

# Pericardicentesis and Contemporary Practice



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## ABSTRACT

Pericardiocentesis is the evacuation of fluid (which exceeds physiologic levels) from pericardial space. Although it's generally used as a life saving procedure in cardiac tamponade, it is also used for diagnostic purposes. Together with the advances in imaging modalities, pericardiocentesis techniques are diversified. In this report our aim is to give an idea about the history and indications of pericardiocentesis and thereafter briefly explain the techniques of pericardiocentesis under the light of modern advances.

**Key words:** Pericardiocentesis, cardiac tamponade, pericard

## Perikardiyosentez ve Çağdaş Pratiği

### ÖZET

Perikardiyosentez, perikardiyal boşlukta fizyolojik sınırların üzerinde biriken sıvının boşaltılması işlemidir. Klinik pratikte daha çok kardiyak tamponat durumunda hayat kurtarıcı bir işlem olarak uygulandığı gibi tanı amaçlı da yapılmaktadır. Görüntüleme yöntemlerinde gelişmelere bağlı olarak perikardiyosentez yapmak için kullanılan yöntemler de değişkenlik göstermektedir. Bizim bu makalede amacımız; perikardiyosentez tarihçesi ve endikasyonları hakkında bilgi verdikten sonra modern gelişmeler ışığında perikardiyosentez yöntemlerini anlatmaktır.

**Anahtar kelimeler:** Perikardiyosentez, kardiyak tamponad, perikard

## Pericardicentesis and Contemporary Practice

Pericardiocentesis is the evacuation of fluid (which exceeds physiologic levels) from pericardial space. Although it's generally used as a life saving procedure in cardiac tamponade, it is also used for diagnostic purposes. Together with the advances in imaging modalities, pericardiocentesis techniques are diversified. In this report our aim is to give an idea about the history and indications of pericardiocentesis and thereafter briefly explain the techniques of pericardiocentesis under the light of modern advances.

### History

To our best knowledge, first pericardiocentesis was reported by Franz Schuh in Vienna in 1840 (1). In 1956

Bishop et al. reported an article about pericardiocentesis under ECG guidance (2). Although in 1973 Goldberg and colleagues proposed the ultrasonography guided pericardiocentesis, because of low spatial resolution complication rates didn't differ so much (2). In 1982 Cikes reported that the spatial resolution of 2D echocardiography was enough for pericardiocentesis (2). At early 1980s, articles about the usage of contrast echocardiography in pericardiocentesis were published (2). At the same time period, case series of flouroscopy guided pericardiocentesis were reported (2). In 1989 Sandring and colleagues reported a case series of computed tomography (CT) guided pericardiocentesis (2). Recently, various ultrasonographic devices have been designed for pericardiocentesis with real time echocardiographic images (2).

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## Indications

Indications and contraindications for pericardiocentesis according to the guidelines on the diagnosis and management of pericardial diseases published by European Society of Cardiology on 2004 are as follows (2); As a life saving procedure in tamponade (level of evidence B, class I). Presence of >20 mm (end diastolic) fluid on echocardiography. For diagnostic purposes in small effusions (pericardial fluid and tissue analysis, pericardioscopy, epicardial/pericardial biopsy)( level of evidence B, class IIa)

## Contraindications

### Absolute

-Aortic dissection

### Relative

-Uncorrected coagulopathy

-Anticoagulant therapy

-Thrombocytopenia (<50000/mm<sup>3</sup>)

-Small, posterior, localized effusions.

The role of pericardiocentesis in small and non-steroidal antiinflammatory drug responsive effusions is limited. On the other hand, histologic diagnosis can be reached in 18-33% of patients to whom sampling was performed (3,4). Thus nowadays pericardiocentesis is generally used for therapeutic purposes rather than diagnostic purposes.

## Pericardiocentesis techniques

### *Blind pericardiocentesis and pericardiocentesis under EKG guidance*

Despite the advances in imaging modalities and high complication rates, these methods are still bearing in mind when we are talking about pericardiocentesis. These methods protect their place in cardiology and anesthesia handbooks and they are frequently applied on intensive care unit settings.

Briefly, patient is positioned on supine or 30-45° angle position in both methods and the intervention is performed at subxiphoid or left xiphidocostal region. Needle (number 16-18, 5,1-8,3 cm) is directed to left shoulder with an angle of 45°. In an averaged weight patient pericard is located 6-8 cm far away from the skin. In the ECG guided method all extremity derivations are

used and they are attached to the needle. Any ST segment elevation or ventricular premature beat indicates a right ventricular contact and PR segment elevation or atrial premature beat indicates right atrial contact. If the fluid evacuated from pericardial space is hemorrhagic, then it should be thrown on a clean sponge. The occurrence of coagulation on sponge suggest cardiac perforation. Measurement of hameotocrit is also another method to differentiate the nature of fluid if it is a pericardial fluid or blood evacuated from the ventricles. After being sure that the needle is in pericardial space, according to the aim of procedure and amount of fluid, either evacuation of fluid can be done or a drainage catheter can be placed to pericardial space. If a drainage catheter is placed it should be kept in its place until the fluid income falls below 50 cc/day .

Although they are widely used, complication rates of both methods are high. Blind pericardiocentesis have a mortality rate up to 6% and a morbidity rate up to 20% (5). In the ECG guided method, if the needle is placed to an electrically inactive place (tumour infiltration, infiltrative cardiomyopathy, infarct related fibrosis), method loses its sensitivity (6).

### *Flouroscopy guided pericardiocentesis*

Flouroscopy guided pericardiocentesis is especially preferred by invasive cardiologist. In this method subxiphoid region is used and needle is directed from anterior diaphragmatic edge of right ventricle to left shoulder. Radiocontrast agent or wire location on floro can be used to make sure the physician whether needle is in pericardial space or not. Radiation exposure is a disadvantage of this method. Making mass/effusion discrimination is also difficult in this method. In a case series reported by Duvernoy et al. mortality rate was 0.6%, cardiac chamber perforation was 5.6% and arterial bleeding was 1.4% (7).

### *Echocardiography guided pericardiocentesis*

Advantages of echocardiography guided pericardiocentesis are ease of mobility, absence of radiation and being a non-invasive method. In addition, it gives an opportunity to evaluate the patient before, during and after the procedure. It has lower complication rates compared to other techniques. In the biggest case series with 1127 patients reported by Mayo clinic 1.2% major (one mortal perforation, 5 non-mortal perforation, one intercostal artery perforation, 5 pneumothorax) and

3.5% minor complication rates (eleven self limited perforation, 6 self limited pneumothorax, 10 non-sustained ventricular tachycardia) were reported (5). This is why in most centers echocardiography is used as a standard tool for pericardiocentesis.

In echocardiography guided pericardiocentesis, patient lies in supine or slightly left lateral decubitus position. Afterwards apical, parasternal and subcostal windows are used for imaging. At this point, the shortest distance between the skin and the place of maximum pericardial fluid is found. In addition, localization of liver is made to prevent any possible trauma to this organ. Because of the air in alveolar tissue, sonographic waves can not penetrate to lung tissue. For this reason with echocardiography guided pericardiocentesis risk of pneumothorax is lower.

Subxiphoidal, left subxiphoid angle and apical regions are preferred entry sides. Although fluid-skin distance is determinant for entry point, each region have some advantages and disadvantages. Subxiphoid method is the most widely used technique. Low possibility of pleural or peritoneal entry and wide experience make it as a preferred technique. But especially in obese patients the needle entry distance gets longer. In addition, termination of bleeding from a perforated right ventricle or right atrium is unusual. There are some reports about apical approach from different centers (5, 8). By this method, especially loculated, limited and anteriorly located effusions are suitable for evacuation. Possible left ventricular perforation can limit itself, because of its muscle mass is enough for limitation of perforation. But risk of pneumothorax, injury to important vessels like left anterior descending artery and left internal mammary is more frequent in this method.

After the entry location is determined, proper cleaning and local anesthesia should be done. According to the location of probe, the distance between skin and effusion is measured. To locate the tip of needle, contrast can be produced in pericardial space by the help of agitated saline. After entering to the pericardial space, according to the amount of pericardial effusion fluid is evacuated either by needle or drainage catheter. Last two techniques that were mentioned above are the most preferred procedures in our clinic. Our complication rates are similar with the literature.

#### **Novel techniques**

Although echocardiographic method has many advantages, because it does not give real time images it cannot show the perforation of pericardial membrane. A recently developed "The ColorMark ( Echocatch, Inc., Princeton, NJ) " device overcomes this restriction (9). This device is attached to the pericardiocentesis needle and it transforms vibration of needle to colored doppler images. By this method real time images can be obtained. Many studies are still going on with this device in cardiology and in other fields (10-12) .

Evacuation of effusions that was collected after surgery and purulent pericarditis is especially not easy. In these situations, stereotactic devices or CT guided pericardiocentesis can be thought. In a study reported by Klein and his colleagues major complication rate was 0.3% and minor complication rate was 6.9% and no death was observed (13).

#### **CONCLUSION**

Pericardiocentesis is generally used as a life saving procedure. But today the invasive and non-invasive imaging modalities are improved and complication rates of blind or ECG guided pericardiocentesis make them inappropriate because of being opposite to the aim of the procedure. It is obvious that appropriate selection of method according to the patient and according to the aim of procedure will increase the success rates and decrease the complication rates.

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