Injecting a Ventricular Tachycardia into the heart; a unique case report

Anthoula Plevritaki[1], Emmanuel Kanoupakis[1], Emmanuel Koutalas[1], George L. Lazopoulos[2], Alexandros P. Patrianakos[1], mmanuel Foukarakis[3], Dimitris Lempidakis[1], Paris Kalogerakos[2], Dimitrios Koutentakis[4], and George E. Kochiadakis[1]

[1]Cardiology Department University Hospital of Heraklion Heraklion Greece
[2]Cardiac Surgery Unit University Hospital of Heraklion Heraklion Greece
[3]Cardiology Department Venizeleion General Hospital of Heraklion Heraklion Greece
[4]Neurosurgery Department Venizeleion General Hospital of Heraklion Heraklion Greece

September 19, 2022

Abstract

A 52-year-old woman presented with malignant ventricular arrthythmogenesis intraoperatively during kyphoplasty for an osteoporotic fracture of a lumbar vertebra. No previous cardiovascular condition was known. Causes of arrhythmogenesis associated with the procedure were excluded. Due to her positive family history for dilated cardiomyopathy, upcoming thoughts were made for unmasking a previous asymptomatic cardiomyopathy. Nevertheless, an intracardiac cement embolism was diagnosed and, finally, the patient underwent an open heart surgery with successful removal of the cardiac cement while no new arrhythmogenic episode was recorded during follow up.

Injecting a Ventricular Tachycardia into the heart; a unique case report

Emmanuel M. Kanoupakis MD[1], Anthoula Plevritaki MD[1], Emmanuel P. Koutalas MD[1], George L. Lazopoulos MD[2], Alexandros P. Patrianakos MD[1], Emmanuel Foukarakis MD[3], Dimitrios Lempidakis MD[1], Paris Dimitrios Kalogerakos MD[2], Dimitrios Koutentakis MD[4], George E. Kochiadakis MD[1]

Affiliations :[1]Cardiology Department, University Hospital of Heraklion, Heraklion, Greece,[2]Cardiac Surgery Unit, University Hospital of Heraklion, Heraklion, Greece, [3]Cardiology Department, Venizeleion General Hospital of Heraklion, Heraklion, Greece,[4]Neurosurgery Department, Venizeleion General Hospital of Heraklion, Heraklion, Greece

Correspondence : to Emmanuel M. Kanoupakis MD, Cardiology Department, University Hospital of Heraklion, Heraklion, Greece.

E-mail address: *kanoup@gmail.com*

Funding : None.

Conflicts of Interest : None.

Authorship : All authors had access to the data and a role in writing this manuscript.

Article type : Case Report

ORCID:

Anthoula Plevritaki: *https://orcid.org/0000-0002-8251-5520*

Emmanuel P. Koutalas: *https://orcid.org/0000-0002-9958-2869*

Paris Dimitrios Kalogerakos:

https://orcid.org/0000-0003-0313-9641

Requests for reprints should be addressed to Emmanuel M. Kanoupakis MD, Cardiology Department, University Hospital of Heraklion, Heraklion, Greece. E-mail address: kanoup@gmail.com

Keywords : kyphoplasty, dilated cardiomyopathy, ventricular tachycardia, cement, cardiopulmonary embolism

Abstract

A 52-year-old woman presented with malignant ventricular arrthythmogenesis intraoperatively during kyphoplasty for an osteoporotic fracture of a lumbar vertebra. No previous cardiovascular condition was known. Causes of arrhythmogenesis associated with the procedure were excluded. Due to her positive family history for dilated cardiomyopathy, upcoming thoughts were made for unmasking a previous asymptomatic cardiomyopathy. Nevertheless, an intracardiac cement embolism was diagnosed and, finally, the patient underwent an open heart surgery with successful removal of the cardiac cement while no new arrhythmogenic episode was recorded during follow up.

Introduction:

Percutaneous balloon kyphoplasty (KP) is a minimally invasive technique performed for painful osteoporotic or neoplastic vertebral compression fractures refractory to maximum applied conservative measures[1]. A frequently reported complication of KP concerns cement leakage, which can occur locally in the intervertebral disc space and into paravertebral soft tissues, but also at more distant sites through the paravertebral veins (up to 24%). Once bone cement inserts the veins, it migrates through the valveless venous plexus to the azygos venous system, reaching the superior vena cava. The embolus may further migrate into the right heart chambers and the pulmonary arterial system ultimately causing cardiopulmonary embolism, also known as cement embolism[2].

Case Report

A cardiology consult was sought for a 52-year-old female from Neurosurgery Department when recurrent episodes of polymorphic non-sustained ventricular tachycardia (NSVT) were recorded intraoperatively. The patient was referred for kyphoplasty (KP), due to a recent fracture of an osteoporotic lumbar vertebra that was refractory to conventional analgesics. Her preoperative examination was unremarkable except for back sensitivity. The procedure was completed uneventfully and the patient was transferred to the Cardiology Department for further evaluation.

A transthoracic echocardiogram (TTE) performed at first evaluation demonstrated a normal sized left ventricle (left ventricular end-diastolic diameter, LVEDD=52mm) with a normal ejection fraction (EF) of 55%.

A subsequent 24-hour ambulatory electrocardiogram (ECG) revealed intermittent ventricular arrhythmogenesis (single premature ventricular contractions 688/24h, nsVT, 22 episodes/24h). Common reversible causes of arrhythmogenesis associated with the procedure were excluded (e.g. intraoperative hypoxia, hypotension, or electrolyte imbalance). Other causes of arrhythmogenesis, such as myocardial ischemia or inflammatory processes, inherited or acquired cardiac channel dysfunctions were of low suspicion given the normal serial 12-lead ECG and blood test findings.

The patient was free of cardiovascular disease and denied any episodes of chest pain, dizziness, palpitations or syncope in the past. She smoked tobacco, but she did not drink alcohol, or use illicit drugs. Her brother had received a cardioverter-defibrillator after being diagnosed with dilated cardiomyopathy (DCM) and had subsequently died at the age of 60. Her father had died suddenly at the age of 62.

The patient's clinical presentation raised suspicion of an inherited cardiomyopathy due to her family history of DCM and the documented VTs. In some cases, a preclinical phase without cardiac expression subsequently progresses towards mild cardiac abnormalities, such as isolated LV dilatation, or arrhythmogenic features with life-threatening ventricular arrhythmias (2%) or with frequent ventricular arrhythmias (30%), which are unrelated to the severity of LV dysfunction. These clinical manifestations are described otherwise as arrhythmogenic DCM.[3]

The next diagnostic step included a scheduled coronary angiography in order to exclude coronary artery disease. Of surprise, fluoroscopy imaging depicted a mobile radiopaque material projected right upon the cardiac silhouette, moving simultaneously with the cardiac contractions, postulating an intracardiac position (Video). The catheterization was interrupted until further evaluation.

The Neurosurgery Department was contacted and after reviewing the procedural protocol, the case of an inserted and abandoned guidewire, needle or suture was rejected. However, as cement material had been injected into the vertebra intraprocedurally to stabilize the fracture, an intravenous cement leak could have occurred that had been entrapped and solidified inside the cardiac cavities.

The patient underwent a dedicated TTE focusing on the right ventricle (RV) demonstrating a linear structure constituting of two parts, that were parallel to the elongated axis of the RV and rebounded at the inferior basal segment of the latter; the free ends were directing towards the RV free wall (Figure 1). A chest computed tomography (CT) was also performed that confirmed the above findings and also excluded coronary heart disease (Figure 2).

Anticoagulation was initiated and the patient was transferred to the Cardiac Surgery Unit. The patient underwent an open heart surgery with successful removal of the foreign body (Figure 3), confirming that the material was composed of cement related to her recent spinal procedure. The successful surgical removal of the cement material led to the cease of the patient's arrhythmogenesis.

The patient recovered from the spinal cord procedure uneventfully and regained full mobility. Serial TTEs and ambulatory ECGs reported normal finding during follow-up.

Discussion

Most cases of cement embolism are asymptomatic, with only 1% presenting with dyspnea, which usually resolves with conservative management (i.e., oxygen therapy, anticoagulants), so the incidental finding of cement emboli in an asymptomatic patient does not definitely necessitate medical treatment or removal.[4] This is because the cement emboli are generally small and scatter in the peripheral areas of the lung arteries.

However, in patients with central emboli (cardiac chambers, main pulmonary artery branches), the anticoagulants cannot dissolve the cement or relieve the right ventricular overload; furthermore, when the cement is localized into the heart, it can cause cardiac rupture and/or cardiac tamponade, thus surgical extraction might be warranted.[5] Symptomatic patients with cement material into the right atrium are usually managed via percutaneous retrieval, whilst those with RV involvement or perforation are managed surgically.[6]

High level of suspicion is required when in patient's history is referred that material such as cement has been injected during a KP procedure. To the best of our knowledge this is the first reported case of ventricular arrhythmogenic presentation of a cardiac cement embolus after a KP procedure.

References

1. Lee JH.; Lee JH.; Jin Y. Surgical techniques and clinical evidence of vertebroplasty and kyphoplasty for osteoporotic vertebral fractures. *Osteoporos Sarcopenia.* **(2017)** *3* (2), 82-9. DOI: 10.1016/j.afos.2017.06.002.
2. Abdul-Jalil Y.; Bartels J.; Alberti O.; Becker R. Delayed presentation of pulmonary polymethylmethacrylate emboli after percutaneous vertebroplasty. *Spine* (Phila Pa 1976). **(2007)***32* (20), E589-93. DOI: 10.1097/BRS.0b013e31814b84ba.

3. McNally EM.; Mestroni L.; Luisa Mestroni. Dilated cardiomyopathy: genetic determinants and mechanisms. *Circ Res* **(2017)***121* (7), 731-748. DOI: 10.1161/CIRCRESAHA.116.309396.
4. Choe DH.; Marom EM.; Ahrar K.; Truong MT.; Madewell JE. Pulmonary embolism of polymethyl methacrylate during percutaneous vertebroplasty and kyphoplasty. *AJR Am J of Roentgenol.* **(2004)***183* (4), 1097-102. DOI: 10.2214/ajr.183.4.1831097.
5. Weininger G, Elefteriades JA. Intracardiac Cement Embolism. N Engl J Med. 2021:385:e49. doi: 10.1056/NEJMicm2032931.
6. Hatzantonis C, Czyz M, Pyzik R, Boszczyk BM. Intracardiac bone cement embolism as a complication of vertebroplasty: management strategy. Eur Spine J. 2017;26:3199-205. doi: 10.1007/s00586-016-4695-x.

Figure Legends

Figure 1:

Transthoracic heart ultrasound demonstrating the presence of a foreign body inside the right ventricle. RV: right ventricle, CEM: cement

Figure 2:

Chest computed tomography: Presence of a linear structure consisting of two parts, that are parallel to the elongated axis of right ventricle (RV) and rebound at the base of RV; the free ends are adjacent to the free wall of RV

Figure 3:

Surgical preparation: Cement was extracted into two separated parts with length of 57mm and 52mm each.