

Notes

Position of the cecum in the extraembryonic and abdominal coelom in the early fetal period

Nagata

Short title: Position of the cecum in the Fetus

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The intestine starts to herniate into the extraembryonic coelom at the Carnegie stage 16^{1,2}, and subsequently returns to the abdominal coelom during the early fetal period. The process of herniation has been well described in previous studies; however, the process by which the intestinal loop returns to the abdomen is still not adequately described¹⁻³. In our recent study, intestinal movements during the intestinal return process were recorded and measured using three-dimensional fetal images obtained with magnetic resonance (MR) microscopy⁴. Data concerning the timing and speed of return were provided in that study. Thus, the position of the cecum before and after return has been described in the present notes.

We selected 22 samples from the Kyoto collection, including samples from the herniation phase (n = 5; crown-rump length [CRL], 22–32 mm), transition phase (with the intestine in the process of returning to the abdominal coelom; n = 3; CRLs, 37, 41, and 43 mm), and phase after complete return (n = 14; CRL, 44–69 mm). MR images were acquired using a 7-T MR system (BioSpec 70/20 USR; Bruker Biospin MRI GmbH, Ettlingen, Germany). Orthogonal three-dimensional coordinates were used to show the position of the cecum and several anatomical landmarks. Lines passing through the landmarks on the ventral cranial site at the eighth thoracic (Th8) and fifth lumbar vertebrae were defined as the X-axis, whereas Th8 was defined as the origin (Fig. 1). The precise methodology was described previously⁴.

The cecum was located on the left side of the extraembryonic coelom in all herniation phase samples, as expected from the position of the first loop of the midgut (Fig. 1A), which is consistent with the results of our previous study¹. The cecum was located in the right caudal portions of the abdominal coelom in the samples from the phase after complete return. The height of the cecum in the x-y plane was 6.5 mm at the maximum in the 32-mm CRL samples, with the highest CRL in the herniation phase (Fig. 1B). The height decreased linearly in samples from the transition phase and phase after complete return.

Our data quantitatively indicate for the first time that the cecum immediately reaches its final position in the right lower quadrant of the abdomen (the adult position), which corroborates the data from recent studies^{2,3,5}. The cecum is still

believed to migrate from the upper to the lower abdomen (so-called descent and fixation of the cecum during the fetal period)^{6,7}, and such description can be found occasionally even in the latest literature.

References

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Figure legend

Figure 1. Position of the cecum in the abdominal coelom

A) Position of the cecum in the abdominal coelom in the ventral view (x–y plane). The cecum in the extraembryonic (red) and abdominal coelom (blue) is shown. Data from the samples in the transition phase are indicated with an asterisk.

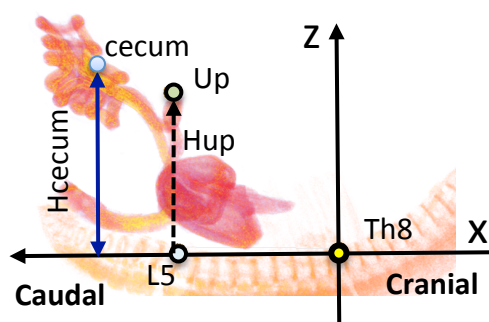
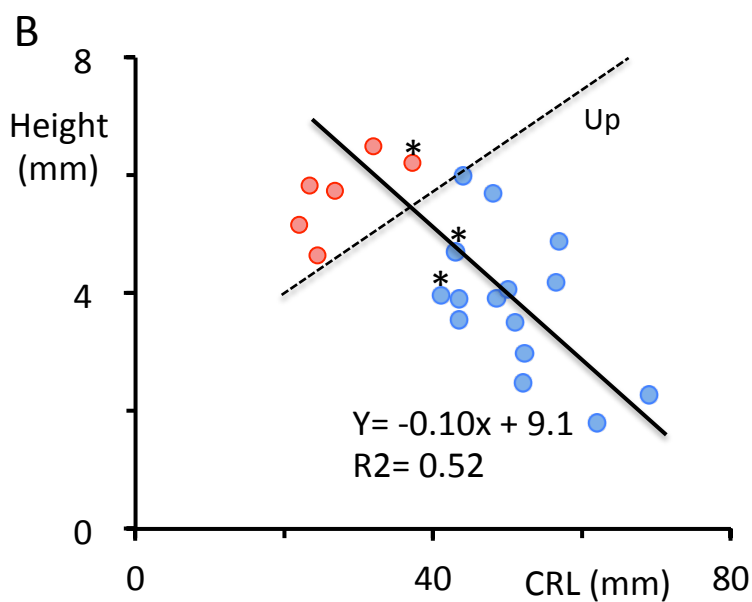
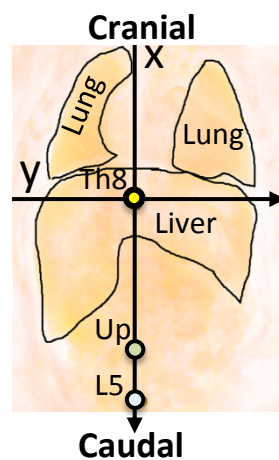
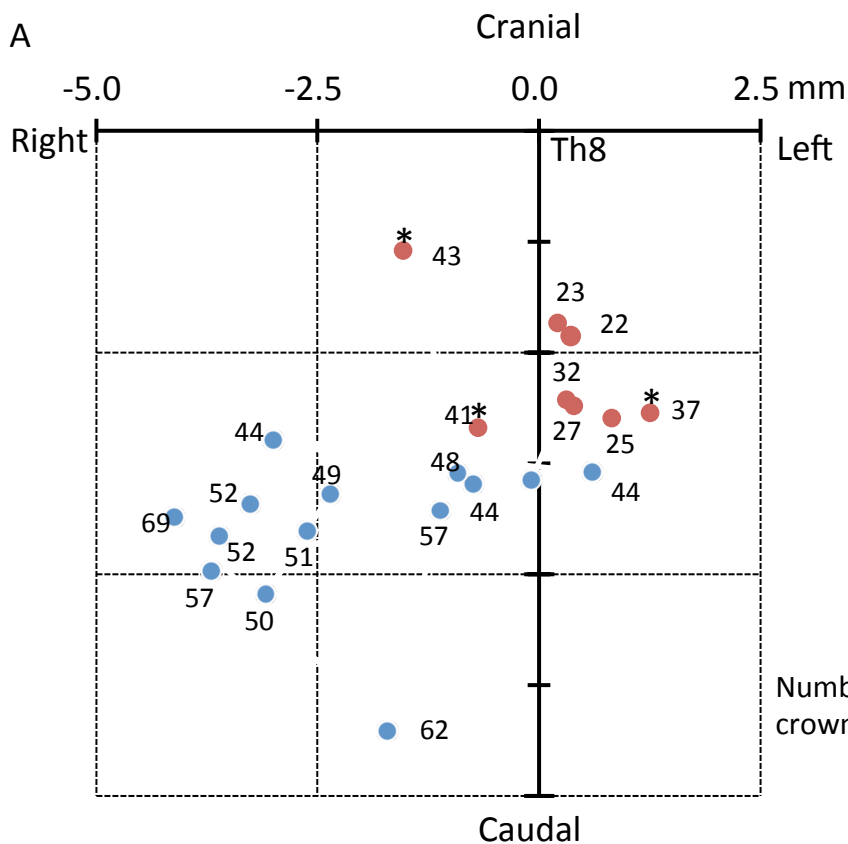
The orthogonal coordinates used in the present study. Ventral view indicating the x- and y-axes and the origin (Th8).

B) Height of the cecum in the x–y plane

The cecum is located in the extraembryonic coelom (red) and abdomen (blue).

Data from the samples in the transition phase are indicated with an asterisk.

The dotted line indicates the regression line of Height of Up according to the crown-rump length, where Up was defined as the cranial site of the umbilical ring in the mid-sagittal plane.



L5: 5th lumbar vertebra
 Th8: 8th thoracic vertebra
 Up: the cranial site of the umbilical ring in the mid-sagittal plane
 Hcecum: the height of the cecum in the x-y plane