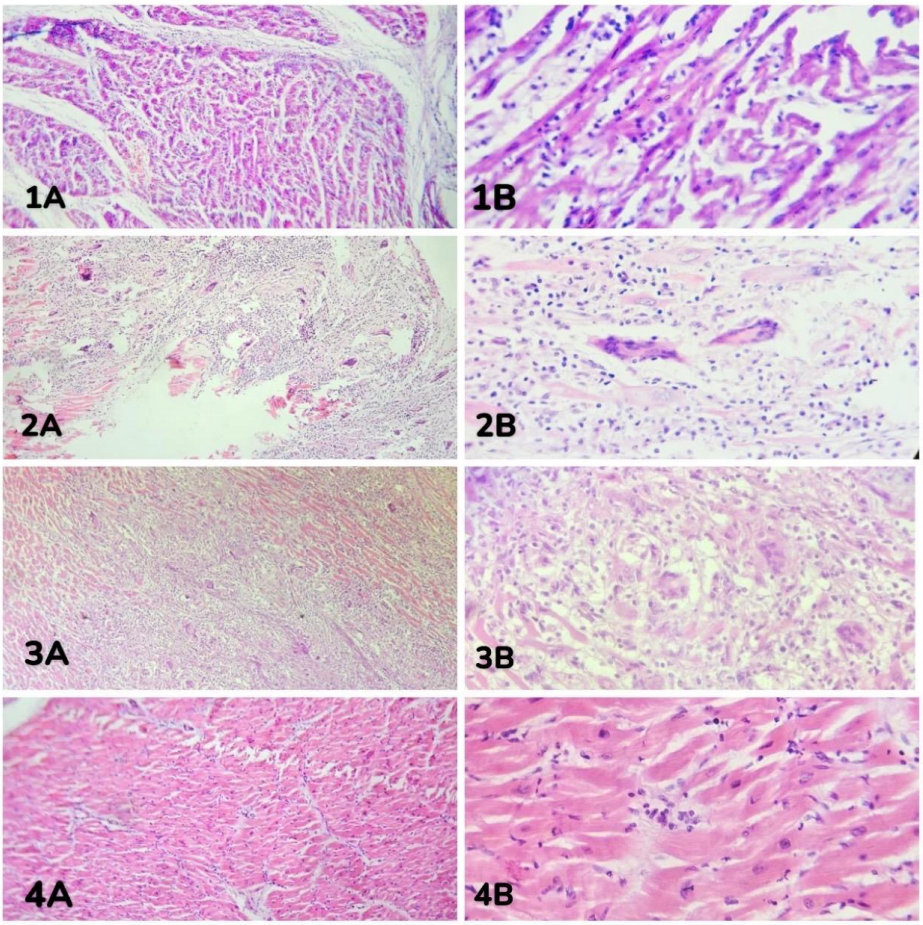
- Out of 23 cases, 3(13.04%) cases on histopathological examination of heart show presence of multinucleated giant cells with lymphocyte in interstitium of myocardium suggestive of Giant cell Myocarditis.
- One out of 3 cases have additional finding of arteritis in both coronary arteries. On gross examination of these 3 cases, 1 case shows few hyperemic areas in apex and interventricular septum. Sections from other organs like lungs, liver, kidney, spleen and brain show no remarkable features

Granulomatous Myocarditis

- 1(4.3%) case on histopathological examination of heart shows presence of epitheloid cell granuloma in myocardium along with granulomatous inflammatory cell infiltrates in lungs, liver and one kidney. Ziehl-Neelsen stain for acid fast bacilli is positive for lungs, liver and kidney, hence the possibility of Tuberculous myocarditis is considered.
- On gross examination of the heart, whitish patch is seen on the pericardium.

Polymorphonuclear cell Myocarditis (Predominantly Neutrophilic myocarditis)

- 2(8.6%) cases on histopathological examination of heart show plenty of polymorphonuclear cells predominantly neutrophils with foci of myocytolysis showing possibility of bacterial myocarditis.
- On gross examination of heart, coronary arteries are normal. There are no gross and microscopic findings of ischemic heart disease.
- Sections from other organs are unremarkable.



(Figure: 1A-10x H & E Stain -Viral Myocarditis, Figure: 1B-40x H & E Stain -Viral Myocarditis, Figure: 2A-10x H & E Stain -Giant cell myocarditis, Figure: 2B-40x H & E Stain -Giant cell myocarditis, Figure:3A: 10x H & E Stain -Granulomatous myocarditis, Figure:3B: 40x H & E Stain -Granulomatous myocarditis, Figure 4A: 10x H & E Stain -Polymorph nuclear cell myocarditis, Figure 4B: 40x H & E Stain -polymorph nuclear cell myocarditis)

DISCUSSION

- The prevalence of myocarditis has been estimated to range from 10.2 to 105.6 per 100,000 people worldwide, with relevant regional differences influenced by a variety of pathogens, as well as locally available diagnostics procedures. Total 726 autopsy are received during period of July 2023 to July 2024, 23 (3%) cases show histopathological features of myocarditis. This study investigated 23 myocarditis cases, representing a tiny fraction of all autopsied sudden cardiac deaths. Similarly, studies conducted by Passarino et al. [13] and Gravanis and Sternby [14] recognized histopathological features of myocarditis in only 5.1% and 1.06% of autopsied cases among the Italian and Swedish populations, respectively.
- In the present study, most of the fatalities are in males (91.3%), aligning with the findings of Bhatia et al. [15] and Harris et al. [16] who reported that males constituted 76% and 65% of their enrolled cases. Interestingly, the effect of sex on myocarditis was studied in animal models and cell cultures, which showed that testosterone enhances viral replicability and promotes more intense inflammatory and immune responses that contribute to the pathogenesis of myocarditis. Also, males' lifestyles may include more vigorous muscular activities that could precipitate fatal complications of myocarditis, including acute heart failure or arrhythmia. [17]

- Myocarditis frequently mimics myocardial infarction in young adults due to non-specific symptoms and clinical presentation.
- Lymphocytic myocarditis is a type which has been in predominance in our study, representing 73.9% of the cases. Lymphocytic myocarditis is mainly associated with Viral etiology. [18] In 2009, Treacy A et al [19] reported a case of sudden death due to myocarditis caused by Adenovirus serotype 3 in a child. In our case we also reported a death due to lymphocytic myocarditis in a 3year old female child. Harris et al [16] reported that lymphocytic myocarditis was the most prevalent subtype, constituting 67% of their autopsied cases in the USA. Also, in the UK, Bhatia et al. [15] declared that lymphocytic myocarditis constituted 56% of cases. In these two studies, neutrophilic myocarditis accounted for a small percentage of myocarditis-related deaths.
- Autoimmunity has been increasingly recognized as one of the main factors sustaining inflammation and disease progression in myocarditis.
- Neutrophilic myocarditis is a rare histological type of myocarditis which is related to bacterial infections associated with pancarditis. Myocardial involvement is most frequently due to hematogenous dissemination in septicemia. Neutrophils predominate and may be irregularly distributed or form micro-abscesses around damaged myocytes and more significant areas of necrosis. In present study 2 cases, out of 23 cases of myocarditis show features of neutrophilic myocarditis. All these cases show normal coronary artery and no histological features of acute myocardial infarction.
- In study of Fnon et al [20], 30cases show (71.4%) neutrophilic myocarditis out of total 42 cases. Contrary to typical findings in the literature, neutrophilic myocarditis was the most common subtype observed in Egypt, which may be linked to the high prevalence of Rheumatic heart disease (RHD)and infections. Lymphocytic myocarditis was the second most prevalent subtype, while eosinophilic and giant cell myocarditis were less frequently identified in that study. This research emphasizes the need to protect against RHD and fatal infections in developing societies and highlights the importance of histopathological examinations for all cases of sudden cardiac death. Bacterial agents leading to myocarditis include pathogens such as Corynebacterium diphtheria, Beta-haemolytic streptococci, Meningococci, Salmonella typhi or paratyphi, Borrelia burgdorferi, Mycoplasma pneumonia and Chlamydia psittaci.
- Giant cell myocarditis also known as Idiopathic giant cell myocarditis is a rare form of myocarditis which is usually seen in young adults. Giant cell myocarditis, a particularly aggressive form, is characterized by more widespread multicentric destruction of the cardiac myocytes. [8] It may be associated with autoimmune diseases, such as SLE, Sjögren's syndrome, vasculitis, ulcerative colitis and polymyositis. Shanmugam J et al [21], in 2015, reported a case of sudden death due to giant cell myocarditis in a 33year old male. In our study we reported 3 cases of idiopathic giant cell myocarditis all in males between age group 21-50 year. The epidemiology of giant cell myocarditis has not been investigated comprehensively given its low incidence. An autopsy study, including 377,841 autopsy cases, found the incidence of giant cell myocarditis to be 0.007%. [22] In comparison, the incidence of other types of myocarditis was considerably higher (0.11%). [22]
- A study carried out by Prashant R. Patel et al [23] on autopsy cases in 2013, showed 3 cases (42.8%) of Giant cell myocarditis whereas only 1 case (14.28%) of lymphocytic myocarditis and 1 case of granulomatous myocarditis out of 7 cases of myocarditis. The ratio of incidence of giant cell and lymphocytic myocarditis is reversed in our study where we have 73.9% cases with lymphocytic myocarditis and 13.04% of giant cell myocarditis. Out of 7 cases of myocarditis in their study six were male and one was female which shows predominance in male. These findings are in line with our study where the male to female ratio is 10.5:1.
- Granulomatous myocarditis is a rare type of myocarditis. In present study, it is found in 1 (out of 23 cases) male patient, age group 31-40 year. Prashant R. Patel et al [23] study also shows 1 case of granulomatous myocarditis. The major causes include sarcoidosis and tuberculosis. In our case noncaseating granuloma is seen with negative AFB stain in the sections taken from heart. But sections from lung, liver and one kidney show granuloma and sections are positive for acid fast bacilli. As reported by a study conducted by Kanchan T [24], AFB stain is not positive in each and every case of Tuberculous myocarditis, in present study, this case is labelled as granulomatous myocarditis, most probably tuberculous myocarditis.

LIMITATIONS

- Typically, autopsies are performed only in cases of suspicious deaths, which means that the full spectrum of myocarditis-related mortality, particularly in clinical settings, may not be captured. Also, the scarcity of data concerning the lifestyle factors, medical histories, and causative agents of myocarditis was considered a limitation of the current study.

RECOMMENDATIONS

- Based on the findings of this study, we recommend integrating histopathological examination of the heart into routine autopsy procedures for cases of sudden death. Forensic medicine practitioners should consider myocarditis in instances of sudden death following a recent viral illness, as viral myocarditis may present with minimal or even no cardiac symptoms.
- We recommend future prospective research investigating myocarditis using immunohistochemistry, which enhances the accuracy of identifying specific types of inflammatory cells and improves diagnostic sensitivity. In

addition to immunohistochemistry, another diagnostic modality can be used to verify the underlying causes of myocarditis, including molecular techniques such as polymerase chain reaction (PCR), viral serology, microbiological cultures, autoimmune markers, and toxicological analysis.

CONCLUSION:

In this study, total 23 autopsy cases of myocarditis are found, from July 2023 to July 2024. Most common age group affected is 31-40year and male is predominantly affected. Most common histopathological finding are of lymphocytic myocarditis followed by giant cell myocarditis. The reported cases of myocarditis, whether in the current study or previous research, might be just the tip of the iceberg, and many myocarditis-related deaths could remain unreported. Diagnosing myocarditis clinically is highly challenging due to non-specific symptoms and the limitations of definitive diagnostic tools, apart from invasive endo myocardial Biopsy. Furthermore, myocarditis might stand behind various acute and chronic life-threatening conditions, such as arrhythmias, acute heart failure, and, dilated cardiomyopathy. In many instances, these cases typically do not undergo autopsy unless medico legal issues are raised. Additionally, the normal gross appearance of the heart in some myocarditis cases can be misleading to forensic medical examiners who might not pursue histopathological assessment.

Meticulous autopsy and proper histopathological examination play an important role to find out various etiology of myocarditis and in future, knowledge of these etiological agents can help in understanding the course of the disease and implementing new therapeutic strategies for prevention of sudden cardiac death in young individuals. The limited awareness of this disease leads to an even deeper knowledge gap that we urgently need to fill. International collaborations will be necessary to make progress in developing effective therapies for this increasing patient population.

REFERENCES:

1. Caforio, A. L. P., Pankuweit, S., Arbustini, E., Basso, C., Gimeno-Blanes, J., Felix, S. B., Fu, M., Heliö, T., Heymans, S., Jahns, R., & Elliott, P. M. (2013). Current state of knowledge on aetiology, diagnosis, management, and therapy of myocarditis: A position statement of the European Society of Cardiology Working Group on Myocardial and Pericardial Diseases. European Heart Journal, 34(33), 2636–2648. https://doi.org/10.1093/eurheartj/eht210
2. Ammirati, E., Cipriani, M., Lilliu, M., Sormani, P., Varrenti, M., Raineri, C., Petrella, D., Garascia, A., Pedrotti, P., Roghi, A., & Frigerio, M. (2017). Survival and left ventricular function changes in fulminant versus nonfulminant acute myocarditis. Circulation, 136(6), 529–545. https://doi.org/10.1161/CIRCULATIONAHA.117.026386
3. Schultheiss, H. P., Kühl, U., & Cooper, L. T. (2011). The management of myocarditis. European Heart Journal, 32(21), 2616–2625. https://doi.org/10.1093/eurheartj/ehr165
4. Reddy, K. S. N., & Murty, O. P. (2013). The essentials of forensic medicine and toxicology (32nd ed., p. 145). Jaypee Brothers.
5. Wakafuji, S., & Okada, R. (1986). Twenty-year autopsy statistics of myocarditis incidence in Japan. Japanese Circulation Journal, 50, 1288–1293. https://doi.org/10.1253/jcj.50.1288
6. Kytö, V., Saraste, A., & Voipio-Pulkki, L. M. (2007). Incidence of fatal myocarditis: A population-based study in Finland. American Journal of Epidemiology, 165(5), 570–574. https://doi.org/10.1093/aje/kwk078
7. Sternberg, S. S. (2019). Sternberg's diagnostic surgical pathology (7th ed., Vol. 1, pp. 1470–1472). Wolters Kluwer.
8. Rosai, J. (2018). Rosai and Ackerman's surgical pathology (11th ed., Vol. 2, pp. 1918–1919). Elsevier.
9. Falleti, J., Orabona, P., Municinò, M., Castellaro, G., Fusco, G., & Mansueto, G. (2024). An update on myocarditis in forensic pathology. Diagnostics, 14, 760. https://doi.org/10.3390/diagnostics14070760
10. Leone, O., Pieroni, M., Rapezzi, C., & Olivotto, I. (2019). The spectrum of myocarditis: From pathology to the clinics. Virchows Archiv, 475, 279–301. https://doi.org/10.1007/s00428-019-02600-6
11. Schwab, C., Domke, L. M., Hartmann, L., Stenzinger, A., Longerich, T., & Schirmacher, P. (2023). Autopsy-based histopathological characterization of myocarditis after anti-SARS-CoV-2 vaccination. Clinical Research in Cardiology, 112, 431–440. https://doi.org/10.1007/s00392-022-02064-3
12. Hamza, A. (2017). Declining rate of autopsies: Implications for anatomic pathology residents. Autopsy & Case Reports, 7, 1–2. https://doi.org/10.4322/acr.2017.019
13. Passarino, G., Burlo, P., Ciccone, G., Comino, A., Cravello, M., Iannicelli, P., & Mollo, F. (1997). Prevalence of myocarditis at autopsy in Turin, Italy. Archives of Pathology & Laboratory Medicine, 121, 619–622.
14. Gravanis, M. B., & Sternby, N. H. (1991). Incidence of myocarditis: A 10-year autopsy study from Malmö, Sweden. Archives of Pathology & Laboratory Medicine, 115, 390–392.
15. Bhatia, R. T., Finocchiaro, G., Westaby, J., Chatrath, N., Behr, E. R., Papadakis, M., Sharma, S., & Sheppard, M. N. (2023). Myocarditis and sudden cardiac death in the community. Circulation: Arrhythmia and Electrophysiology, 16, e012129. https://doi.org/10.1161/CIRCEP.123.012129
16. Harris, K. M., Mackey-Bojack, S., Bennett, M., Nwaudo, D., Duncanson, E., & Maron, B. J. (2021). Sudden unexpected death due to myocarditis in young people, including athletes. American Journal of Cardiology, 143, 131–134.

17. Fairweather, D., Beetler, D. J., Musigk, N., Heidecker, B., Lyle, M. A., Cooper, L. T., Jr., & Bruno, K. A. (2023). Sex and gender differences in myocarditis and dilated cardiomyopathy. Frontiers in Cardiovascular Medicine, 10, 1129348. https://doi.org/10.3389/fcvm.2023.1129348
18. Toressa, A. F., Braga, D. N., Muniz, F., Mendonça, C., Oliveira, D. N., Souza, E. T., et al. (2013). Lymphocytic myocarditis at autopsy in patients with dengue fever. Brazilian Journal of Infectious Diseases, 17(5), 619–621.
19. Treacy, A., Carr, M. J., Dunford, L., Palacios, G., Cannon, G. A., O'Grady, A., et al. (2010). Sudden death due to myocarditis caused by adenovirus serotype 3. Journal of Clinical Microbiology, 48(2), 642–645. https://doi.org/10.1128/JCM.01557-09
20. Fnon, N. F., Ismael, N. E.-H. S., Hassan, H. H., El-Sheikh, S. A.-E., & Sobh, Z. K. (2022). A post-mortem study of unexpected natural pediatric deaths in Egypt. Egyptian Journal of Forensic Sciences, 12, 55.
21. Shanmugam, J., et al. (2015). Cardiac involvement in myocarditis. Cardiology Research, 6(6), 372–375. https://doi.org/10.14740/cr446e
22. Okada, R., & Wakafuji, S. (1985). Myocarditis in autopsy. Heart and Vessels, 1, 23–29. https://doi.org/10.1007/BF02072354
23. Patel, P., Tailor, H. J., & Hathila, R. N. (2013). Autopsy study of myocarditis of different etiologies at tertiary care hospital. Biennial Journal of GAPM.
24. Kanchan, T., Nagesh, K. R., Lobo, F. D., & Menezes, R. G. (2010). Tubercular granuloma in myocardium: An autopsy report. Singapore Medical Journal, 51(1), e15–e17.