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Title (type in CAPITAL LETTERS): **DYNAMIC 3D-IMAGING OF THE PELVIC FLOOR USING ELECTRON BEAM COMPUTERIZED TOMOGRAPHY**

Aims of Study

To freeze anatomical motion imaging methods with a very short exposure time are required. Electron beam(ultrafast) computerized tomography (EBCT) is to date one of the fastest modalities to provide sectional images. The aim of the study was to apply this technique to the evaluation of the whole female pelvis at rest and during movement (straining) and to try to create two- and three dimensional moving reconstructions of the female pelvic floor.

Methods

12 women (3 with normal pelvic floor and 9 with genital prolapse of different grades) were examined with an Imatron C-150 XP Ultrafast CT Scanner (software version 12.34). The bladder was filled with 150 ml contrast solution and the vagina was marked with a contrast soaked stripe. Rectal contrast filling was done only in one case. Patients were examined in the continuous volume scanning mode (CVS) in relaxation and during straining (3 mm slice thickness and 2 mm table feed; scan time 100 ms) to obtain static images. Dynamic images of the pelvic floor and adjacent organs were obtained in the multislice flow mode (50ms exposure time) while the patients were asked to strain. The data of these studies were transferred to an external high performance workstation (Silicon Graphics Onyx i-Station, Infinite Reality graphics board, modified VolRen volume renderer,John Hopkins Hospital, Baltimore) which allows 3D-display with real time interaction. The static 3 mm CVS studies acquired in relaxation and during straining were rendered in different display modes. For dynamic imaging two detector arrays and 4 x-ray source positions allowed scanning of 8 anatomical levels without moving the patient table. One volume scan, which consisted of 2 double slices with 14 mm separated by 4 mm gaps took 224 ms. This was repeated 20 times, creating 20 data sets. These multislice flow mode image series consisting of 20 data volumes with 8 slices from each 224 ms scan interval were automatically assorted by a program developed by one of the authors. By interpolating the entire data volume to 2 mm slice spacing and subsequent volume rendering a set of twenty 3D images for a 3D movie with a time resolution of 232 ms was created.

Results

In all examinations static and dynamic two- and three-dimensional reconstructions of the pelvic floor were possible. A 3D-movie with a time resolution of 232 ms over a range of 7.6 cm in the z-axis was created. The anatomy of the striated pelvic floor musculature and the adjacent organs were well demonstrated on the axial slices. During valsalva manoeuver a marked lateral motion of the two portions of the levator plate as well as a caudal displacement of the pelvic organs could be seen. The static reconstruction resulted in high quality pictures, wheres the overlapping dynamic images had a slightly worse resolution.

Conclusions

Electron beam computerized tomography allows the examination of the whole pelvic organs during movements. In addition to the clinically easy to study finding of downward displacement of the pelvic organs this method could demonstrate a side-movement of the levator plate thus enlarging the hiatus of the pelvic floor. EBCT can also provide a high quality static threedimensionl reconstruction of the whole pelvic floor with a short exposure time, thus enabling to study the pelvis during valsalva . Although MRI images of the pelvic floor soft tissue are superior to CT images, the short exposure time and near real time data acquisition of EBCT allows a better insight of general movements within the pelvis during increasing intraabdominal pressure.