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# TOMOGRAPHIC ULTRASOUND OF THE PELVIC FLOOR: WHICH LEVELS MATTER MOST?

Hypothesis / aims of study

Tomographic ultrasound has greatly simplified pelvic floor assessment by translabial 4D ultrasound (1). Abnormalities of the insertion of the levator ani on the inferior pubic ramus and pelvic sidewall can be documented on a single frame and assessed at a glance. Such defects have been shown to be associated with reduced pelvic floor muscle contraction strength, with increased pelvic organ descent and female pelvic organ prolapse and with increased distension of the levator hiatus. In this study we intended to determine which levels of the levator hiatus are most strongly associated with alterations in pelvic organ support.

Study design, materials and methods

This is a sub-analysis of a study conducted in 296 nulliparous women carrying a singleton pregnancy who were seen at 36-38 weeks' gestation and again at 3-4 months postpartum as part of an ongoing study of delivery- related pelvic floor trauma. They underwent an interview and 4D translabial Ultrasound as previously described (2). We analysed postpartum changes in bladder neck descent as well as strain on maximal Valsalva (3) as indicators of altered pelvic organ support. Tomographic ultrasound was performed on volumes obtained at maximal pelvic floor contraction, at 2.5 mm slice intervals, from 5 mm below to 12.5 mm above the plane of minimal hiatal dimensions, producing 8 slices per patient. These slices were scored as positive or negative for levator avulsion, using a combination of direct visualisation of the insertion of the puborectalis muscle on the pelvic sidewall and measurement of the levator- urethra gap, with measurements of over 2.5 cm being regarded as abnormal.

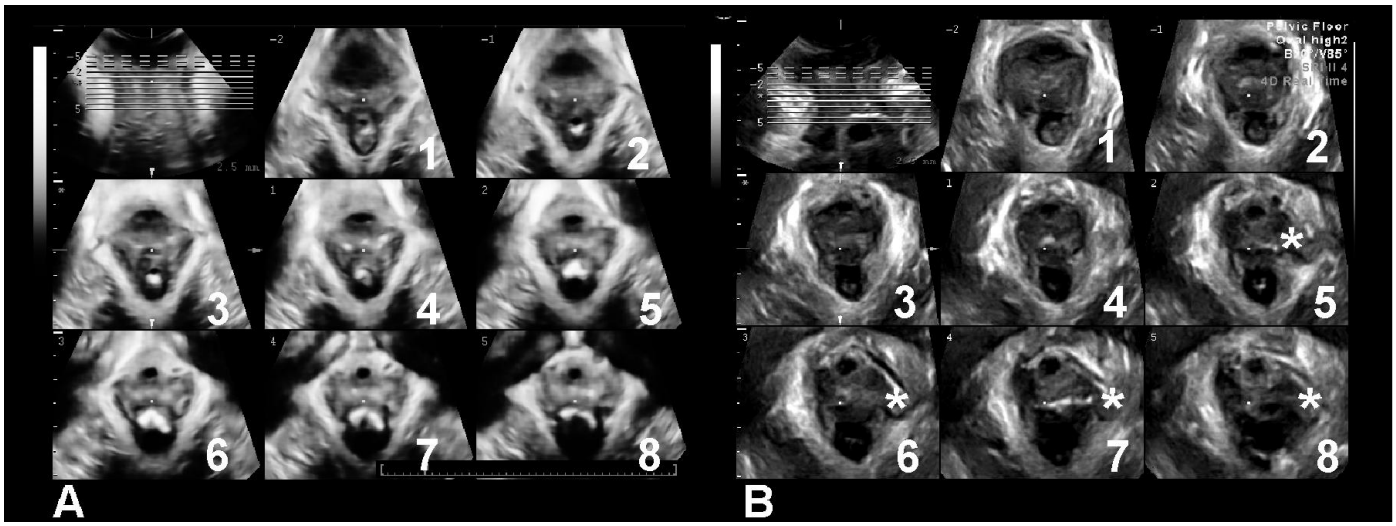


*Figure: Tomographic or 'multislice' ultrasound images of a normal pelvic floor (A) and a minor form of unilateral trauma (B) visible in slices 5-8. On palpation the hiatus itself was intact, as was the insertion of the puborectalis on the inferior pubic ramus, but there was a gap in the puborectalis in the region of the obturator foramen, implying detachment of the muscle from the arcus tendineus.*

Results

The mean age of patients who returned for a postnatal appointment (n=208, 70%) was 27 (range 18-40). The majority had had a normal vaginal delivery (n=99, 48%), 31 were seen after vacuum or forceps (15%) and 78 after Caesarean Section (38%). 26 (20% of those after vaginal delivery) were diagnosed with an avulsion injury. A total of 1664 tomographic slices were assessed bilaterally, and 386 single side abnormalities were detected. An abnormality in slices 3 to 8 was associated with increased bladder neck descent postpartum (P= 0.038 to P<0.001) and increased hiatal area on Valsalva (P= 0.029 to P< 0.001). This was not the case for the two most distal slices (1 and 2), see Table 1. Results for strain on Valsalva were inconsistent.

| Parameter | Slice | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| BND | n.s. | n.s. | 0.038 | 0.025 | 0.004 | 0.002 | 0.001 | 0.004 |
| Hiatal area, Valsalva | n.s. | n.s. | 0.029 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Strain on Valsalva | 0.033 | n.s. | n.s. | n.s. | n.s. | 0.027 | 0.028 | n.s. |

*Table: The association between defects diagnosed at slice levels 1-8 (from 5 mm below the plane of minimal dimensions for slice 1 and 12.5 mm above this level for slice 8) and changes in imaging parameters of pelvic organ support and pelvic floor function observed between ante- and postpartal assessments. T-test statistics.*

Interpretation of results

It appears that defects observed below the plane of minimal hiatal dimensions are not strongly associated with alterations in measures of pelvic organ support due to childbirth. While slices at and above the plane of minimal hiatal dimensions showed a statistically significant relationship between defects and increased bladder neck descent and increased hiatal distension postpartum, this was not the case for those below the reference plane. Results for Strain on Valsalva were inconsistent.

Concluding message

We found no association between defects observed on tomographic ultrasound below the plane of minimal hiatal dimensions and indices of increased hiatal area on Vaslalva or bladder neck descent on Valsalva. This implies that defects observed below this plane are either irrelevant for pelvic organ support or artefactual. The latter may be due to the fact that the reference plane used by us is Euclidean, i.e., flat, while the true hiatal plane may be non- Euclidean, i.e., warped. We propose to ignore imaging information obtained below the plane of minimal hiatal dimensions when diagnosing avulsion injury of the puborectalis muscle.

References

1. Ultrasound Obstet Gynecol 2005; 25: 580-585
2. Ultrasound Obstet Gynecol 2007; 29: 329- 334
3. Ultrasound Obstet Gynecol 2008; 31: 201-205



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|---|---|
| ***Specify source of funding or grant*** | **Betty Byrne Henderson Foundation, Brisbane, Queensland** |
| ***Is this a clinical trial?*** | **No** |
| ***What were the subjects in the study?*** | **HUMAN** |
| ***Was this study approved by an ethics committee?*** | **Yes** |
| ***Specify Name of Ethics Committee*** | **Sydney West Area HREC** |
| ***Was the Declaration of Helsinki followed?*** | **Yes** |
| ***Was informed consent obtained from the patients?*** | **Yes** |