


## Cardiac Arrest in an Anesthesia Perspective

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Article Info	ABSTRACT
<b>Keywords:</b> Cardiac Arrest, Perspective, Anesthesia	Cardiac Arrest occurs when the heart suddenly stops pumping and is the third leading cause of death in industrialized countries. Given the breadth of the medical discipline of anesthesiology, anesthesiologists always have a great opportunity to influence the safety and quality of patient care and maintain vital organ function systems during surgery. Literature searches over the last 5 years were carried out using the NCBI database, PubMed, Science Direct and the Google search engine with the keywords Cardiac Arrest, Perspective, Anesthesia. So we got 22 selected articles which were analyzed using the Unsystematic Narrative review method. Immediate treatment through providing cardiopulmonary resuscitation and eliminating causative factors is an effort to prevent death from cardiac arrest. Heart attacks regardless of location must be treated immediately. Cardiac arrest during surgery also needs to be considered because during the operation it is possible that the frequency of heart attacks associated with a significant reduction in anesthesia occurs over time. The administration of anesthesia equipment is the most common source of problems, in the ICU, it is estimated that equipment and supply problems account for 15.8% of the total side effects; similarly, equipment is involved in approximately 14–30% of all intraoperative problems. So, anesthetists are expected to always monitor and check equipment to prevent heart attacks or other complications.
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### INTRODUCTION

Cardiac arrest occurs when the heart suddenly stops pumping. When this happens, blood stops flowing to the brain and other vital organs. Cardiac arrest is caused by certain types of arrhythmias that prevent the heart from pumping blood. Cardiac arrest is a medical emergency. Nine out of 10 people who have a cardiac arrest outside of hospital die often within minutes.<sup>1</sup> Cardiac arrest is the third cause of death in industrialized countries. To improve survival, science and research in cardiac arrest, cardiopulmonary resuscitation (CPR) and post-resuscitation care are the main goals and objectives of the European Resuscitation Council (ERC).<sup>2</sup>

Cardiac arrest is differentiated based on its location into out-of-hospital cardiac arrest (OHCA) and in-hospital cardiac arrest. (IHCA). Compared with OHCA, IHCA has received much less attention in research regarding both initial and post-Heart Attack Treatment. Therefore, treatment guidelines for IHCA are largely extrapolated from OHCA. IHCA is

common and the lack of evidence-based treatment for IHCA is quite worrying. Registry data have been used to extrapolate the annual incidence of adult IHCA in the US. from 300,000. In Europe, the annual incidence is between 1.5 and 2.8 per 1,000 hospital admissions. In Sweden the incidence is 1.7 per 1000 hospital admissions, a total of 2500 per year.<sup>3</sup>

Given the breadth of medical disciplines to anesthesiology (anesthesia, perioperative care, intensive care medicine, pain therapy, and emergency medicine), anesthesiologists have always had a great opportunity across specialties to influence the safety and quality of patient care.<sup>4</sup> One of the responsibilities of an anesthesiologist is to maintain vital organ functions during surgery, including ensuring adequate respiration for the patient by monitoring the airway. Therefore, it is not surprising that anesthesiologists have an important role in the development of cardiopulmonary resuscitation (CPR) techniques outside and inside the operating room.<sup>5</sup>

## METHOD

Initial literature searches were carried out through the NCBI database, PubMed, Science Direct and the Google search engine with the keywords Cardiac Arrest, Anaesthetic Perspective. The library sources used in this article involve 22 libraries from both national and international journals and can be accessed openly (open access). A narrative literature review (unsystematic narrative review) was carried out to synthesize information from selected articles published within the last 5 years. This article was analyzed by identifying, assessing, then interpreting all research findings narratively.

## RESULTS

In 2015, approximately 350,000 adult individuals in the United States experienced nontraumatic out-of-hospital cardiac arrest (OHCA) and were treated by emergency medical services (EMS) personnel. Despite recent improvements, less than 40% of adult individuals receive lay-initiated CPR, and less than 12% apply an automated external defibrillator (AED) prior to EMS arrival. After significant improvement, survival after OHCA has been stable since 2012.

Additionally, approximately 1.2% of adult individuals hospitalized in the US suffer from in-hospital cardiac arrest (IHCA). Aid benefits for IHCAs are much better than aid benefits for OHCA, and aid benefits for IHCAs continue to increase.<sup>6</sup>

### **Out-of-Hospital Cardiac Arrest (OHCA)**

Immediate treatment through providing cardiopulmonary resuscitation and eliminating causative factors is an effort to prevent death in cases of cardiac arrest.<sup>7</sup> Only 25% to 30% of patients with OHCA initially achieve return of spontaneous circulation (ROSC) and are hospitalized.<sup>8</sup> The incidence of OHCA is quite high, accompanied by a low survival rate, namely 12%. This low survival is caused by delays in reporting and providing cardiopulmonary resuscitation assistance (RJP).<sup>9</sup> Bystanders are lay helpers who are around cardiac arrest victims and have an important role in handling cardiac arrest cases before the victim receives medical assistance.<sup>10</sup> There are many obstacles when carrying out RJP

actions by bystanders such as lack of knowledge, fear of causing danger to the victim and lack of confidence in the helper.<sup>11</sup>

In the "European Resuscitation Council Guideline 2021" journal Jan-Thorsten Graßner, et al (2021), the actual incidence of OHCA in Europe is unknown. The available literature is largely based on reports of OHCA's attended by EMS. This may underestimate the actual incidence as in some countries, due to culture or belief, bystanders do not contact EMS when they witness a heart failure event. Other reasons for not calling EMS may be that the event was not witnessed, the patient was deemed dead or did not attempt cardiac pulmonary resuscitation (DNACPR) decisions, or the patient had severe comorbidities that were not considered appropriate to request EMS resources.<sup>12</sup>

### **Cardiac Arrest in Hospital (IHCA)**

In-hospital cardiac arrest (IHCA) represents a huge burden for patients, for their families and for the health care system in general. However, to date, research on IHCA has received little attention compared to previous studies of other high-risk conditions in hospitals even though IHCA is considered a reversible condition if caught in time. The important role of early identification of patients with deviations in vital signs is highlighted in this European Resuscitation Council (ERC) guideline, the chain of survival states that effective pathways and trigger systems and staff education are needed to reduce the incidence of IHCA. In particular, patients admitted to unsupervised general wards are at risk of their condition deteriorating without being noticed by ward staff. Decreased vital signs before IHCA appear to occur in as many as 80% of patients. A medical emergency team (MET) has been implemented to assist the general ward as an efferent part of the track and trigger system. These teams help to intervene before the patient becomes so sick that IHCA occurs or to initiate discussions regarding treatment planning and to reduce the increase in treatment rather than intensify it.<sup>13</sup> About half of heart attacks in hospitals occur on wards, and the remaining half occur in other locations, such as intensive care units and operating rooms.<sup>14</sup>

### **Intraoperative Cardiac Arrest**

Cardiac arrest in the perioperative period is a rare but potentially life-limiting event with a mortality rate of more than 50%. Data collected from 250 United States Hospitals (1.3 million surgical cases) found that 1 in 203 surgical patients underwent cardiopulmonary resuscitation (CPR). It occurs more frequently in cardiac surgery than general surgery (1 in 33 and 1 in 258) and is associated with mortality of more than 50% in the first 30 days postoperatively.<sup>15</sup>

Intraoperative Cardiac Arrest (IOCA) It differs from events inside and outside the hospital because during anesthesia it is usually witnessed and anticipated. IOCA is often caused by hypovolemia due to difficult airway management or due to bleeding. It has been reported that the frequency of heart attacks associated with anesthesia decreased significantly over time from 2.1/10,000 anesthesia (1969-1978) to 0.05/10,000 anesthesia (1989-2001). The incidence of cardiac arrest was higher with general anesthesia (5.5/10,000) compared with regional anesthesia (1.5/10,000) or monitor anesthesia care (0.7/10,000). Apart from the risks of anesthesia, IOCA can be a risk of surgery. IOCA is associated with surgical procedures such as heart and large blood vessel surgery being the

highest risk. Intraoperative hypovolemic shock was the main cause of IOCA (33.3%). Reducing intraoperative bleeding is an important factor to increase the success rate of resuscitation and reduce the occurrence of IOCA.

In the majority of cases, rhythm disturbances are represented by non-shockable rhythms in particular Pulseless Electrical Activity (PEA) and asystole while the main causes are hypovolemia (e.g. abdominal bleeding), respiratory (e.g. inadequate ventilation or oxygenation), myocardial ischemia and metabolic/disorders. electrolyte. The first step in managing IOCA can be done through monitoring. However, in patients undergoing general anesthesia, their consciousness changes as a result of the anesthetic drug. Recognition of cardiac arrest in the operating room, for example, by looking at the heart rhythm on the electrocardiogram shows the saturation curve and palpation of the pulse.<sup>16</sup>

When a cardiac arrest occurs in the operating room, health workers have their respective roles, namely:

1. Anesthetist: Represents who calls emergency codes and the person who prescribes drug administration and leads resuscitation actions with appropriate rhythm presentation and thinking about possible reversible causes.
2. Nurse anesthetist: Works closely with the anesthesiologist in administering medication, where the nurse must be able to control correct CPR and apply a defibrillator.
3. Surgeon: Alternative leader in emergencies. The surgeon must be able to stop the surgical procedure and perform external thoracic compression.
4. Scrub nurse: Nurses who must control the sterility of surgical wounds and the sterility of surgical instruments so that they do not become contaminated.
5. Nurses who are not sterile or in the loop: Play a role in calling for help, controlling the arrival and departure of gurneys in the operating room and assisting the scrub nurse by opening the materials needed to administer IOCA.<sup>16</sup>

In the journal Jochen Hinkelbein, et al (2023), this guideline contains background information and recommendations for the treatment of cardiac arrest in the operating room environment, and addresses controversial topics such as open chest cardiac massage (OCCM), resuscitative endovascular balloon occlusion (REBOA) and resuscitative thoracotomy , pericardiocentesis, needle decompression, and thoracostomy. Successful prevention and management of cardiac arrest during anesthesia and surgery requires anticipation, early recognition and a clear treatment plan. The availability of skilled staff and equipment must also be taken into consideration. Success depends not only on medical knowledge, technical skills and a well-organized team using crew resource management but also on an institutional safety culture embedded in daily practice through continuing education, training and multidisciplinary collaboration.<sup>15</sup>

Joshua S. Jolissaint, MD and Deepika Nehra, MD (2020), stated the anesthesiologist's responsibility during surgery, as well as the anesthesiologist's complete physiological management of each surgical patient for the duration of their operation. Once the decision to proceed with surgery has been made, the value of the anesthesiologist-patient relationship is as important as the anesthesia itself, with studies as early as 1963 showing both the anxiolytic and analgesic effects of the preoperative visit. The emotional and

psychological impact of surgeons and anesthesiologists' relationships with their patients cannot be overstated, and the teamwork between these two individuals is essential to getting these patients through some of their most invasive and life-altering problems.<sup>17</sup>

### **Cardiac Arrest in the Intensive Care Unit (ICU)**

The care of critical patients and patients under general anesthesia depends on the use of complex medical equipment; monitoring devices, ventilators, renal replacement therapy machines, extracorporeal circulation technology, infusion pumps, point-of-care diagnostic equipment, each with different designs and characteristics. Unfortunately, this equipment has the potential to cause errors, be used incorrectly, or fail: in the ICU, it is estimated that equipment and supply problems account for 15.8% of total adverse events; Likewise, equipment is involved in approximately 14–30% of all intraoperative problems and administration of anesthesia equipment is the most common source of problems.<sup>4,18</sup>

In 2008, the ASA (American Society of Anesthesiologists) updated its pre-anesthesia checkout (PAC) guidelines and provided general principles for all anesthesia delivery systems, summarizing the checkout tasks that must be completed daily and before starting the procedure. Anesthesiology and other ICU departments must adapt it to the conditions of their anesthesia machine design and their own practice settings. If implemented correctly, PACs can prevent equipment failure and subsequent patient injury; furthermore, it ensures that backup equipment is ready for use in the event of intraoperative failure. The anesthesiologist must be competent in carrying out all PAC duties.<sup>19</sup>

Other guidelines for general ICU management of post-cardiac arrest patients are based on expert opinion. Most aspects of post-heart attack care follow general ICU practices. Some differences and nuances are inherent. Few aspects of general intensive care have been studied separately in the heart attack population, but heart attack patients have been included in trials of general intensive care practices. Specific features of post-cardiac arrest patients include the risk of brain injury and the need to apply neurointensive treatment principles, the high incidence of myocardial dysfunction, the use of anticoagulants and anti-platelet drugs and the high risk of aspiration pneumonitis.<sup>20</sup>

Many post-cardiac arrest patients require sedation and appropriate pain management, especially those treated with targeted temperature management (TTM). During TTM, shivering is common and this can be managed with opioids and sedation. TTM affects the metabolism of some drugs and the effects are generally prolonged. An RCT compared the use of propofol and fentanyl with midazolam and fentanyl. In a trial of 59 patients, the use of propofol and remifentanyl resulted in shorter awakening times but was associated with more frequent noradrenaline requirements. <sup>21</sup> Similar findings have been demonstrated in observational studies. Discontinuation of sedation is best initiated after TTM and rewarming are completed.<sup>22</sup>

## **CONCLUSION**

Cardiac arrest knows no time or place, heart attacks outside the hospital, in the hospital, during surgery, or even in the intensive care unit. Overcoming delays in treatment, identifying vital signs in the ward room and during surgery and managing the preparation of anesthesia medical equipment before use helps to minimize the possibility of a heart



attack or other risky conditions. One of the roles of anesthesia in treating cardiac arrest is the responsibility of maintaining the vital organ function system during the operation, including ensuring adequate respiration for the patient by monitoring the airway.

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