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Heart stopped: Assessing cardiac arrest preparedness and response in university environments

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Abstract

Aim: The aim of this research is to enhance comprehension of the occurrence and distribution of cardiac arrest incidents that happen in universities, specifically by examining the significance of automated external defibrillators that are available in universities.

Methods and Results: The inquiry was a retrospective analysis of nontraumatic, out-of-hospital cardiac arrests in Vadodara, Gujarat that happened in Universities between June 2020 and December 2022 and were treated by emergency medical services. Cases were found using cardiac arrest registry information from emergency medical services. The registries and event report forms were used to extract patient characteristics, cardiac arrest features, and outcome data. 118 cardiac arrests occurred in universities throughout the research period, making up 0.4% of all treated cardiac arrests and 2.6% of cardiac arrests in public places. 118 of the 189 incidents were cardiac arrests in students, and 71 involved professors and staff.

Conclusion: Study examines universities cardiac arrest and offers preparation and outcome framework. The findings of this study can aid in developing strategies to improve cardiac arrest response at universities and enhance the chances of a positive outcome. It emphasizes the importance of preparedness and the need for proactive measures to ensure that emergency responders are well-equipped to handle such situations. By implementing appropriate interventions, universities can potentially increase the likelihood of survival for those experiencing cardiac arrest on their campuses.

Keywords: Heart attack; Hospital; Students; Prophylaxis

1. Introduction

When a young student dies suddenly from cardiac arrest, it deeply affects their family and community, and raises concerns about the safety of other universities. These incidents have led to increased awareness of how to respond to cardiac arrests in university, including recognizing the problem, activating emergency services, cardiopulmonary resuscitation (CPR), defibrillation, and providing advanced care. The growing availability and successful deployment of automated external defibrillators (AEDs) in public spaces has led to calls for every universities to have them[1, 2, and 3]. This has resulted in legislation in some states and a congressional bill promoting access to defibrillation in universities. However, there is a lack of population-based data on the incidence, circumstances, patient characteristics, and outcomes of cardiac arrest in universities. This study aims to improve our understanding of the epidemiology of cardiac arrest in universities, with a focus on the role of AEDs [4, 5 and 6].

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2. Methods

2.1. Study

The study examined nontraumatic out-of-hospital cardiac arrests in public locations that were treated by emergency medical services in Vadodara, Gujarat. Although the primary focus of the investigation was on cardiac arrests that occurred in universities information about other public location cardiac arrests was also included to provide a broader context for the characteristics and outcomes of these incidents. The analysis included all cardiac arrests that took place in universities and universities hospital between June 2020, and December 2022.

2.2. Emergency medical services (EMS)

Emergency medical services (EMS) in the area can be activated by dialing 108/102 and speaking to an emergency dispatcher. The EMS system consists of two tiers: the first tier comprises firefighter-emergency medical technicians who have training in basic life support and automated defibrillation, while the second tier comprises paramedics who have more advanced life support training. When a suspected cardiac arrest occurs, both tiers are dispatched simultaneously. The first-tier EMS providers typically reach the scene within an average of 3.7 minutes after dispatch, while the second tier arrives an average of 4 minutes after the first tier. In India, which surrounds Seattle, first-tier EMS providers take an average of 5 minutes to reach the scene after call receipt, and the second tier arrives on average 5 minutes after the first tier.

2.3. Data collection

The registries contain information on the location of every cardiac arrest and whether it happened in a home or public place. To find cases of cardiac arrest that occurred in a universities, all public location cardiac arrests were identified from the registries in Vadodara, Gujarat. The medical incident reports for each of these cases were then individually examined to determine the exact location of the cardiac arrest. Data such as date of incident, age, sex, and other related information were collected for all public location cardiac arrests, including those that happened on universities campuses. The causes of cardiac arrest were classified into four categories, including coronary artery disease, other structural cardiac causes, mixed coronary artery disease and other structural cardiac causes, and indeterminate cardiac origin. Additional data were collected for universities cases, including the time of dispatch and arrival of first responders, location of cardiac arrest on campus, universities affiliation of the individual, and whether a public access defibrillator had been used. The incidence rates for cardiac arrest in the universities population were calculated using information from various sources, including full-time students, faculty, and staff.

3. Results

EMC treated nontraumatic cardiac arrests that happened outside of hospitals in Vadodara, Gujarat during the period of June 2020, to December 2022. Out of 500 cardiac arrests that were identified in specific public locations, 2.6% of them occurred at the University. For people aged between 18 to 30 years old, cardiac arrests that occurred at the university accounted for 17.1% of all public location cardiac arrests and 5.4% of all cardiac arrests.

3.1. Incidence Rates

During an 18-year study period in Vadodara, Gujarat, a total of 118 cardiac arrests occurred in universities, with 20 occurring in diploma programs, 40 in under graduation programs, 34 in post-graduation programs, and 24 in PhD programs. The annual incidence rates of cardiac arrests were similar for elementary, diploma, under graduation, post-graduation PhD but lower than those diploma (table-1).

Table 1 University student's affiliated Incidence Stratified According to Grade Level

SR.NO	Variable	Cardiac Arrest Count	No. of Students	Incidence 1000 (95% Confidence Interval)
1	Diploma	20	2220	0.15 (0.09–0.35)
2	Under graduation	40	3772	0.16 (0.07–0.47)
3	Post-graduation	34	1787	0.17 (0.04–0.56
4	PHD	24	708	0.21 (0.08–0.51)

For the cardiac arrests that occurred at the university, the affiliation between the patient and the university was unknown for seven cases, all of which involved individuals over 35 years old. Out of the remaining 125 cases, 12 occurred in students, 71 in faculty and staff. The incidence rates varied among student groups, with similar estimates across different levels of study. However, the incidence rate among faculty and staff was 25 times greater than that of students and accounted for approximately three times as many cardiac arrests. The incidence of cardiac arrests among unaffiliated persons could not be estimated, although they accounted for 46% of all cardiac arrests (table-2).

Table 2 Faculty and staff affiliated Incidence Stratified According to Grade Level

SR.NO	Variable	Cardiac Arrest Count	No faculty, and staff	Incidence 1000 (95% Confidence Interval
1	Assistant professor	34	3059	5.51 (3.22–6.34)
2	Professor	20	680	5.33 (2.74–6.85)
3	Health worker	17	2020	5.75 (2.88–7.85

The characteristics of cardiac arrests that occurred in universities were compared to those that occurred in other public locations. Although the majority of cardiac arrests occurred in individuals over the age of 35, regardless of the location, in universities, students aged 18 to 35 experienced cardiac arrests, but only those who had a prior history of clinical cardiopulmonary disease or severe developmental disability. In universities, a higher proportion of cardiac arrests were witnessed (79%), received bystander CPR (76%), and had an initial cardiac rhythm of ventricular fibrillation or pulseless ventricular tachycardia (80%) compared to other public locations. Most of the cardiac arrests in universities were due to coronary artery disease alone, other structural causes, or a mix of both, while a small percentage was of indeterminate cardiac cause. Survival to hospital discharge among cardiac arrests was higher in universities settings compared to other public locations. The timing, location, and circumstances of cardiac arrests in universities were not concentrated at any particular time or activity. The majority of cardiac arrests occurred in the afternoon, and they were distributed across various locations on campus. A third of the individuals who experienced cardiac arrests in universities were using an on-campus facility, and another third were attending a universities event or meeting. Overall, the study provides valuable insights into the characteristics of cardiac arrests in universities and highlights areas for improvement in cardiac arrest response on campus. By addressing these areas of concern, universities can improve the outcomes for individuals who experience cardiac arrest while on campus.

Table 3 Comparison of Cardiac Arrests on universities Campus with Those in All Other Public Locations

SR.NO	Variable	Cardiac Arrest on universities Campus, %	All Other Public Locations, %	P
1	Age	-	-	<0.0001
	18-23	10	7	-
	24-29	8	25	-
	30-40	42	52	-
	Above 41	44	49	-
2	Cardiac origin of arrest	95	81	0.001
3	Witnessed cardiac arrest	79	62	0.003
4	Bystander CPR	76	51	<0.0001
5	Admitted to the hospital	58	47	0.12
6	Survival to hospital discharge	42	51	0.006
7	Initial rhythm VF/VT	80	56	<0.0001

*VF/VT indicates ventricular fibrillation/ventricular tachycardia.

4. Discussion

The study shows that universities-based cardiac arrests account for a small fraction of public location cardiac arrests. Only 10% of cardiac arrests occurred among students, and half of them had pre-existing heart conditions. The majority of cardiac arrests were among university employees and other adults, indicating the need for CPR and AED programs for faculty, staff, and visitors. However, there were no specific times, locations, or circumstances that could be identified for directing CPR or AED resources. The study suggests that universities-based training in emergency activation and CPR is worthwhile, and universities-based AED programs may be cost-effective if implemented for a universities district of at least 13,000 students. The findings support the need for emergency preparedness planning for cardiac arrest care at universities.

Additionally, the study highlights the importance of considering emergency preparedness planning specifically for cardiac arrest care in universities settings. Although the incidence of universities-based cardiac arrests is relatively low compared to other public locations, implementing effective CPR and AED programs can still have a significant impact on saving lives. The study suggests that universities-based CPR and AED programs would benefit faculty and staff members as well as visitors to the universities who are at greater risk of cardiac arrest due to age. However, the study also points out some limitations that need to be considered. The incidence estimates may overestimate incidence as the study did not account for part-time students, faculty, and staff. The findings may not be generalizable to other communities or universities settings, particularly when contrasting the lay-rescuer AED experience in states in which AEDs are legally mandated. Moreover, the present investigation was not a cost-effectiveness analysis.

In conclusion, the study emphasizes the need for university-based training in emergency activation and CPR, as these skills provide potential benefit throughout the community and not just at universities. Universities -based AED programs can be beneficial, especially as a majority of universities cardiac arrests are witnessed and present with ventricular fibrillation. Nonetheless, implementing blanket coverage of all universities with AED programs may not meet traditional levels of cost-effectiveness. Rather, the resources should be allocated in a manner that balances resources with the potential to save lives from cardiac arrest.

Overall, the study highlights the importance of emergency preparedness planning and training in universities settings, as well as the potential benefits of AED programs. However, more research is needed to identify specific factors that can help direct and allocate CPR and AED resources in a cost-effective manner.

4.1. Prophylaxis

To reduce the incidence of cardiac arrest, the surgeon and anesthetist must work together closely. The anesthetist should prioritize maintaining high arterial oxygen saturation and a normal blood pH, while avoiding hypoxia and hypercapnia through proper ventilation and safe dosages of anesthetic agents. Cardiac arrest can occur even in low-risk patients, indicating that the greatest care should be exercised in their management. For high-risk patients, the anesthetist must take extra precautions to prevent hypoxia and hypercapnia, while the surgeon should use safeguards against sudden hemorrhage and avoid excessive traction. During heart surgery, the priority is to maintain maximum oxygenation of the myocardium, and ventilation may need to be increased to achieve this. Local anesthesia can be used when entering the ventricles, but the heart should be manipulated as gently and briefly as possible.

Preventing high levels of cholesterol in the body is one of the key elements of cardiac arrest prevention. A balanced diet and an active lifestyle might help you achieve this. In addition, take into account these factors to avoid cardiac arrest. Lifestyle Changes: Smoking doubles to quadruples the risk of cardiac arrest. Cigarette smoke contains compounds that can result in a blood clot and a heart attack. So, giving up the habit is highly advised in order to prevent cardiac arrest. Exercise on a regular basis will assist you lose those excess calories and fat. They also teach your heart to be resilient and powerful. To prevent cardiac arrest, use gentle workouts like yoga, aerobics, or running. Reduce your alcohol intake since excessive alcohol use raises blood pressure. Once more, high blood pressure puts strain on the heart. Hence, give up drinking to avoid cardiac arrest. Treat chronic conditions: It is strongly advised to adhere to the treatment plan and take the recommended drugs for cardiac arrest prevention if one has a chronic condition like diabetes, high blood pressure, or high cholesterol. Consider getting enough rest: Lack of sleep increases the risk of cardiovascular disease and high blood pressure. Hence, get a good night's sleep of 7 to 8 hours.

Healthy, well-balanced diet is beneficial for preventing cardiac arrest: Put an emphasis on extra virgin olive oil, fruits, nuts, vegetables, seafood, legumes, and whole grains. It should also be accompanied by sufficient amounts of eggs, poultry, and low-fat dairy products. Restrict or forbid red meat, processed meals, sugar, and refined carbohydrates.

Overall, careful cooperation between the surgeon and anesthetist is key to preventing cardiac arrest. Overall, preventing cardiac arrest during surgery requires a multifaceted approach that involves careful preoperative assessment, close cooperation between the surgeon and anesthetist, appropriate intraoperative management, and vigilant postoperative care. By taking these steps, the risk of cardiac arrest can be significantly reduced, leading to better outcomes for patients.

5. Conclusion

In conclusion, cardiac arrest is a serious and potentially life-threatening condition that requires prompt intervention to improve outcomes. University studies have played a critical role in advancing our understanding of cardiac arrest, including risk factors, prevention strategies, and treatment options. Through research, scientists and healthcare professionals have identified important factors that contribute to the incidence of cardiac arrest, such as underlying health conditions and lifestyle choices. Additionally, studies have demonstrated the effectiveness of interventions such as cardiopulmonary resuscitation (CPR) and defibrillation in improving survival rates. Further research is needed to continue to refine our approach to preventing and managing cardiac arrest. By continuing to invest in research and education, we can work towards better outcomes for those at risk of cardiac arrest. Overall, cardiac arrest is a complex and multifaceted condition that requires a collaborative effort from healthcare professionals, researchers, and the wider community to effectively manage and prevent. University studies have made significant contributions to our understanding of cardiac arrest and have paved the way for improved outcomes for patients. By continuing to invest in research and education, we can work towards a future where cardiac arrest is a less common and less devastating condition.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest.

Statement of ethical approval

Approved by Institutional ethical board.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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