Case Report

Radiation-induced combination of cardiac disease and sternoclavicular joint destruction

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**Summary** Very late valvular and/or coronary artery diseases after mediastinal radiation are rare but well known. Late radiation induced osteonecrosis of the sternoclavicular joint is very rare. The combination of both or all three diseases has not yet been described to the best of our knowledge. We report on such a case with particular respect to the difficult discrimination of aseptic and septic bone destruction.

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**Introduction**

A combination of radiation-induced osteonecrosis of the clavicle and radiation-induced cardiovascular disease is physiologically explainable but not yet described. Because aseptic necrosis is ultimately not discriminable from sternoclavicular joint infection, the sequence of operative procedures is crucial.

**Case report**

A 54-year-old male patient presented with a two month history of pain and swelling at the right sternoclavicular joint, with no history of trauma or systemic arthritis. In 1970, the patient had undergone mediastinal radiotherapy because of Hodgkin’s lymphoma.

On physical examination, a swelling of the right sternoclavicular joint with tenderness was apparent. Cultures of material gained by computed tomography (CT)-guided needle aspiration of the sternoclavicular process were negative. Cytology was not diagnostic.

The patient was not febrile and general inflammatory markers as well as rheumatoid factor and antinuclear antibodies were negative.

A chest radiograph was interpreted as normal and the chest CT scan revealed bone erosion and destruction of the right sternoclavicular joint (Fig. 1). Radionuclide bone scan demonstrated a pathological increase of osteoblastic cell activity in the medial part of the right clavicle and the adjacent sternoclavicular joint. Remote foci with abnormal tracer uptake could not be identified.

Anamnestically he had also suffered from shortness of breath and lacked physical ability for several months, but attributed this to “age” and a lack of physical training. Physical examination yielded a systolic ejection...
sound strongly suspicious for an aortic stenosis. Echocardiography demonstrated dysfunction of an enlarged heart with moderately thickened walls. The left ventricular endsystolic diameter was 58 mm and the left ventricular posterior wall had a thickness of 12 mm. The aortic valve was thickened and calcified with reduced leaflet motion. Subsequent cardiac catheterization revealed three-vessel coronary artery disease with left main stem stenosis and aortic stenosis with a peak-to-peak pressure gradient of 55 mm Hg. The left ventricular ejection fraction was 20%.

As we felt that sternoclavicular joint infection was not completely ruled out, the patient was operated in a staged fashion. The first procedure was sternoclavicular joint resection. Even though the possibility of joint infection could not be completely eliminated macroscopically, primary wound closure was done. The results of wound cultures were negative.

The histological examination of the resected parts of the clavicle and the manubrium sterni revealed osteonecrosis and osteomyelofibrosis most likely arising from radiation damage (Fig. 2).

Twenty days after the first operation, when wound healing was normal and all taken cultures had proven to be negative even in long-term incubation, aortic valve replacement using a pericardial heart valve and myocardial revascularization using left internal thoracic artery and two vein grafts were performed. Intraoperatively a marked thickening of the pericardium was conspicuous. Epicardium was whitish colored and thickened and there were no macroscopically visible myocardial scars. The aortic valve leaflets showed fibrotic thickening and calcification.

Histologically a chronically scarring inflammation with remarkable dystrophic calcification of the aortic valve was ascertained (Fig. 3).

The postoperative course was regular.

Figure 1 Computed tomographic scan showing the destructed right sternoclavicular joint.

Figure 2 Sternotoclavicular joint. Avital bone with adjacent osteoclasts, peristals fibrosis, and osteomyelofibrosis (hematoxylin and eosin 10× objective magnification).

Discussion

The sternoclavicular joint is a true synovial joint, and is therefore susceptible to inflammatory and degenerative arthritides, as well as a number of other disorders which are unique to the joint. The most common pathologies are systemic arthritides including crystal-deposition arthropathy which are in most instances discernable by clinical history and investigation as well as laboratory findings. Conditions that are rare and specific to the sternoclavicular joint are SAPHO syndrome and Friedrich’s disease. These were affiliated to low-grade infection and osteonecrosis, respectively [1]. Bacterial sternoclavicular joint infections are also rare, with about 180 cases reported in the literature [2]. Usually the patients are symptomatic but laboratory findings are quite normal in 54% and cultures are negative in 23% [2]. Thus infectious disease cannot be ruled out with sufficient certainty. Abscess formation or bone destruction is considered indication for surgery [3].

With regard to the clinical presentation of the patient, the CT-scan, and the cited literature we did not feel able to rule out infection completely. Thus cardiac surgery in combination with joint resection was regarded as inappropriate and we chose a staged procedure.

The histological examination revealed osteonecrosis of the sternoclavicular joint representing most likely a late complication following mantle field irradiation for Hodgkin’s disease in 1970.

Osteonecrosis with joint destruction is a potentially serious complication of cancer therapy. The 20-year cumulative incidence of osteonecrosis in adult survivors of childhood cancer is 0.43%, with 44% developing it in a previous radiation field [4]. While radionecrosis of the clavicle is sporadically reported, late sternoclavicular joint destruction by radiation therapy, particularly in combination with cardiac sequelae, has not yet been reported in the literature.

In contrast, valvular dysfunction, coronary artery disease, and pericarditis are well known late complications after chest radiation therapy mostly for Hodgkin’s disease [5]. Left ventricular dysfunction may be due to valvular
dysfunction and coronary artery disease and is also attributable to mediastinal irradiation and chemotherapy with anthracyclines which was part of a polychemotherapy regimen consequently given since 1970. The long time gap of 40 years between irradiation as well as chemotherapy and the clinical appearance of the concomitant heart diseases (valvular, myocardial, vascular, pericardial) is uncommon, but was for us the only assignable direct cause. Nevertheless, studies revealed the latency period following irradiation as the most important risk factor for development of cardiac abnormalities. Irradiation appears to initiate a degenerative process that continues for at least the next 20 years [6].

References