Clinician Wire Puncture Injury to the Hand from Chest Compressions on a Patient with a Median Sternotomy: A Case Report

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Abstract

Standard precautions, including protections from blood and body fluid exposure, are designed to protect health care providers from infections. Sharps safety practices rarely include the potential for the unconscious patient's own body to be a potential source of clinician percutaneous injury from sharp objects outside of the perioperative setting. This case report reviews a percutaneous injury to the hand of a physician who was performing chest compressions on a patient with an out-of-hospital cardiac arrest. The 76-year-old patient in cardiac arrest had undergone a medial sternotomy surgery 15 years before the arrest. The sternal wire rotated owing to the initial chest compressions, breaking the clinician's nitrile glove and producing an open wound on the thenar region of the clinician's right hand. Application of a 10 × 10 12-ply gauze pack on the chest of the patient in cardiac arrest allowed the resuscitation team to continue with the compressions with no further wounds from the wire. This case report is a novel contribution to the published literature and advances standard precautions considerations in patients with out-of-hospital cardiac arrest, with the sternotomy wire from previous surgery as a source of percutaneous clinician injury during chest compression.

Key words: Sternotomy; Cardiorespiratory arrest; Sternotomy suture; Case report

Introduction

Advanced life support teams responding to out-of-hospital cardiac arrest may face rare and unusual situations in uncontrolled settings, with limited information on the patient they are treating. These teams must have advanced knowledge of all the usual and unusual pathologies that could be found as first responders in the community setting.[1] This case report describes the percutaneous injury experienced by a physician responding to an out-of-hospital cardiopulmonary arrest while administering chest compressions.

Nontransport Rapid Deployment Background

Rapid deployment vehicle teams in Madrid, Spain, are composed of a physician, nurse, and a driver who also has basic Emergency Medical Services training. These rapid deployment teams are equipped with vehicles such as vans with all the materials and equipment of a fully equipped intensive care ambulance. However, these rapid deployment teams do not have the capacity to transfer patients. Their objective is to reach the incident as quickly as possible and begin the health care procedures and stabilization of the patient as soon as possible while the ambulance or further support, if required, arrives.

Patient Information

An emergency call was received on 112 (similar to United States 911) in Madrid in 2019, informing dispatch of a 76-year-old male patient with cardiorespiratory failure in a park. His medical history included arterial hypertension, ischemic heart disease with bypass from acute myocardial infarction to anterior descent, and saphenous to right

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FIGURE 1

Lump in chest due to broken sternal wire. (Reproduced with permission from the American College of Emergency Physicians. Marshall KD, Weese SL. Man with chest pain and lump in neck. *Ann Emerg Med*. 2018;71(2):169-188. https://doi.org/10.1016/j.annemergmed.2017.08.060).

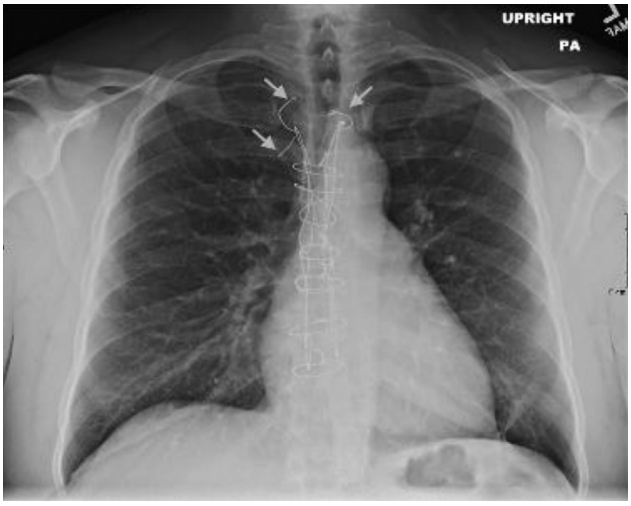

FIGURE 2

X-ray of broken sternal wire. (Reproduced with permission from the American College of Emergency Physicians. Marshall KD, Weese SL. Man with chest pain and lump in neck. *Ann Emerg Med*. 2018;71(2):169-188. doi: https://doi.org/10.1016/j.annemergmed.2017.08.060).

coronary 15 years ago, presenting with diabetes mellitus and renal failure.

Diagnostic Assessment

Bystanders who saw the patient fall unconscious and called 112 informed the team that they had not performed basic cardiopulmonary resuscitation (CPR). Upon the arrival of the rapid deployment vehicle Advanced Life Support team, 7 minutes after the call was received, advanced resuscitation maneuvers were begun. This case fell under the code 0 procedure, which indicates that in the case of an unconscious patient where the medical Emergency Medical Services' arrival time is under 10 minutes, resuscitation techniques should be administered to restore vital signs or maintain organ perfusion for potential organ donation.

The patient's airway was opened and supported with orotracheal intubation by the physician; intravenous access and drug treatment protocol were begun by the nurse, and chest compressions were started by the medical technician. The patient's initial cardiac rhythm was asystole.

Once the airway was secured, the clinician team rotated turns to provide chest compressions. Chest compressions were first performed by the medical technician and then the physician.

During the first rotation of physician administered chest compressions, the physician noticed punctures in the palm of the hand that was in contact with the patient's sternal surface, and a lump was observed in the central area of the sternum (similar to Figures 1 and 2). She realized that the nitrile glove was broken in the area of the palm of the hand, and when she removed it, she noted a puncture wound in the thenar region of her right hand.

Therapeutic Intervention and Patient Outcome

Unaware of the origin of these wounds to the physician's hand, the clinical team thoroughly examined the patient's chest. During this assessment, a surgical scar was observed under the patient's chest hair. The clinician team then observed that the median sternotomy wire from the patient's chest had penetrated the skin. The wire tip could be seen with the naked eye. The point of the sternotomy wire that appeared was no longer than 0.5 cm from the surface of the patient's skin. This observation was consistent with the published literature, given that it is described that sternal wire can change position when under pressure.[1] In this

case, the sternal wire changed position during the initial chest compressions during the medical technician's rotation.

The team tried to protect themselves from further injury by using a pack of 10 × 10 cm 12-ply sterile gauze to cover the protruding sternotomy wire and continued chest compressions. After 25 minutes of advanced life support, resuscitation maneuvers were suspended. The patient's death was certified.

Discussion

This case report presents a novel contribution to the published literature and advances standard precautions considerations in patients with out-of-hospital cardiac arrest, with the patient's sternotomy wire from previous surgery as a source of percutaneous clinician injury during chest compressions. Median sternotomy is a surgical technique performed during cardiac and pulmonary surgeries.[2] The sternum is closed with a wire suture at the completion of the surgery.

The wires used in a medial sternotomy have been described[3] as capable of a slight rotation under pressure, which can cause the wire to be palpable from the skin, externally. If chest compressions are conducted on a patient who has undergone a sternotomy, the wire can rotate sufficiently to point outward and puncture the patient's skin and subsequently the clinician's hands performing the chest compressions. Chest compressions are reportedly contraindicated in patients who have undergone recent sternotomy.[4] This precaution is meant to prevent excess stress at the surgical site and prevent the breakage or movement of the wires used for the suture. Although medial sternotomy is a well-described technique with many options for suture, procedures performed more than 10 years ago commonly used the sternal wire.[1] The possibility of this wire migrating or moving when handled or placed under pressure has also been described.[5] What has not been previously described is that this happens during chest compressions owing to a CPR technique.

There are 2 published cases pertinent to this present case. The first is an abdominal CPR technique[6] in a patient with a very recent median sternotomy to avoid dehiscence and potential rupture of the sternum. The second case is that of a 44-year-old male who presented with chest pain and a lump in the neck, which X-ray revealed to be the point where the sternal wire had broken.[7] We found no other similar cases reported in the published literature, wherein a past, healed sternotomy became a sharps injury risk for clinicians.

Thus, in patients who have undergone a previous medial sternotomy with sternal wire who require chest compressions, we document a risk of injury to the clinician. Prevention can include considerations that (1) chest compressions are contraindicated, (2) use of abdominal CPR techniques, or (3) padding and/or covering the site as we did by applying a full pack of 10 × 10 cm 12-ply sterile gauze to continue chest compressions.

Follow-Up and Clinician Outcomes

After resuscitation was discontinued and we confirmed that the nitrile gloves and the skin of the physician had been punctured, follow-up according to the protocol for the accidental puncture in interventions with patients was initiated. Although the patient was considered at low risk, it should be noted that 30- to 40-year-old surgical procedures present a risk of viral contagion exposure such as hepatitis or human immunodeficiency virus, which are some of the main sharps injury-related blood and body fluid exposure infection risks to health workers.[8]

Following the standard postexposure prophylaxis procedures for percutaneous injury exposure,[9] the injured physician was taken for blood tests for human immunodeficiency virus, hepatitis B virus, and hepatitis C virus. The results were negative for bloodborne infectious-contagious diseases. Because this was a single case involving exposure to only one clinician, no further postexposure prophylaxis protocols or procedures were applied to the other members of the emergency response team whose skin remained intact.

Author Disclosures

Conflicts of interest: none to report.

This case report adheres to Elsevier's Patient Consent Policy.

The authors give their consent for the publication of this manuscript to the Journal of Emergency Nursing

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