Sternal fracture after elective electrical cardioversion of atrial fibrillation

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Sirs:

A 69-year-old female was admitted to our institution for ablative treatment of paroxysmal atrial fibrillation (AF) after her amiodarone medication had to be discontinued due to visual side effects. She suffered from intermittent palpitations and had a history of hypertension, coronary artery disease, and ICD implantation for ventricular tachycardia. On echocardiography her left atrial diameter was found to be normal and her left ventricular ejection fraction mildly reduced. One day after catheter-based ablation and circumferential pulmonary vein isolation the patient experienced a symptomatic AF recurrence. After an internal cardioversion attempt with a synchronized 30-J ICD shock had failed, external cardioversion with an anterior–posterior (AP) electrode position was attempted, utilizing a hand-held paddle to apply firm pressure to the sternal electrode during application of a 150- and a 200-J biphasic shock. Sinus rhythm, however, was not maintained due to immediate recurrences of AF. As the patient recovered from sedation, she complained of a new, sharp pre-sternal chest pain that increased with deep breathing.

On physical examination of the chest there was pre-sternal tenderness without crepitation on palpation. Findings were interpreted as an irritation of the musculoskeletal tissue from direct current application, and pain medication was prescribed. Over the following days, however, symptoms persisted. After conventional chest X-ray findings did not explain the symptoms, a computed tomography (CT) of the chest revealed a fracture of the sternal body, approximately 2.5 cm below the manubriosternal joint (Fig. 1). The patient had no history of prior chest trauma, and there were no overt medical conditions predisposing to fractures. Dual energy X-ray absorptiometry revealed normal bone mineral density, thereby ruling out osteoporosis. Conservative treatment with a chest bandage was added and pain medication was continued since the fracture was stable and not significantly dislocated.

Since decades, electrical cardioversion is very frequently and widely applied to terminate persistent AF. Recent randomized controlled trials suggest that an AP electrode position [1] and the use of hand-held paddles [2] optimize cardioversion success rates without compromising on patient safety. The present case illustrates that application of this electrode configuration may carry a risk of sternal fracture, a complication usually caused by blunt chest trauma (e.g., traffic or sports accidents), but hitherto unrelated to electrical cardioversion of AF. Iatrogenic sternal fracture is known to occur after cardio-pulmonary resuscitation due to chest compression [3] or application of a pre-cordial thumb [4]. In the present case, electrical cardioversion caused sternal fracture because the electrodes for direct current application were attached in an AP position and because a hand-held paddle was pressed to the sternum. Manual application of firm pressure to the anterior sternal electrode enhances electrode–tissue contact and reduces transthoracic resistance, thereby increasing current

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Fig. 1 Chest CT with intravenous administration of contrast material showing fracture in the upper portion of the sternal body (*arrow*)

flow to the heart and defibrillation success [5]. With an AP electrode position and hand-held paddles, however, pronounced pressure to the sternum may cause sternal fracture, as illustrated by the present case. Of note, this complication occurred in the absence of conditions that predispose to fractures, e.g., osteoporosis, and despite the fact that the procedure was carried out by a physician with substantial experience in electrical cardioversion.

In conclusion, this case illustrates that sternal fracture should be considered as a potential complication of electrical cardioversion when an AP electrode position and hand-held paddles are utilized. With this electrode configuration, excessive pre-sternal pressure to the anterior electrode should be avoided.

Conflict of interest The authors declare that they have no conflict of interest.

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