

Intracardiac Foreign Body Formation from Bone Cement Material Following Total Hip Replacement: A Case Report¹

Jin Hee Moon, M.D., In Jae Lee, M.D., Hyun Beom Kim, M.D.,
Eun Young Ko, M.D., Sung Hye Koh, M.D., Keon Ha Kim, M.D.

A linear intracardiac foreign body was identified following a total hip replacement (THR) on chest CT and transesophageal echocardiography in a 60-year-old woman with rheumatoid arthritis. Leakage and migration of bone cement during arthroplasty is a possible explanation for this rare complication. Therefore, adequate preparation and handling of cement using biplane fluoroscopy are recommended during arthroplasty.

Index words : Chest, CT

Heart, echocardiography

Heart, foreign bodies

Injections of acrylic cement into a diseased femoral head and femoral canal have usually been involved in a procedure of total hip replacement (THR). Severe complications resulting from this procedure are infrequent. However, this procedure can cause localized problems such as infection or cement leakage into the femoral vein to inferior vena cava. We report a case of symptomatic foreign body formation in the right cardiac chambers caused by acrylic cement migration following a THR.

Case Report

A 60-year-old woman was hospitalized for hip pain which made standing on her own difficult. The patient had a history of rheumatoid arthritis in both hips for 15 years. Hip joint problems gradually worsened until the patient was not able to stand by herself. Radiologic find-

ings from both hip joints confirmed advanced rheumatoid arthritis.

Initial chest radiography showed no remarkable findings. Initial blood gas analysis showed mild elevation of pO_2 (111.6 mmHg), and normal range of pCO_2 (35.4 mmHg). Other blood chemistry results were not remarkable. Preoperative echocardiography showed no remarkable findings.

Left hip replacement was performed through the posterolateral approach using a bone cement injection gun under general anesthesia. The acrylic cement had been prepared at room temperature (22 °C) and mixed with 1g of tungsten powder. There were no systemic complications after left hip replacement. One month later, right hip replacement was performed using the same method.

A few days after the right hip replacement, the patient was bothered by a cough and complained of mild dyspnea. Chest radiography showed no remarkable finding and blood gas analysis revealed both pO_2 (84.7 mmHg) and pCO_2 (38.0 mmHg) to be within normal ranges. Doppler sonography of both lower extremities showed no evidence of deep vein thrombosis. Echocardiography revealed a linear echogenic structure adjacent to the tricuspid valve with mild tricuspid regurgitation, mild pul-

¹Department of Radiology, Hallym University College of Medicine
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Address reprint requests to : In Jae Lee, M.D., Department of Radiology,
Hallym University Sacred Heart Hospital,
896 Pyungchon-dong, Anyang, Kyungki-do 431-070, Korea.
Tel. 82-31-380-3885 Fax. 82-31-380-3878
E-mail: ijlee2003@yahoo.co.kr

monary hypertension and a moderate amount of pericardial effusion (Fig. 1A).

Exact delineation of the linear structure adjacent to the tricuspid valve was difficult to obtain with transthoracic echocardiography. Consequently, a transesophageal echocardiography was performed. It revealed an abnormal linear structure that seemed to originate in the right atrial appendage extending into the right ventricle (Fig. 1B). Because the structure was less mobile than cardiac movement, it was considered to be a foreign body with a hard structure. The cardiac ejection fraction decreased following THR from 62% to 39%.

Non-enhanced chest CT scan showed a focal high attenuation structure within the right cardiac chamber (Fig. 1C). Chest CT with three-dimensional reconstruction of images revealed a linear high attenuation lesion

6.4 cm in length with an irregular contour in the right atrium and ventricle (Fig. 1D). The linear structure was regarded as bone cement material related to the THR procedure. The patient was treated with theophylline, aspirin, and prednisolon. There was mild improvement of cardiopulmonary symptoms following medical treatment. Because of the deterioration of cardiac contractility, surgical removal of bone cement was recommended for the patient. However, the patient refused the operation and was discharged.

In this case, the intracardiac foreign body was not surgically confirmed to be bone cement material. However, there does not appear to be any other factors that may have caused this condition. Therefore, we regarded the intracardiac foreign body as bone cement material related to the THR procedure.

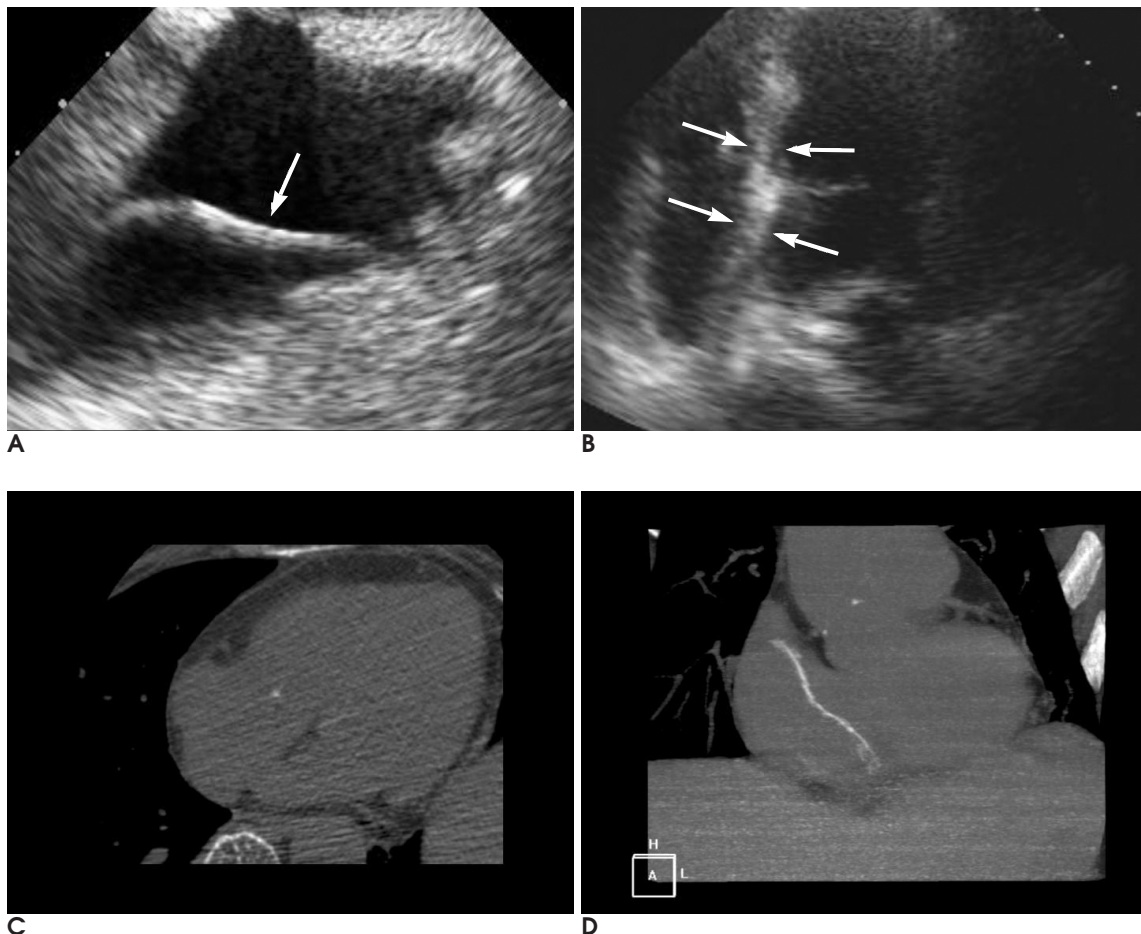


Fig. 1. A 60-year-old woman with an intracardiac foreign body from bone cement material migrated into the right cardiac chamber following THR.

- A.** Echocardiogram shows a linear echogenic structure in the right cardiac chamber.
- B.** Transesophageal echocardiogram also shows a linear echogenic structure in the right atrium and ventricle crossing the tricuspid valve.
- C.** Unenhanced chest CT scan shows a focal high attenuation structure within the right cardiac chamber.
- D.** Three-dimensional CT reformation image shows a linear high attenuation structure in the right atrium and ventricle.

Discussion

Although THR using a cement injection gun is considered to be a less invasive procedure compared with open surgery, complications can occur during the procedure. Many authors have described an association between the use of bone cement (polymethylmethacrylate) in human hip arthroplasty and cardiovascular complications such as hypotension, bradycardia, asystole, and bronchospasm. The etiology of these effects is not entirely clear, but mechanisms such as fat embolism associated with increased intramedullary pressure, air embolism, a neurogenic reflex, the release of vasoactive mediators such as histamine, direct depressive effects on the myocardium, peripheral vasodilatation, and activation of the coagulation cascade within the lungs have been suggested (1, 2). Other complications reported in literature include cardiac arrhythmias, myocardial infarction and cardiac arrest (3). Although many reports have documented symptomatic conditions caused by acrylic cement, there have been no radiologic reports which deal with symptomatic intracardiac foreign body formation.

The patient had cardiopulmonary symptoms including cough, mild dyspnea and lowered ejection fraction. An abnormal linear structure in the right cardiac chamber on echocardiography suggested bone cement had toxic effect on cardiopulmonary system.

The acrylic cement leakage and foreign body formation can be explained by the fluid consistency of the acrylic cement at the moment of injection. More extensive leaks may occur if the tip of the injection gun is positioned incorrectly or the procedure is performed under high pressure with a large volume of acrylic cement (1, 2).

In this case, leakage may have been caused by insufficient polymerization of the acrylic cement at the time of injection, which allowed leakage of the cement into the inferior vena cava and right cardiac chamber. For this reason, the acrylic cement must be mixed to the proper consistency (i.e., a stage of advanced polymerization) before injection, so that the several difficulties to evaluate factors that affect the polymerization rate (e.g., room temperature) may be better controlled.

Good quality lateral fluoroscopy is essential during injection of the bone cement material because it can detect

even minimal cement leakage into the femoral vein immediately. Jensen et al (4) recommend a barium/tungsten combination for adequate visualization of needle positioning and venous flow during fluoroscopy. Usually the cement is mixed only with tungsten powder to achieve opacification during fluoroscopy. In addition, biplane fluoroscopy or intermittent anteroposterior fluoroscopy may also help to overcome this problem.

Venous leaks are more frequent with hypervascular lesions (4). Although rheumatoid arthritis is not a hypervascular lesion, in many reported cases cardiac problems following THR were associated with rheumatoid arthritis (4). Acrylic cement leakage causing cardiac problems or pulmonary embolisms have been reported after vertebroplasty more often than after THR, although much more cement is used during arthroplasty than is required for vertebroplasty (5).

With regard to prophylaxis, in addition to correct handling of the cement and its insertion at the proper time under low pressure with manual packing, careful monitoring and pre- and postoperative systemic evaluation including evaluation of the heart are necessary (6, 7).

In conclusion, intracardiac foreign body formation can occur by bone cement material after THR. To avoid such a complication, careful handling of the cement material and monitoring of its leakage are essential.

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