695

Doumouchtsis S K[1], Nazarian D[1], Gauthaman N[1], Munneke G[1]
1. *St Georges Hospital NHS Trust*

3D VOLUME RENDERING OF MRI SCANNING OF VAGINAL AND PARAURETHRAL LESIONS.

Hypothesis / aims of study

Vaginal and paraurethral lesions are often non-specific and only 50 to 60% are diagnosed by physical examination (1). Confirmation through further investigations is often necessary. Imaging techniques play a vital role in the differential diagnosis and particularly diagnosis of urethral diverticula. MRI is non invasive and produces high resolution images as well as excellent tissue contrast compared to other imaging modalities, thus providing an excellent source of cross sectional anatomical data to aid clinical diagnosis and management (2). However, MRI is able to demonstrate only 2D representations of these lesions. We rendered 3D models of the pelvic floor in women with vaginal para-urethral lesions from conventional MRI images. The aim of this study was to assess the clinical feasibility of rendering 3D models in patients with these lesions and to obtain additional information previously unavailable to us through 2D imaging modalities.

Study design, materials and methods

We studied MRI pelvic scans from five female patients aged between 26 and 40 years old undergoing investigation for a vaginal or paraurethral mass. An open source software package 3D Slicer v.3.4.0 (Brigham and Women's Hospital, Harvard Medical School, Boston MA, USA) was used for visualisation, segmentation, label mapping 3D volume rendering and image analysis. Using 3D Slicer, 3 dimensional volume renderings of the bladder, urethra and para-urethral masses were developed and analysed determining surface area and volumetric data for all three structures. Linear dimensions of cranio-caudal height, lateral width and depth were also ascertained and then compared with findings from clinical, MRI, surgical and histopathological reports.

Results

Of the 5 patients selected, 2 patients were investigated for urethral diverticula, 1 for a para-vaginal cyst, 1 for paraurethral cysts and 1 for masses likely related to previous urethral bulking injections. The surface area and volume of the lesions as well as of the bladder and urethra were calculated from all 5 3D models generated from MRI pelvic sequences. Linear dimensions for all 3 structures were calculated to 2 decimal places from multiple images in different visual planes. The measurements calculated cranio-caudal height, lateral width, depth and distance of para-urethral pathology from the bladder neck and urethral meatus accurately and results were reviewed against MRI, surgical or pathological reports. High quality 3D models were successfully rendered enabling the detailed viewing of the spatial relationship between anatomical structures.

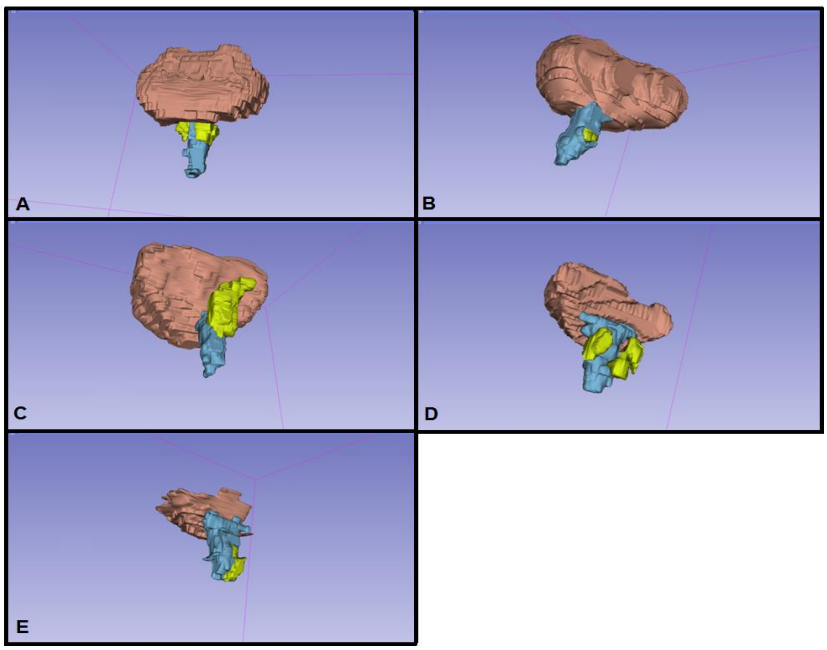

Figure 1. 3D surface renderings of 5 patients with suspected para-urethral or para-vaginal masses. Bladder (pink), Urethra (blue), pathology (yellow). (**A**) Bulking procedure related masses x3, (**B**) Urethral diverticulum, (**C**) Gartner's cyst, (**D**) Paraurethral cysts x3, (**E**) Urethral diverticulum.

Interpretation of results

3D volume rendering of vaginal and paraurethral lesions based on conventional MRI is a feasible technique. Analysis of the 3D surface models yielded linear, surface area and volumetric data to a high degree of accuracy. These models had the characteristics and resolution to allow identification of structures and their relationships. They may have an invaluable role in surgical planning and enable surgeons ascertain anatomical relationships more accurately compared to the use of 2D MRI imaging and clinical examination alone. This technology could be advanced further to produce highly accurate 3D pelvic models as a framework for surgical simulation (3).

Concluding message

3D volume rendering of MRI images may provide detailed anatomical representation of pelvic structures and lesions in addition to conventional 2D MRI imaging. Further prospective studies are required to evaluate the role of this technique in the investigation of these lesions and in planning and undertaking appropriate management.

	Demographics (Age ethnicity, parity)	Clinical Presentation	Clinical Diagnosis	MRI	Surgical findings	Histology
1	40y, Black, Para3	Mixed urinary incontinence, Palpable sub-urethral mass	Urethral diverticulum 6 x 9 mm	Urethral defect at 5'o clock Small collapsed diverticulum 6x9 mm	Urethral diverticulum 10 x 20 mm at 5 o'clock, 1cm from external meatus	20x10x10 urethral diverticulum
2	40y, White European, Para3 Previous urethral Bulking x 2 followed by vaginal childbirth	Recurrent stress urinary incontinence	Grade 2 urethrocele, ?suburethral cyst	3 septated cysts around proximal urethra, 14x13, 15x10, and 13x9mm Likely bulking material	Not applicable	Not applicable
3	36 y, White European, Para 2	Stress urinary incontinence, Vaginal mass	3cm vaginal cyst in right anterior fornix	R lateral vaginal wall cyst 3.8x1.5x1.4cm with septations	4-5 cm R anterolateral vaginal wall cyst, no communication with urethra	Mesonephric cyst
4	39y, Chinese, Para 2	Vaginal lump, Minor stress urinary incontinence,	1x Grade1 cystocele 2 paraurethral cysts: 1x R suburethral 0.5x1 cm 1x R lateral wall wall 0.5 x 1cm	3 Paraurethral cysts No urethral connection R sided: 15mm, 11mm, L sided: 12mm	EUA: 2 para-urethral cysts, no connection to urethra Not excised	N/A
5	26y White European para1	Vaginal lump, intermittently draining milky fluid urethrally diagnosed during pregnancy	3-4 cm urethral diverticulum	Urethrtal diverticulum 8x23mm	Urethral diverticulum 3-4 cm	25 x 20 mm urethral diverticulum

Table 1. Patient demographics, clinical, MRI, surgical and histological findings.

References

1. Venyo A , Gopall A. Female Urethral Diverticula: A Review of the Literature. WebmedCentral UROLOGY 2012; 3(5):WMC003428
2. Hricak H. MRI of the Female Pelvis: A review. AJR 1986; 146:1115-1122
3. Kraima AC, Smit NN, Jansma D, Wallner C, Bleys RLAW, Van De Velde CJH et al. Toward a Highly-Detailed 3D Pelvic Model: Approaching an Ultra-Specific Level for Surgical Simulation and Anatomical Education. Clinical Anatomy 2013; 26: 333-338

Disclosures

Funding: NONE **Clinical Trial:** No **Subjects:** HUMAN **Ethics not Req'd:** This study was registered as an audit. Audit reference number (333). **Helsinki not Req'd:** no identifiable data was used. this study only required existing data available from the electronic Patient Record and anonymised radiological data and thus did not require input from participants or alter their care pathway. No human material or identifiable data was used. **Informed Consent:** Yes