Binucleate Neurons in the Human Foetal Heart

Although many early authors have described binucleate nerve cells in the human heart (Kasem-Beck[1], Lissauer[2], Michailow[3]) more recently doubt has been cast on the authenticity of these cells. King and Coakley[4] claimed that the appearance of a binucleate cell may be produced by the superimposition of 2 discrete cells or their very close contact. They noted that it was rare to find 2 nucleoli. Rintoul[5] using a silver technique found that parasympathetic effector cells characterized by a dark nucleus surrounded by pale cytoplasm occasionally appeared to be binucleate due to the presence of a dark ovoid opacity lying in the cytoplasm which did not possess a nuclear membrane and did not contain a nucleolus; he observed that this intracellular opacity did not appear in such cells after staining with methylene blue.

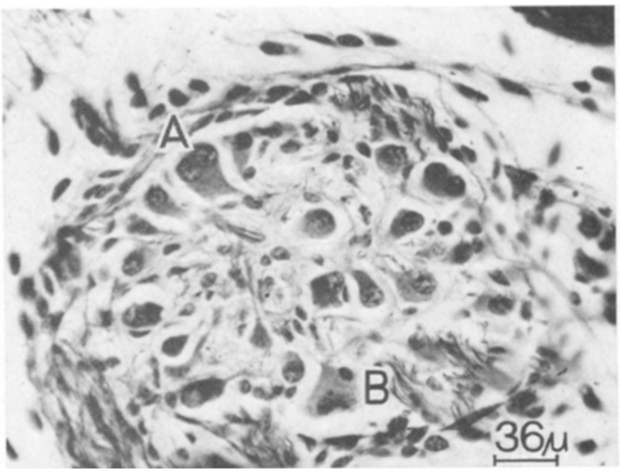

Fig. 1. 120 mm human foetal heart. Ganglion, containing 2 binucleate cells (A and B), lying in the epicardial tissues of the postero-superior wall of the left atrium. Paraffin section. Samuel's silver stain.

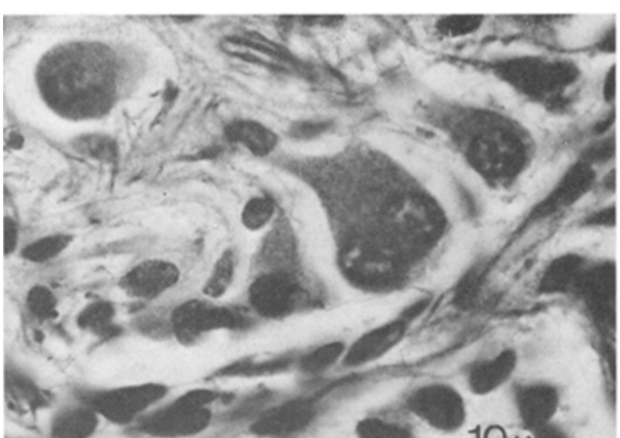

Fig. 2. High-power view of Figure 1 (A) showing the reticular nuclei lying in close apposition.

Binucleate cells have been detected in the hearts from a series of human foetuses ranging in age from 12 weeks (50 mm crown-rump length) until term after both routine haematoxylin and eosin and silver staining (Samuel[6]) methods. At the 55 mm stage of development binucleate cells are occasionally present in the fusiform ganglia lying in the adventitia of both the aorta and pulmonary artery. Slightly later (65 mm) they are found in ganglia situated close to the superior atrial walls and, still later (120 mm) they are present in about $^2/_3$ of the intrinsic cardiac ganglia. By this stage (120 mm) most ganglia contain at least 1 of these forms while a few contain 3 or more (Figure 1). Although a considerable variation in size has been observed, most of the cells are large (65×55 µ) and irregularly shaped. They contain 2 well-defined reticular nuclei surrounded by granular cytoplasm. A number of cells have been identified in which each nucleus contains a well-developed nucleolus. Often the nuclei are close together (Figure 1, A; Figure 2) and may be so close that they appear to be a single mass of chromatin (Figure 1, B). However, other cells are elongated with the nuclei situated at opposite poles of the cell. The frequency of occurrence of binucleate cells reaches a peak at the 120 mm stage and then declines so that, at term, only a few of these cells can be identified in the atrial ganglia.

Binucleate cells make their appearance at a stage in the development of the innervation of the heart when the immature neuroblasts seen in the early stages are becoming fewer in number and when their migration along nerve bundles passing from the cardiac plexus has almost ceased. On this basis binucleate nerve cells may represent a stage in a mechanism to increase the number of ganglion cells in the heart, by a process of active division, at a time when migration of neuroblasts into the heart has virtually ceased.

Zusammenfassung. Mit Hilfe gewöhnlicher Färbungen wie auch mit Versilberungen hat man in Herzen menschlicher Fetusse von 50 mm SSL bis zur Geburtsreife zweikernige Zellen entdecken können. Am meisten finden sich bei Fetussen von 120 mm SSL, das heisst wenn die Migration der Nervenzellen ins Herz fast beendet ist; dieser Tatsache liegt vielleicht ein Mechanismus zugrunde, der durch einen aktiven Spaltungsprozess die Zahl der im Herzen enthaltenen Nervenzellen vermehren soll.

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