数字化单心室胎儿人体结构数据集采集与心脏三维重建

Dataset collection for visible fetus with single ventricle and digital three dimensional reconstruction of the heart

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中文摘要：

　　目的　建立数字化单心室胎儿人体结构数据集,以及单心室合并主动脉缩窄的数字化三维心脏模型。　方法　选择经产前超声确诊后于妊娠35周引产、引产后经MR和64排CT扫描证实患有心脏复杂畸形的女性胎儿尸体标本1具,体质量2650 g,在-25℃低温实验室中从头至足逐层连续性铣切,同时用高清晰度数码相机摄影,得到胎儿人体结构数据集。采用半自动分割软件和Photoshop软件对心脏及心底部大血管进行图像分割与三维重建。　结果　CT扫描层厚0.625 mm。MR扫描层厚3.0 mm。连续解剖横断面层厚0.2 mm,全身共1495个断面。数字化摄影分辨力为10 989 056 pixels(4064×2704)像素,每个断面图像文件大小为31.4 MB,整个解剖切片数据集大小为46.943 GB。重建的心脏模型可以局部或整体多角度显示,与CT重建图像高度一致。　结论　所得数字化单心室胎儿人体结构数据集为整个标本的连续断面,无节段性数据缺损,且伴有复杂心脏畸形,对心脏外科及临床医学影像学教学均具有重要意义。

英文摘要：

　　Objective To build the dataset of visible fetus with single ventricle (SV) and aortic coarctation (CoA), and to rebuild a 3D digitized heart model. **Methods** After undergoing macroscopical, CT and MR examinations, a cadaver of 35- week female fetus with SV and CoA which weighted 2650 g was selected. A digital milling machine was used to shave off slices of the cadaver layer by layer from head to foot in a laboratory at -25℃. The successive cross-sections were photographed with a high-definition digital camera to obtain the structural dataset of the cadaver. Semi-automated segmentation and Photoshop software were selected to segment the heart and great vessels of base of the heart. The segmented structures were reconstructed in 3D. **Results** CT scans were made in every 0.625 mm, and MRI with 3.0 mm slice thickness for the body. For serial cross-sections, the thickness was 0.2 mm. Thus, a total of 1495 slices were obtained, and the photo for every slice was saved as a 31.4 MB file in a resolution of 10989056 pixels (4064×2704). Finally, the complete data files reached to 46.943 GB. A 3D reconstruction and stereo display of the heart with SV and CoA were established. The reconstructed structures could be displayed singly, in small groups or as a whole and continuously rotated in 3D space at different velocities. **Conclusion** This study provides an accurate successive dataset for the automated segmentation algorithmic study of fetal development and anatomical structure for making plans of heart surgical and clinical image medical teaching about complicated congenital heart diseases.

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