Ambulatory electrocardiographic evaluation of the heart in patients treated by megachemotherapy and bone marrow transplantation

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Abstract—The aim of the study was evaluation of the frequency of conduction defects and cardiac arrhythmias before and one month (once a week) after bone marrow transplantation (BMT). It was evaluated by 24-hour electrocardiography based on the Holter’s method. There were 50 patients (mean age 29.0 years) examined who were treated with megachemotherapy based on BuCy2, BuCy4 (busulphan and cyclophosphamide), BEAM (carmustine, etoposide, cytarabine, melphalan) and dexamBEAM (dexam-dexamethason) programs before BMT. No heart conduction defects occurred. The mean heart rate increased after BMT. Tachycardia (>100/min) was observed in 92.5–98.1% of patients and bradycardia (<60/min) in 41.6–68.0% patients. In 6% of patients bradycardia below 40/min occurred. The heart rate was increased in patients who previously used anthracycline antibiotics, had anaemia or fever, and in patients after autologous BMT (p < 0.05). The complex ventricular extrasystoles were detected in 20% of patients before megachemotherapy. They were more frequently observed in patients with hypokalemia (p < 0.05). After therapy these extrasystoles were observed in a total of 24% patients. There was a statistically significant correlation between this kind of extrasystole and age. The extrasystoles developed mainly in young men. In 10% they occurred de novo and also mainly in men. The heart failure (III°, IV° according to NYHA) occurred in 14% of patients and death caused by heart (or multiorgan) damage in 18%. Older patients and those who had higher mean heart rate during the first month after BMT were dying more frequently (p < 0.05).

Key words: Ambulatory electrocardiography; arrhythmias; bone marrow transplantation; cardiotoxicity.

INTRODUCTION

Bone marrow transplantation (BMT) is an effective treatment for many hematologic malignancies and disorders of hematopoiesis or immunity. This kind of
therapy is associated with many toxicities occurring in the early or post-transplant periods. Serious pulmonary, gastrointestinal, infectious, immunological and also cardiological complications appear among the patients. Many authors do not consider involvement of the heart to be an important post-transplant problem [1, 2] but some of them support the concept that effects on the heart are an important source of morbidity and mortality following BMT [3].

There are several mechanisms by which BMT could be harmful to the heart. First, the conditioning therapy; next, total body irradiation or irradiation of the chest which could add to the effects of chemotherapy; and further, septic infections, previously received anthracycline antibiotics, anaemia, electrolytic and disturbances in blood gases could all be contributive. The above described clinical abnormalities after BMT range over a wide spectrum of cardiac pathology, cardiomyopathy, ischaemia and arrhythmia. The arrhythmias include ventricular and supraventricular extrasystoles, paroxysmal atrial fibrillation, supraventricular tachycardia and QT prolongation with ventricular tachyarrhythmias [2].

The frequency of the arrhythmias was established on the basis of standard electrocardiography. To our knowledge, until now nobody has used regular ambulatory electrocardiography or long-term monitoring in investigation of this problem.

The aim of the study was evaluation of the frequency of conduction defects and cardiac arrhythmias before and one month after megachemotherapy and bone marrow transplantation using ambulatory electrocardiography.

MATERIALS AND METHODS

Fifty adult patients who underwent BMT between 1992 and 1996 at the Department of Hematology, Karol Marcinkowski University of Medical Sciences in Poznań, Poland were investigated (Table 1). There were 30 men and 20 women aged 13–56 years (mean age 29.0 years). The underlying diseases were as follows: chronic myelocytic leukemia (CML), 17 cases; acute myelocytic leukemia (AML), 15 cases; Hodgkin’s disease (HD), 10 cases; non-Hodgkin lymphoma (NHL), 5 cases; myeloma multiplex (MM), 2 cases; and myelodysplastic syndrome (MDS), 1 case.

The conditioning regimens preceding the transplantation were BuCy2 (in three cases with etoposide and in two with melphalan), 20 patients; BuCy4, 16 patients; BEAM, 9 patients; and dexamBEAM, 5 patients (Table 2). There were 28 autologous and 22 allogeneic transplantations. All patients before megachemotherapy and bone marrow transplantation were in very good clinical condition (according to Karnovsky’s scale 90–100%), with efficient circulation, ejection fraction (echocardiographic evaluation) over 50%.

The 24-hour electrocardiography based on Holter’s method was made before and after chemotherapy (before bone marrow transplantation) and then, once a week,