
Introduction
Cartilagenous and osseous metaplasia in the heart is known to result rarely in human myocardial infarction and to be induced experimentally by allylamine treatment in rats. However, no detailed study has been reported on cartilagenous and osseous metaplasia in rat myocardial infarction.

In this study, we have constantly found cartilagenous and osseous metaplasia in the heart of spontaneous hypertensive rat (SHR) with experimentally induced myocardial infarction. In addition, we investigated these metaplastic changes histopathologically.

Materials and methods
Fifteen male SHR aged 32 weeks were used. Under ether anesthesia, a left sided thoracotomy was performed and the left coronary artery was ligated. The oral administration of 0.5% carboxymethylcellulose gel 2ml/kg/day was continued for 4 weeks. At the end of the administration period, the heart was excised and the right ventricle was incised. A catheter was inserted into the left ventricular cavity in retrograde fashion through the aorta and the atrioventricular groove was ligated. The left ventricle was fixed with 10% neutral buffered formalin at the constant pressure of 5mmHg. After fixation, the left ventricle was separated from the atrium and the right ventricle, and routinely embedded in paraffin. Five to seven serial sections of intervals of every 2mm were cut from apex to base. The sections were stained with H.E., Toluidine blue and Dahl's method for calcium, and examined microscopically.

Results
Cartilagenous and osseous metaplasia was found in all the hearts with infarction, and located in both papillary muscle and subendocardium. The incidences of these metaplastic changes were 87% at 2mm distant from the apex; 100% at 4mm; 100% at 6mm; 47% at 8mm; 13% at 10mm; 0% at more than 12mm. Histologically, cartilagenous tissue consisted of cartilage cells with lacuna and matrix, which indicated metachromasia by Toluidine blue stain, and partially calcified. Osseous tissue was composed of osteocytes and eosinophilic, calcium-positive matrix. Generally, cartilage and osseous tissues were adjacent to each other. Nevertheless, we also observed some preparations suggesting the transformation of cartilage into bone.

Discussion
The previous studies have showed that cartilage and bone are formed from undifferentiated mesenchymal cells due to the interaction with some chemical mediators and a compressive stress in a differential process. The increased pressure load of hypertension on the heart is considered to exist in SHR. Consequently, it would appear that the pressure load is contributed to these metaplastic changes in our examination.

Conclusion
Cartilagenous and osseous metaplasia were observed in the area of experimentally induced myocardial infarction in SHR. These metaplasia were located in papillary muscle and subendocardium in the vicinity of the apex.