Introduction: Incontinence and pelvic prolapse, two of the most common urogynecologic conditions affecting women, are attributed to various functional and anatomic abnormalities of the bladder, urethra, and pelvic organs. Currently available methods of evaluation for these conditions include physical exam, bead-chain cystography, vaginography, ultrasound, and video urodynamics. Compared to these methods, MRI can offer superior, multi-compartment soft-tissue detail without radiation exposure or invasive patient preparation. Yang, et al, reported dynamic MRI evaluation of pelvic floor descent in patients who were imaged at rest and while straining in the supine position. Fielding, et al, observed changes that occurred in the resting pelvic floor anatomy of normal volunteers when imaged in supine and sitting positions within an open MRI environment. In our work, we performed dynamic evaluation of pelvic floor anatomy in asymptomatic female volunteers in supine, lithotomy, and sitting positions with simultaneous manometry in an open-configuration MRI.

Methods: Ten normal female volunteers participated in the study. The subject age ranged from 25 to 48. All denied symptoms of incontinence or prolapse and prior pelvic surgery. The subjects were imaged in an open .5 T open MR scanner (Signa-SP, GE Medical Systems, Milwaukee, WI) with real-time pelvic manometry. The pelvic manometer was constructed using a saline-filled sterile condom wrapped around a 12F Robinson catheter (Sherwood Medical, St. Louis, MO) which was attached to a central venous pressure monitor. The subjects voided within a half-hour prior to starting the study and self-inserted the manometer intravaginally prior to entering the MR scanner. The volunteers were imaged in the supine, lithotomy, and sitting positions. A body flex coil was wrapped around the pelvis when imaging in the supine and lithotomy positions. A loop coil was placed under the patient when imaging in the sitting position. In each of the three positions, the patients were imaged at rest and while straining. The degree of straining was standardized to 30ml rise in water manometric pressure from baseline. For each set of imaging, sagittal localizer was followed by a midline sagittal T2-weighted Fast Spin Echo scan (TR 3000; TE 104; 36x36 FOV; 256x128 matrix; 1 NEX; 9mm skip 1mm; 30 seconds) demonstrating the bladder, urethra, symphysis, vagina, cervix, and rectum. Using the sagittal images, the following parameters were measured: distance between the symphysis and anterior urethra, distance between symphysis and posterior urethra, posterior urethral angle, and the distances from the bladder neck and cervix to the pubococcygeal line.

Results: Image quality was adequate to demonstrate the pelvic floor anatomy in all cases [Figure 1a - 1f]. Pelvic floor anatomic measurements are shown in Figure 2.

Conclusions: Images of the pelvic floor may be obtained in supine, lithotomy, and sitting positions during rest and straining in an open MR environment. Significant variations in pelvic floor anatomy were observed among asymptomatic volunteers. It is hoped that collection of dynamic, multi-positional pelvimetric measurements in asymptomatic volunteers will establish a baseline for evaluation of patients with stress incontinence and pelvic prolapse.

References:

Figure 1: Sagittal T2-weighted FSE images in the pelvis. (A) supine at rest; (B) supine while straining; (C) lithotomy at rest; (D) lithotomy while straining; (E) sitting at rest; (F) sitting while straining.

Figure 2: Pelvic floor measurements in asymptomatic women.