CASE REPORTS

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Postoperative Ventricular Fibrillation and Undiagnosed Primary Amyloidosis

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AMYLOIDOSIS is a disease characterized by deposition of amyloid proteins in various body tissues. The natural history of primary amyloidosis is poorly understood, and the clinical diagnosis is often not made until the disease is far advanced. There is a high prevalence of conduction disturbances associated with this disease, and heart-related problems are a frequent cause of death for patients with primary amyloidosis.[1–5] Sudden death is common, occurring in one third of these patients.[6,7] Here we present a case of unexpected postoperative cardiac arrest in a patient who was found at autopsy to have primary amyloidosis.

Case Report

A 79-yr-old man underwent a lumbar laminectomy for spinal stenosis. His only significant medical history was malaria treated in 1945. He denied a history of chest pain, syncope, or shortness of breath. With the exception of lower-extremity weakness, his physical examination was unremarkable. His laboratory results were all normal, including a creatinine level of 1.2 mg/dl and a blood urea nitrogen level of 14 mg/dl. The preoperative electrocardiogram showed normal sinus rhythm with a rate of 68 beats/min. There was no evidence of conduction abnormalities, with a PR interval of 176 ms and a QT/QTc of 380/404 ms. There was no evidence of left ventricular hypertrophy. The chest radiograph did not show any evidence of acute disease or cardiomegaly.

Anesthesia was induced using 275 mg thiopental, 150 μg fentanyl, and 8 mg vecuronium and was maintained with isoflurane, nitrous oxide, and fentanyl. Surgery was initiated, and the operative course was uneventful, with an estimated blood loss of 300 ml. The patient was given 12 mg morphine in divided intravenous doses, and the incision was infiltrated with bupivacaine before skin closure. The patient was turned supine and extubated when he was breathing spontaneously, demonstrating good strength and following commands. He was awake, cooperative, and verbalized having back pain at the operative site in the next 20 min in the postanesthesia care unit. One minute after receiving 2 mg intravenous morphine, the patient had an oxygen saturation of 98% as he developed monomorphic ventricular tachycardia that quickly degenerated into ventricular fibrillation. Because no pulse was palpable, cardiopulmonary resuscitation was started immediately. His ventricular fibrillation was treated with repeated attempted cardioversions and high doses of epinephrine, lidocaine, bicarbonate, and magnesium. Other drugs administered included procainamide, bretylium, and amiodarone. Ventricular fibrillation was the dominant rhythm, although intermittent sinus tachycardia was present, with transient mean arterial pressures of 60–80 mmHg. A sample of blood was drawn 30 min after the arrest to check the serum bupivacaine concentration. After 80 min of aggressive treatment, the decision was made to discontinue cardiopulmonary resuscitation.

An autopsy revealed significant cardiomegaly (500 g) and mild coronary atherosclerosis, with no evidence of acute or remote myocardial infarction. Microscopic evaluation of the myocardium showed extensive amyloid light-chain amyloidosis. Laboratory testing showed serum bupivacaine concentrations of 0.5 and 0.6 μg/ml (toxic = 6.0 μg/ml).

Discussion

We report a case of unexpected postoperative sudden death linked to primary amyloidosis undiagnosed before surgery. This patient developed ventricular fibrillation refractory to resuscitative efforts. Autopsy revealed extensive infiltration of amyloid light-chain fibers in the myocardium.

Sudden deaths attributable to cardiac amyloidosis outside the operating room are not uncommon.[1,2,4–7] Between 1982 and 1986, 810 patients who had sudden cardiac deaths underwent autopsy by the Osaka Medical Examiner's Office.[8] Among the 200 cases examined in 1986, 0.5% showed cardiac amyloidosis under microscopic examination.

Because patients with cardiac amyloidosis have a high prevalence of conduction abnormalities on standard electrocardiograms, one might expect severe brady-

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arrhythmias to be the primary cause of these deaths. The observation that clinically significant bradyarrhythmias are relatively rare in patients with primary amyloidosis, whereas complex ventricular arrhythmias may occur in up to 47% of these patients, suggests that sudden death in amyloid heart disease may be caused by ventricular arrhythmia rather than bradycardia.[9] It is possible that the infiltration of the myocardium by amyloid fibrils produces ventricular arrhythmias by disruption of the normal cellular architecture. This theory is supported by the observation that patients with cardiac amyloidosis have a prolonged QTc in comparison with controls.[10]

Anesthetic agents can further increase the susceptibility of the cardiac conduction system to arrhythmia. For example, anesthetics that selectively decrease the rate of depolarization of the higher pacemaker sites while the lower cells are unaffected favor the movement pacemaker to a lower area in the heart. In addition, factors that increase the rate of spontaneous depolarization of a lower pacing site favor the takeover of these as the cardiac pacemaker. Opioids, parasympathomimetic drugs, and inhalational anesthetics tend to slow pacemaker sites above the atrioventricular node. Factors that may increase automatic pacemaker activity below the atrioventricular node are catecholamines, hypercarbia, and hypoxia. A combination of anesthetic agents that depress the atrial pacemaker and an increase in catecholamines because of pain may have led to the fatal ventricular arrhythmia in this case.

Another potential factor is local anesthetic toxicity. The refractory nature of this arrest and the fact that bupivacaine had been infiltrated into the incision led to a presumptive diagnosis of bupivacaine-induced cardiac arrest. However, the low serum concentrations of bupivacaine are inconsistent with bupivacaine toxicity.

Patients with amyloidosis have successfully undergone surgery with general anesthesia, but there have been reports of conduction blocks, postoperative congestive heart failure, and death.[11–13] High-dose melphalan with autologous bone marrow transplantation has been used to treat patients with systemic amyloid light-chain amyloidosis with cardiac involvement, and this treatment may decrease the risk of cardiac complications.[14,15]

Because patients with severe renal amyloidosis can be candidates for renal transplantation, potential cardiac involvement should be considered in these patients. Two-dimensional echocardiography may help confirm cardiac involvement in such cases because it shows a granular sparkling appearance in patients with cardiac amyloidosis. If present, the prophylactic use of an intravenous cardiac pacer to treat potential heart block should be considered.

In summary, cardiac amyloidosis may be occult even when it is severe, and the first clinical sign of this disease may be a fatal arrhythmia. When patients with known primary amyloidosis are considered for elective surgery, further testing with cardiac echocardiography may be helpful in assessing the extent of the cardiac involvement.[9]

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