Introduction

Pericardiocentesis of moderate, small or loculated pericardial effusions is a controversial issue. It should not be routinely performed if the patient is not symptomatic and effusion is spontaneously resolving and unless further diagnostic and/or therapeutic options are available (e.g. pericardioscopy, epicardial or pericardial biopsy, application of intrapericardial treatment). In addition, access to the small or moderated effusions requires a learning curve. Several experimental and few clinical concepts have been developed for access of a small pericardial effusion or normal pericardium. These procedures will be reviewed in the following sections.

Pericardiocentesis Guided by Epicardial Halo Phenomenon

For the diagnosis of pericardial effusion in the pre-echocardiography era the radiological findings were of greatest importance. One of the most valuable tools was the evaluation of the epicardial halo phenomenon. However, the correlation of this phenomenon with the presence of and/or the size of pericardial effusion was never resolved. In an effort to improve feasibility and safety of pericardiocentesis for small pericardial effusions we have noted the applicability of the sign for fluoroscopic guidance of the procedure.

In most of the patients with pericardial effusion there is a clear fluoroscopic distinction between the epicardial surface of the heart and the surroundings, which can be appreciated best in the left lateral view (90 degrees) in the cine fluoroscopy (Fig. 5.1, Video 1.3). In the pre-echocardiography era this sign was utilized for the follow-up of pericardial effusions [1–3]. The halo phenomenon, however, has not been previously applied to guide pericardiocentesis.

In our own experience the sensitivity of the epicardial halo sign for the detection of pericardial effusion was 84.1% and 92.0% in anterior-posterior (PA) and lateral angiographic view respectively [4]. As expected, the specificity of the sign for the detection of pericardial effusion was lower: 57.2% and 44.9% (PA vs. lateral view) revealing a likelihood ratio to establish the effusion of 1.5 and 1.7 in PA angiographic view and lateral angiographic view respectively.

Eisenberg et al. [5] demonstrated 94% specificity, but only 12% sensitivity of the epicardial halo sign in 83 patients with pericardial effusion and in 17 controls with no effusion. The results were better for large and moderate effusions with 92% specificity and 22% sensitivity. These findings confirm that the epicardial halo sign is sensitive enough that it could
be used for guidance of pericardiocentesis in the large majority of patients. The low specificity of the sign is not a limitation for guidance of pericardiocentesis since all patients undergoing the procedure will certainly have to undergo echocardiography before establishing the indication for the drainage of pericardial effusion. Of note, the intensity of the epicardial halo sign may depend on the size of the pericardial effusion, the body-mass index, the technical features of the radiology equipment, as well as the age of the patient and the heart rate and there is therefore a small subpopulation of patients in which it cannot be applied for guidance of pericardiocentesis [4].

Physical Origin of the Sign

Regarding the origin of the epicardial halo phenomenon two main hypotheses have been discussed in the literature. The first explains the epicardial halo as a radiological projection of the subepicardial fat layer [1, 6, 7]. Other experimental and clinical studies, however, have shown that the intensity of the sign correlated with the size of pericardial effusion [8]. In an attempt to explain the origin of the sign Tehranzadeh and Kelly [8] constructed an original model demonstrating that the difference between the X-ray absorption coefficient of the blood in the cardiac chambers and of the transudate in the pericardial space is the most important contributing factor for the appreciation of the halo phenomenon.

Our findings partially support this view, since in our experience, the intensity of the sign was reduced after evacuation of pericardial effusion. However, there is still no good explanation for the origin of the sign in patients with coronary artery disease who had no pericardial effusion on echocardiography, except probably the presence of epicardial fat [9].

Tangential Approach to the Pericardial Surface

The epicardial halo delineates the epicardial surface of the heart and is used to guide the pericardiocentesis as a line or a border that the needle tip should not cross during the procedure (Fig. 5.2). For the guidance of pericardiocentesis the sign is considered positive, when a halo is visualized in the 90 degrees lateral projection on fluoroscopy, as an anterior demarcation line of higher radiographic density than both the pericardial effusion and the heart shadow, thicker than 2 mm (see Fig. 5.1a). A positive epicardial halo sign may also be noticed, although less frequently, in the frontal projection (see Fig. 5.1b) as an elliptical stripe paralleling the lower left heart border [2, 10].

The procedure is performed in the cardiac catheterization laboratory, using the Tuohy-17, blunt-tip introducer needle, subxiphoid route and local anesthesia. The tangential approach assumed that the puncturing needle is directed posteriorly until the tip passes the bony cage, then the hub of the needle is pressed toward the diaphragm and the needle is advanced tangentially to the epicardial halo. In this way, the needle is directed to the area where the accumulation of the effusion is certainly larger than in the frontal region of the pericardium, assuming that...