Clinical question.

"In adult cardiac arrest (prehospital or in-hospital) due to a cardiac tamponade (P), does use of specific interventions (I) as opposed to standard care (according to treatment algorithm) (C), improve outcome (O) (eg. ROSC, survival)?" ALS-SC-070B

Is this question addressing an intervention/therapy, prognosis or diagnosis? intervention

State if this is a proposed new topic or revision of existing worksheet: new

Conflict of interest specific to this question

Do any of the authors listed above have conflict of interest disclosures relevant to this worksheet? no

Search strategy (including electronic databases searched).

Pubmed: tamponade [MESH] and heart arrest [MESH]; tamponade and cardiopulmonary resuscitation [MESH]; tamponade and cardiac arrest; tamponade and CPR; tamponade and resuscitation; tamponade and technique; tamponade and echocardiography; pericardiocentesis

Cochrane library: tamponade and cardiac arrest; tamponade and cardiopulmonary resuscitation; tamponade and CPR

Embase: tamponade and Cardiopulmonary resuscitation; tamponade and CPR; tamponade and cardiac arrest; tamponade and resuscitation; tamponade and echocardiography; pericardiocentesis

Endnote Library: tamponade

Review of all sections indexed under "tamponade" in "Guidelines" and "ACLS Provider Manual"

State inclusion and exclusion criteria

The following studies were excluded:
- studies not involving cardiac arrest or pre-cardiac arrest
- diagnostic imaging studies without specific therapeutic interventions
- reviews without primary data

The following studies were included:
- human studies of traumatic and non-traumatic cardiac arrest where some or all of the patients had evidence of tamponade as the cause of the cardiac arrest. Traumatic cardiac arrest studies were given LOE 5, since they were an extrapolation to non-traumatic arrest
- a few case reports of new interventions being used for treatment of cardiac arrest from tamponade, because of the paucity of other data.

Number of articles/sources meeting criteria for further review:

785 articles met the initial search criteria. All but 8 were excluded because they did not deal with cardiac arrest and resuscitation; or were reviews with no primary data; or were diagnostic imaging studies without specific therapeutic interventions. An additional 6 were added because they dealt with tamponade in the pre-cardiac arrest state and that those data could be extrapolated to the cardiac arrest state.
### Summary of evidence

#### Evidence Supporting Clinical Question

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**Level of evidence**

- **A** = Return of spontaneous circulation
- **B** = Survival of event
- **C** = Survival to hospital discharge
- **D** = Intact neurological survival
- **E** = Other endpoint
- **F** = time to ventilation
- **G** = successful ventilation

**Italics** = Animal studies

**Note:** The “E” endpoint is used for survival to discharge in patients who were not in cardiac arrest for entry into the study. They had a pre-arrest condition. Most patients did survive to hospital discharge.
## Evidence Neutral to Clinical question

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<td><strong>Van der Wouw 1997, 780 E</strong></td>
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<td><strong>Armoutoglou 2006, 763 C,D</strong></td>
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- **E** = Other endpoint
- **F** = Time to ventilation
- **G** = Successful ventilation

*Italics = Animal studies*
### Evidence Opposing Clinical Question

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- **A** = Return of spontaneous circulation
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- **G** = Successful ventilation
- **Italic** = Animal studies
In pulseless arrest, diagnosing tamponade is typically done with echocardiography which can be transesophageal (van der Wouw, Koster et al. 1997, 780) (LOE 4) or transthoracic. The current treatment for cardiac tamponade is drainage of the pericardial fluid with pericardiocentesis, generally without image guidance. Fluid loading may additionally be helpful in augmenting blood flow.

No level 1 evidence could be found for alternative interventions to treat cardiac tamponade.

A number of studies have evaluated the use of echocardiography to guide pericardiocentesis in the pre-arrest setting, and suggest that such echocardiographic guidance may improve the safety and efficacy of the procedure. A retrospective study of 53 patients with non-traumatic cardiac tamponade who underwent pericardiocentesis guided by echocardiography (Maggiolini et al. 2001, 821) (LOE 5), showed that the procedure was successful in 52/53 and there were only 3 non-life-threatening complications. These data compare favorably with pericardiocentesis without echocardiography guidance. In a study of 41 patients who underwent 46 echocardiography guided pericardiocentesis for pre-arrest cardiac tamponade (Salem et al. 1999, 1251) (LOE 5), all procedures were successful and only 2 patients had non-life-threatening complications. These data again compare favorably with non-echocardiography guided procedures. The latter success rates were achieved at an institution with relatively low volumes suggesting that substantial experience in echo-guided procedures may not be needed.

Additional studies of echocardiography guided pericardiocentesis in the pre-arrest setting include the following three studies: (1) A retrospective study of 42 patients requiring pericardial drainage due to post operative cardiac tamponade (Susini et al. 1993, 178) (LOE 5), 29 patients received echo-guided needle pericardiocentesis with success in 89%, and 16 patient underwent surgical pericardiotomy with 100% success. No life-threatening complications were noted, and the two drainage methods were felt to be comparable. (2) A retrospective review of 92 patients undergoing pericardial drainage for pre-arrest, non-traumatic cardiac tamponade (Tsang et al. 2003, 704) (LOE 5), 5 patients had direct pericardiectomy. 87 underwent echo-guided pericardiocentesis and half had pericardial drains placed, and 7 required surgical drainage. After follow-up for 3.8 years, it was noted that pericardiocentesis with catheter drainage was definitive treatment, with improved results over those without catheter drainage, that surgical drainage was necessary only for recurrent effusions, and that survival was similar to the general population. (3) A large retrospective study of 1127 pericardiocentesis procedures over 21 years, where there was relieving of cardiac tamponade from all causes including malignancy, and perforations from catheter-based procedures (Tsang et al. 2002, 429) (LOE 5). Echocardiography guidance was used and there was a 97% success rate and only a 1.2% major complication rate and a 3.5% minor complication rate. Most patients had pericardial drainage catheters placed. It was concluded that pericardiocentesis with drainage can reduce the need for surgical management.

A few studies have shown that patients with cardiac tamponade from trauma may benefit from emergency department thoracotomy and pericardiotomy. Coats et al (Coats, Keogh et al. 2001, 670) (LOE 5) studied 39 patients who received prehospital emergency thoracotomy by physicians to treat cardiac arrest from penetrating trauma. 18 patients had cardiac tamponade and 4(22%) survived. Powell et al (Powell, Moore et al. 2004, 211) (LOE 5) studied a registry of 959 patients who underwent emergency department resuscitative thoracotomy. From the 62 patients who survived to hospital discharge, 26 patients had received prehospital CPR. Eleven of those latter survivors had tamponade from penetrating trauma, and had CPR for < 15 minutes. The incidence of infection was very low. Lewis et al (Lewis and Knottenbelt 1991, 5) (LOE 5) studied 45 trauma patients who underwent emergency room thoracotomy for circulatory collapse or cardiac arrest. 0/13 patients with blunt trauma survived. 8/32 patients with penetrating trauma survived and 7 of those had cardiac tamponade. Thus, emergency department thoracotomy with pericardiotomy appears beneficial in treating tamponade from penetrating trauma.

Wang et al (Wang et al 2008, 425) (LOE 2) prospectively studied 23 patients with tamponade from non-traumatic hemopericardium and out of hospital cardiac arrest. Patients were stratified into 4 groups receiving subxiphoid pericardiotomy or percutaneous pericardial catheter drainage in different sequences. There was an improvement in ROSC rates with subxiphoid pericardiotomy, and an improvement in drainage success, but the numbers were small. Degiannis et al (Degiannis et al. 2006, 1258) (LOE 5) retrospectively reviewed 117 patients with penetrating trauma. 51 patients had cardiac tamponade, which was diagnosed with ultrasonography after the treating physician had a high index of suspicion. Patients with confirmed tamponade were treated with sternotomy or thoracotomy in a nearby operating room, with an 8% mortality. Thus, emergency sternotomy or thoracotomy appears beneficial in treating tamponade from penetrating trauma.
Post-surgical patients may benefit from invasive CPR. Anthi et al (Anthi, Tzelepis et al. 1998, 15) (LOE 5) studied 29 patients who had unexpected cardiac arrest post surgery. Open chest CPR was done following closed chest CPR. Five patients had cardiac tamponade and all five of those patients survived to hospital discharge.

A few case reports support the use of alternative treatments. In one case, (Bernard and Rosalion 2008, 311) a patient suffered a cardiac arrest due to tamponade during cardiac catheterization. Pericardiocentesis was unsuccessful, but tamponade was reversed by open drainage via thoracotomy. The patient was also treated with 40/ml/kg iced intravenous fluid during CPR and made a satisfactory neurological recovery. In another case, (Arnaoutoglou, Petrou et al. 2006, 763) there was a successful resuscitation of a patient with cardiac tamponade treated with extracorporeal circulation and mild hypothermia, in addition to pericardiocentesis.

Acknowledgements: None

Citation List


LOE: 5
Quality: Fair
Summary: Open chest CPR following closed chest CPR in patients with unexpected cardiac arrest post surgery. A total of 29 patients had cardiac arrest but only a 5 had cardiac arrest due to tamponade. All five survived.


LOE: 5
Quality: Poor
Summary: Case report of a successful resuscitation of a patient with cardiac arrest from cardiac tamponade treated with extracorporeal circulation and mild hypothermia, in addition to pericardiocentesis.


LOE: 5
Quality: Poor
Summary: Case report of a patient suffering a cardiac arrest due to tamponade during cardiac catheterization. Pericardiocentesis was unsuccessful, but tamponade was reversed by open drainage via
thoracotomy. Patient was also treated with 40/ml/kg iced intravenous fluid during CPR and made a satisfactory neurological recovery.


LOE: 5
Quality: Fair
Summary: 39 patients received prehospital emergency thoracotomy to treat cardiac arrest from penetrating trauma. 18 patients had cardiac tamponade and 4(22%) survived. None of the other patients survived. Emergency thoracotomy appears beneficial in treating tamponade from penetrating trauma.


LOE: 5
Quality: Fair
Summary: 117 patients with penetrating trauma had a retrospective review of their diagnostic and treatment course. 51 patients had cardiac tamponade, which was diagnosed with ultrasonography after the treating physician had a high index of suspicion. Patients with confirmed tamponade were treated with sternotomy or thoracotomy, with an 8% mortality. Emergency sternotomy or thoracotomy appears beneficial in treating tamponade from penetrating trauma.


LOE: 5
Quality: Fair
Summary: 45 trauma patients underwent emergency room thoracotomy for circulatory collapse or cardiac arrest. 0/13 patients with blunt trauma survived. 8/32 patients with penetrating trauma survived and 7 had cardiac tamponade. Emergency thoracotomy appears beneficial in treating tamponade from penetrating trauma.


LOE: 5
Quality: Fair
Summary: Retrospective study of 53 patients with non-traumatic cardiac tamponade who underwent pericardiocentesis guided by echocardiography. The procedure was successful in 52/53 and there were
3 non-life-threatening complications, with compares favorably with pericardiocentesis without echocardiography guiding.


LOE: 5  
Quality: Fair  
Summary: Registry of 959 patients who underwent emergency department resuscitative thoracotomy. 26 patients who survived to leave the hospital had prehospital CPR. Eleven survivors had pericardial tamponade and had CPR for < 15 minutes.


LOE: 5  
Quality: Fair  
Summary: 41 patients underwent 46 echocardiography guided pericardiocentesis for cardiac tamponade. All procedures were successful and 2 patients had non-life-threatening complications, which compares favorably with non-echocardiography guided procedures. The success rates were achieved at a institution with relatively low volumes suggesting that substantial experience in echo-guided procedures are not needed.


LOE: 5  
Quality: Fair  
Summary: Retrospective study of 42 patients requiring pericardial drainage due to post operative cardiac tamponade. 29 patients received echo-guided needle pericardiocentesis with success in 89%, and 16 patient underwent surgical pericardiotomy. with 100% success. No life-threatenting complications were noted, and the two drainage methods were felt to be comparable.


LOE: 5  
Quality: Fair  
Summary: Retrospective review of 92 patients undergoing pericardial drainage for non-traumatic cardiac tamponade. 5 patients had direct pericardiectomy. 87 unerwent echo-guided pericardiocentesis and half had pericardial drains placed, and 7 required surgical drainage. After follow-up for 3.8 years, it was noted that pericardiocentesis with catheter drainage was definitive treatment, with improved results over those without catheter drainage, that surgical drainage was necessary for recurrent effusions, and that survival was similar to the general population.

LOE: 5
Quality: Fair
Summary: Large retrospective study of 1127 pericardiocentesis procedures over 21 years relieving cardiac tamponade from all causes including malignancy and perforations from catheter-based procedures. Echocardiography guidance was used and there was a 97% success rate and a 1.2% major complication rate and a 3.5% minor complication rate. Most patients had pericardial drainage catheters placed. No procedures during cardiac arrest were noted. It was concluded that pericardial centesis with drainage can reduce the need for surgical management.


LOE: 4
Quality: Poor
Summary: TEE was performed on 48 patients during cardiac arrest. 6 patients with tamponade had diagnosis successfully made with TEE, which were confirmed at autopsy (n=2), surgery (n=1), or successful pericardiocentesis. One patient with tamponade survived to hospital discharge. The authors felt that TTE was adequate for diagnosing tamponade, but that TEE may be helpful in looking for the causes of the tamponade, such as vascular rupture.


LOE: 2
Quality: Poor
Summary: Prospective study of 23 patients with tamponade from non-traumatic hemopericardium and out of hospital cardiac arrest. Patients were stratified into 4 groups receiving subxiphoid pericardiotomy or percutaneous pericardial catheter drainage in different sequences. There was an improvement in ROSC rates with subxiphoid pericardiotomy, and an improvement in drainage success, but the numbers are small.