European Journal of Radiology 75 (2010) 28–31

Contents lists available at ScienceDirect

European Journal of Radiology

journal homepage: www.elsevier.com/locate/ejrad

CT-guided pericardiocenteses: Clinical profile, practice patterns and clinical outcome

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ARTICLE INFO

Article history:
Received 25 March 2010
Accepted 31 March 2010

Keywords:
CT-guided pericardiocenteses
Pericardial effusion
Haematoma

ABSTRACT

Objective: To assess the effectiveness and clinical outcome and technique of CT-guided pericardiocenteses in the treatment of pericardial effusions in adults and children.
Methods: 20 drainages were performed in Seldinger-technique under CT-guidance on 20 patients suffering from pericardial effusions and haematomas. In 85%, the etiology of effusion was postoperative.

The mean age of the patients was 59 years (minimum 9 years, maximum 86 years).There were 12 male and eight female patients. The inclusion criterion was an echocardiographically relevant proved pericardial effusion.
Results: All catheters could be placed successfully (20/20) in the pericardial effusion and allowed for draining of the effusion in all cases under CT-guidance. The overall 30-day mortality rate was 0%. CT-guided pericardiocentesis was successful for withdrawing pericardial fluid and/or relieving tamponade in 100% of all procedures. No major complication was occurred. A total of one minor complication (5%) occurred that required no specific interventions, except for monitoring and appropriate follow-up. We observed one pneumothorax as a minor complication.
Conclusions: Pericardial effusions of various causes can be safely, effectively, and quickly managed with CT-guided pericardiocenteses in adults and children. The ventrolateral entry side for the puncture should be preferred to reach the whole effusion and avoid complications, like a pneumothorax.

1. Introduction

Pericardial effusions can be caused by a variety of diseases, such as malignant systemic disease and post surgical or post-traumatic leaking. Other causes are tuberculosis, viral infections, rheumatic fever, cardiac and renal failure, the latter in association with uraemia [1,2]. Pericardial effusions need drainage when the intrapericardial fluid impairs hemodynamic function (pericardial tamponade) or when aspiration of pericardial effusions is indicated for diagnostic purposes. The volume known to adversely affect cardiac hemodynamics varies from 100 to 200 ml in rapidly accumulating effusions to 2000 ml in slowly developing pericardial effusions [3].

Historically, this was performed as a blind procedure and was associated with a high complication rate [4]. The development of 2-dimensional echocardiography in the 1970s allowed confirmation of the presence and accurate localization of the fluid and substantially enhanced the safety of percutaneous pericardiocentesis [5,6]. The procedure was simple, safe, and effective for immediate relief of pericardial fluid and tamponade but was not regarded as definitive treatment because of high rates of recurrence [5]. Extended catheter drainage was incorporated into the original echo-guided pericardiocentesis procedure in an attempt to reduce recurrence [7].

We report our clinical experience of using CT-guided pericardiocenteses.

The purpose of the actual study presented here was to present our initial experience on feasibility and safety of CT in guided drainage of clinical relevant pericardial effusions and haematomas.

2. Patients and methods

20 patients underwent therapeutic CT-guided pericardiocentesis for treatment of clinically significant pericardial effusions

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0720-048X/$ – see front matter © 2010 Published by Elsevier Ireland Ltd.
doi:10.1016/j.ejrad.2010.04.012

that means symptomatic, hemodynamically significant or large effusions. Clinical characteristics, including success and complications, effusion recurrence, procedural details were determined.

The inclusion criterion for the CT-guided therapy consisted of a sonographically relevant proved pericardial effusion, which had been considered not drainable by sonographic means. Or the effusion was not or not sufficiently visualized by transthoracic ultrasound.

2.1. Procedures and techniques

All CT-guided pericardiocentesis procedures were done by experienced radiologists.

Informed consent was obtained from each patient. The coagulation profile of each patient was checked before the treatment. Patients with a bleeding tendency received a transfusion of platelet concentrates or fresh frozen plasma before the procedure.

Patients were instructed to breath calmly during the procedure and abstain from talking.

Axial images of the whole chest were acquired before biopsy using a spiral CT scan with a 2.5-mm collimation by using four-detector-row CT (Somatom Plus 4 Volume Zoom WIP-version VA 20; Siemens, Forchheim, Germany). Biopsy was monitored by obtaining selected images at the area of interest either by using 10-mm-thick single slice axial CT sections (200 mA) or using CT-fluoroscopy (60 mA) (C.A.R.E. Vision package combined applications to reduce exposure dose; Siemens Medical Systems, Forchheim, Germany) which allows to display six frames per second on an in-room monitor facing the performing radiologist. After release of the foot switch, the last picture displayed is captured (last image hold).

The exposure parameters for CT scanning for pre biopsy, biopsy and post biopsy CT were: tube voltage 120 kV, tube current 120 mAs and 2.5-mm collimation. Pre- and post biopsy scans were reconstructed in 5-mm-thick transverse sections, overlap 5 mm, lung window 2000/−500 HU and soft-tissue window 400/50 HU.

All punctures were performed with an initial puncture needle (17, 5 G, length of 150 mm and Soft-Drainage Set 8-14 French (Somatex Medical Technologies, Teltow, Germany).

Based on the planning CT scan the full extension of the pericardial effusion was evaluated and the optimal entrance point was defined on the planning images. Afterwards this entrance point was marked on the skin. After extensive skin disinfection using local anaesthesia was performed with 10–20 ml Scandicain 1% (Astra Zeneca Wedel, Germany). Then a small (3 mm) skin incision was performed and the 17.5 G puncture needle was carefully advanced into the pericardial effusion, single CT scan or C.A.R.E. Vision was used for verification of the needle position.

Once the needle entered into the pericardial space, the steel needle core was withdrawn, and the sheath was slightly advanced. However, the sheath position was readily confirmed when fluid was withdrawn. Samples of the fluid were collected for microbiologic culture and cytological analysis. Afterwards a guide wire was advanced through the needle. After dilatation of the puncture channel with an appropriate dilatator a pigtail catheter was placed via the guide wire (SOMATEX, Teltow, Germany). The effusion was initially drained completely and the success was assessed by repeated CT scans. The drainage was fixed with Mersilene 2-0 (Ethicon Johnson and Johnson St. Stevens-Woluwe, Belgium) and StayFIX Fixation Device for Percutaneous Catheters (Merit Medical, The Netherlands).

Vital signs, including blood pressure, heart rate and blood oxygen saturation were monitored by a patient monitoring system (GE Healthcare, Milwaukee, WI, USA). Intermittent aspirations were performed as clinically indicated, usually every 4–6 h, until the fluid return over a 24-h period had decreased to less than 25 ml and follow-up 2-dimensional echocardiographic assessment or a repeated CT scan were satisfactory.

Table 1
Characteristics of patients and etiology of effusions.

No. of patients	20
Male no. (%)	12 (60)8 (40)
Female no. (%)	
Mean age in years (range)	59 (9–86)
Etiology of effusions no. (%)	
Postoperative	17 (85)
Infection	1 (5)
Malignancy	1 (5)
Trauma	1 (5)
Hemodynamic status no. (%)	
Echocardiographic tamponade	5 (25)
Clinical tamponade	15 (75)
Mean days after surgery (range in d)	20 (0–58)

2.2. Outcomes

Evaluation criteria included technical success as well as major and minor complications. Pericardiocentesis was considered technical successful if the pericardial space could be punctural and fluid was drained with consecutive release of tamponade. Major complications included any undesirable events occurring as a result of pericardiocentesis that required intervention. Minor complications were those that required no management, except appropriate monitoring and follow-up. Recurrence was defined as reaccumulation of fluid requiring intervention.

3. Results

3.1. Baseline and CT Characteristics

Between January 2007 and March 2009, CT-guided pericardiocenteses was performed in 20 patients (12 male and eight female). The mean age was 59 years (range 9–86 years). In 17 cases (85%) the pericardial effusion developed post operatively after cardiac surgery. The mean interval between surgery and CT-guided intervention was 20 days (range 0–58 days) (Table 1).

3.2. Clinical outcomes

3.2.1. Success and complications of pericardiocentesis

CT-guided pericardiocentesis was successful for withdrawing pericardial fluid and/or relieving tamponade in 100% of all procedures. No major complication was occurred. We observed a small number pneumothorax (5%), which was clinically not relevant and was classified a minor complication. No further treatment or intervention was necessary in this case.

During the 3 months follow-up interval none of our patients developed a recurred pericardial effusion (Table 2). In 85% a circumferential effusion was documented on CT images. 11 patients had a bloody effusion, the remaining nine patients serous effusion. The mean size of effusion was 235 ml (range 2–500 ml). In all cases with a circumferential pericardial effusion we used the venterolateral approach (arrows) (Fig. 1a–d).