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A model patient:

Female pelvic anatomy can be viewed in diverse 3-dimensional images with a new interactive tool

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Case notes

We developed, in portable document format (PDF), a detailed 3-dimensional (3D) interactive anatomic model of 23 pelvic structures that include the muscles, ligaments, and fascia of the pelvic floor and the organs it supports. Bones, blood vessels, and the perineum are illustrated as well. To produce this tool, 3D volumetric models were created from serial 5-mm-thick images that were obtained with a 3-Tesla magnetic resonance scanner. The subject was a healthy, 45-year-old, multiparous woman who was at the 50th percentile for height. Magnetic resonance images were then imported into 3D Slicer software (version 3.4.1; Brigham and Women's Hospital, Boston, MA). Each structure was traced with the use of the most clearly visible axial and/or coronal plane images and lofted into a 3D virtual model that was based on our previous anatomic work.¹⁻⁵ Models were validated against the original scans and tracings.

Next, the 3D models that had been generated by 3D Slicer were imported into Adobe 3D Reviewer (version 9.0; Adobe Systems Inc, San Jose, CA), exported as a universal 3D file, and, with the aid of the program's 3D tool, inserted into Adobe Acrobat 9 Pro (Adobe Systems Inc) and saved as a PDF file.

Conclusion

The 3D PDF file allows the user to view and manipulate detailed 3D models of pelvic anatomy without any specialized visualization software. For example, the model can be rotated and magnified; and structures can be hidden or rendered transparent, which makes it easier to understand complex anatomic relationships (Figures 1 and 2; an interactive model is available online at www.AJOG.org). All that is needed is the readily available (and free) Adobe Reader; cross-section capability is available with Adobe Acrobat. Availability of this

anatomically accurate model is critical to avoiding errors in comprehension that can arise from conceptually based anatomic representations.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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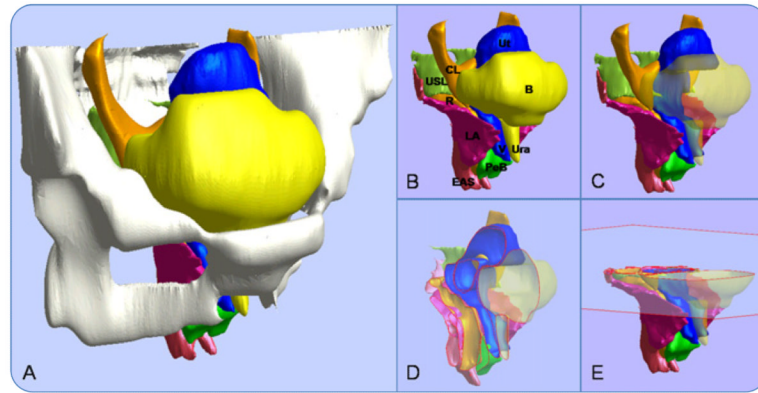


FIGURE 1.

The user can manipulate the 3-dimensional model of pelvic structures. **A**, A three-quarter right anterolateral view. **B**, Hiding the bones reveals selected features. **C**, Making the bladder and urethra transparent reveals the underlying structures. **D**, Sample sagittal cross-section of the remaining structures. **E**, Sample axial cross-section.

B, bladder; *CL*, cardinal ligament; *EAS*, external anal sphincter; *LA*, levator ani; *PeB*, perineal body; *R*, rectum; *Ura*, urethra; *USL*, uterosacral ligament; *Ut*, uterus; *V*, vagina. Luo. A model patient: female pelvic anatomy viewed in diverse 3-dimensional images. *Am J Obstet Gynecol* 2011.

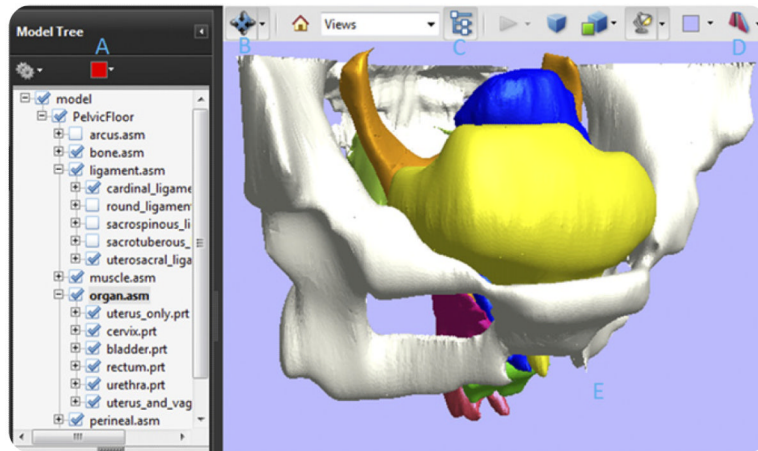


FIGURE 2.

The manipulation interface includes a model tree and toolbar. **A**, The model tree allows users to hide, isolate, or render transparent individual anatomic structures by right clicking on the label. **B**, Using this button in the 3-dimensional toolbar at the top, it is possible to zoom in or out, rotate the model, spin it, and pan over it. **C**, The model tree can be toggled on and off with this button. **D**, Cross-sections can be cut at a given location and orientation. **E**, The 3-dimensional model is activated by clicking on the portable document format file. Luo. A model patient: female pelvic anatomy viewed in diverse 3-dimensional images. *Am J Obstet Gynecol* 2011.