Muscle Bundles of Myocardium in Dextrocardia of Thai

Yoshiyuki Tohno[1*], Pasuk Mahakkanukrauh[2], Setsuko Tohno[1], Nutcharin Ongkana[2], Cho Azuma[1], Yumi Moriwake[1] and Pidhyasak Vaidhayakarn[2]

[1] *Laboratory of Cell Biology, Department of Anatomy, Nara Medical University School of Medicine, Kashihara, Nara 634–8521, Japan*

[2] *Department of Anatomy, Faculty of Medicine, Chiang Mai University, Chiang Mai 50200, Thailand*

**Corresponding author. E-mail: ytohno@naramed-u.ac.jp*

ABSTRACT

Dextrocardia was found in a 43-year-old Thai man. We examined the myocardial architecture in the transposed heart and observed that the superficial muscle fibers ran spirally from base to apex in a clockwise direction, being similar to that of a normal heart. In contrast, the middle muscle fibers of the ventricles presented the mirror image of the normal. The results revealed that the superficial muscle fibers of the ventricles in the transposed heart were not a mirror image of the normal and their direction was the same as that of the normal.

Key words: Dextrocardia, Heart, Myocardium

INTRODUCTION

Situs inversus is extremely rare in human. It is generally thought that the incidence of this anomaly is probable one per five to six thousand individuals (Blegen, 1948). In Thai, only one case of situs inversus was reported in an eight-year-old boy (Vichyanond et al., 1993). The authors (Tohno et al., 1983) previously found one case of situs inversus viscerum totalis observed in a 95-year-old woman in the ordinary dissection at Nara Medical University. we (Tohno et al., 1989) examined the myocardial architecture in the transposed heart and observed that the superficial muscle fibers of the transposed heart ran spirally from base to apex in a clockwise direction. Their direction was the same as that of a normal heart. In the study of the four cardiac valves, one case of dextrocardia was found accidentally in Thai hearts. In this paper, we describe dissected results of the transposed heart.

FINDINGS

One case of dextrocardia was found in a 43-year-old Thai man (cadaver No.: 41/47) at Chiang Mai University, who died of hepatoma. The anatomical records except for the heart were absent unfortunately.

(1) Cardiac Chambers

The transposed heart possessed all of four chambers. The superior and inferior venae cavae and the coronary sinus opened into the atrium situated on the left, which had all of the morphological characteristic of a right atrium. In the atrial septum, there was a well-formed fossa ovalis (17 x 4 mm). The tricuspid valve was present in the left atrioventricular ostium. The wall of the left ventricle was only 3–4 mm thick (Fig. 1A). In the right atrioventricular

ostium, the mitral valve was present. The wall of the right ventricle was 16–17 mm thick (Fig. 1B), being four times thicker than that of the left ventricle. Both the aortic and pulmonary valves had a semilunar valve with three pockets at its origin.

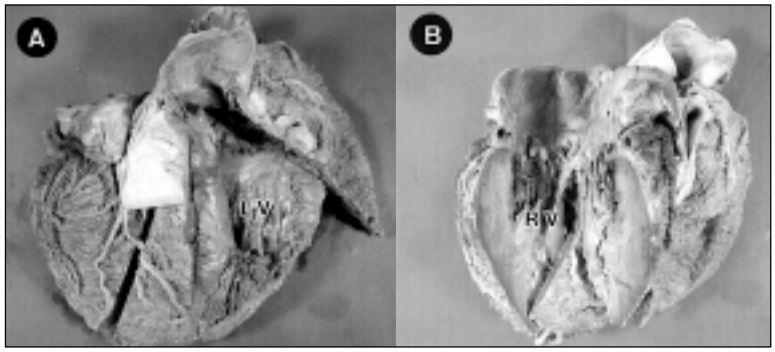

Figure 1. Anterior views of the left (A) and right (B) ventricles. LV and RV indicate the left and right ventricles, respectively.

(2) Coronary Artery

The left and right coronary arteries arose typically from the aortic sinus (Fig. 2). The right coronary artery divided into the anterior interventricular and circumflex rami (Fig. 3A). The anterior interventricular ramus ran through the anterior interventricular sulcus and the circumflex ramus ran through the right coronary sulcus. The left coronary artery ran through the left coronary sulcus and thereafter ran through the posterior interventricular sulcus (Fig 4A). The coronary arteries formed a mirror picture of the normal pattern.

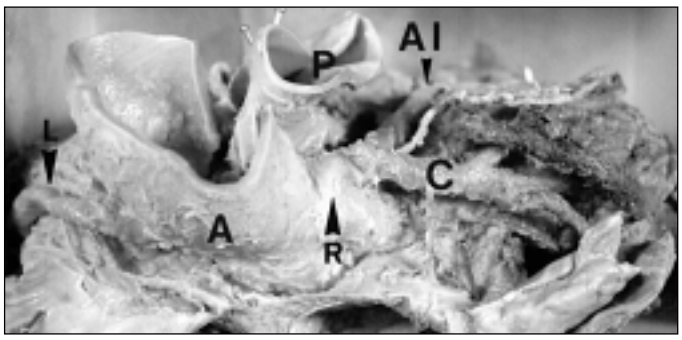

Figure 2. Superior view of the transposed heart. A = ascending aorta; AI = anterior interventricular ramus; C = circumflex ramus; L = left coronary artery; P = pulmonary trunk; and R = right coronary artery.

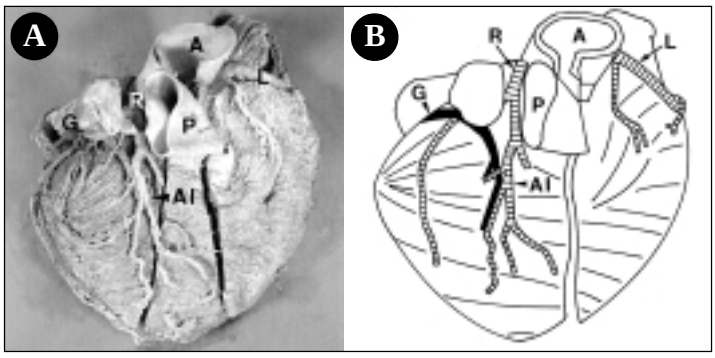

Figure 3. Anterior view of the transposed heart (A) and the tracing (B). A = ascending aorta; AI = anterior interventricular ramus; G = great cardiac vein; L = left coronary artery; P = pulmonary trunk; and R = right coronary artery.

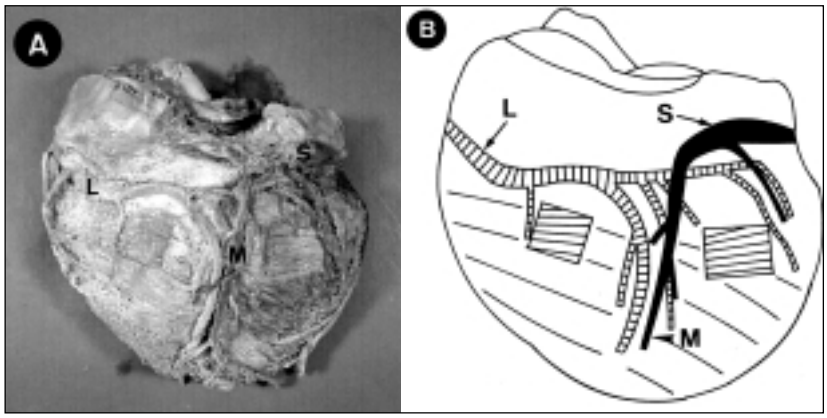

Figure 4. Posterior view of the transposed heart (A) and the tracing (B). L indicates the left coronary artery. S and M indicate the coronary sinus and the middle cardiac vein, respectively. The rectangles indicate the middle muscle layers of myocardium in the ventricles.

(3) Myocardium

The myocardium of the left and right ventricles was composed of the superficial, middle and deep muscle layers. The superficifal muscle fibers of the ventricles ran clockwise from base to apex toward the center of the vortex, which had a striking resemblance to the normal rather than the mirror image pattern (Figs. 3 and 5). The superficial muscle bundles of the ventricles were not a mirror image of the normal. The middle muscle fibers of the ventricles ran perpendicularly to the interventricular sulcus (Fig. 4). The middle muscle fibers of the ventricles presented the mirror image of the normal. The deep muscle fibers of the ventricles ran longitudinally.

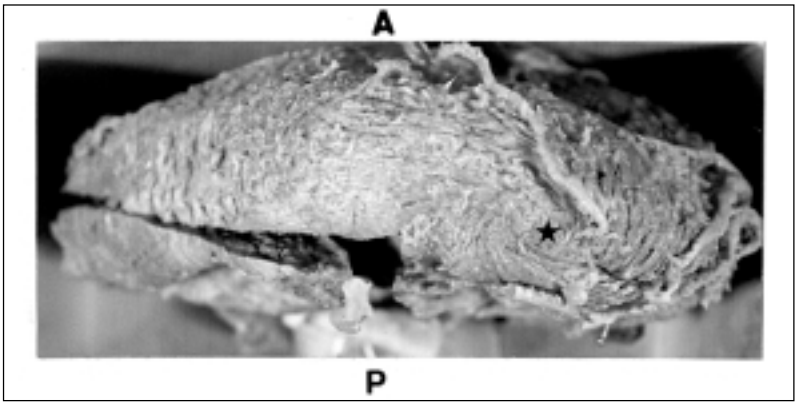

Figure 5. Inferior view of the apex. A and P indicate anterior and posterior views, respectively. Asterisk indicates the center of the cardiac vortex.

DISCUSSION

Vichyanond et al., (1993) reported one clinical case of situs inversus in an eight-year-old Thai boy. To our knowledge, this case of dextrocardia was the first case that was found in the dissection room of Thailand and was reported.

Taussig (1926) found two cases of complete situs inversus of the heart and reported that the main anatomical structure and the deep muscle bundles of the ventricles presented the mirror image of the normal, whereas the direction of the superficial muscle bundles remained unchanged. To elucidate whether the finding was always true, Asami and Koizumi

(1989) examined the myocardial architecture of five specimens of situs inversus viscerum totalis. Every part of the heart and great vessels presented exact mirror images of the normal. however, the superficial muscle fibers of the ventricles ran clockwise from base to apex toward the center of the vortex, which had a striking resemblance to the normal rather than the mirror image pattern. The same finding was also obtained in this case of dextrocardia. Matsumura et al., (1987), Kitamura et al., (1988), and Tohno et al., (1989) reported the same finding in the heart of situs inversus totalis. Up to the present, there is no case that the superficial muscle fibers of the transposed heart ran counterclockwise from base to apex.

It is uncertain why the superficial muscle fibers of the ventricles remain unchanged in the transposed heart.

REFERENCES

Asami, I., and K. Koizumi. 1989. The vortex cordis is never reversely directed, even in situs inversus and L-loop anomaly. Acta Anat. Nippon. 64: 36–45.

Blegen, H. M. 1948. Surgery in situs inversus. Ann. Surg. 129: 244–259.

Kitamura, S., A. Sakai, Y. Nakajima, M. Urano, Y. Tsukamoto, M. Marugami, and E. Kusumoto. 1988. A case of situs inversus totalis associated with the replaced common hepatic artery arising from the superior mesenteric artery. Acta Anat. Nippon. 63: 547–552.

Matsumura, H., Y. Aizawa, and K. Kumaki. 1987. Two cases of situs inversus viscerum totalis. Acta Anat. Nippon. 62: 202.

Tohno, Y., S. Tohno, H. Matsumoto, K. Nishimoto, Y. Noda, J. Nomura, K. Hashizume, M. Hayashi, and K. Ban. 1983. Case of situs inversus viscerum totalis observed in a 95-year-old female. Acta Anat. Nippon. 58: 606–613.

Tohno, Y., S. Tohno, and H. Matsumoto. 1989. Muscle bundles of myocardium in situs inversus viscerum totalis. J. Nara Med. Assoc. 40: 129–131.

Vichyanond, P., K. Thakerngpol, C. Susiva, and B. Chavalittamrong. 1993. Ultrastructural defects of the ciliary epithelium in a child with Kartagener's syndrome. Asian Pac. J. Allergy Immunol. 11: 103–109.