

Follow-up of previous report

Vertebral ontogenesis

Resegmentation refuted

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Eight years ago we supported Remak's (1855) theory of resegmentation (Tanaka and Uthoff 1981). We can no longer agree with this theory following further review of the subject.

Remak's observations were based on transillumination of entire chick embryos done from side to side and not done from front to back. This prevented him from observing the progression of sclerotomes (loose and dense areas) from the lateral sides toward the middle. It is this succession of loose and dense celled areas which leaves the impression of segmentation. The nerve root and its ganglion lie behind the upper part of the primitive vertebra (Ürwirbel of Remak) and the vertebral arch behind the lower part, and the artery between the dense celled area cranially and the loose-celled area caudally. The reverse is true for the definitive vertebra (Sekundärer Wirbelkörper of Remak) in respect to the nerve root and its ganglion and the vertebral arch. Moreover, the artery lies in the middle of the loose-celled area.

It is evident that the progression of loose- and dense-celled areas toward the midline can only be assessed in serial sagittal sections. This was done in a five-week-old human embryo (8 mm crown-rump length, stage 15) in which the presence of primitive vertebrae can be observed on either side of the midline. This review led to our change in opinion. The sections show a gradual change in position of the intervertebral artery, a fact which can be

appreciated in the illustrations of our above-mentioned paper. In laterally situated sections where the primitive vertebra is located, the artery lies between the dense-celled area cranially and the loose-celled area caudally. Sections closer to the midline where the beginning of the definitive vertebra appears show that the artery lies in the middle of the loose-celled area. At this stage the progression of segmentation has not reached the midline. Therefore the distribution of cells at this level is still uniform. At six weeks when the progression of loose- and dense-celled areas has reached the midline, the definitive vertebrae are fully formed.

The primitive vertebrae described by Remak correspond to the sclerotomes lateral to the midline of the embryo. Thus we must conclude that the definitive vertebrae are not found at the same site as the primitive vertebrae. Consequently we prefer to speak of primitive segments instead of primitive vertebrae. In the course of the medial progression of the loose- and dense-celled areas the definitive vertebrae will be formed in their final position and shape as already observed by Verbout (1972).

References

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