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ROLE OF STRAIN ELASTOGRAPHY IN OBSTETRICS AND GYNECOLOGY: PICTORIAL ESSAY OF OUR INITIAL EXPERIENCE

Radiodiagnosis

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ABSTRACT

Ultrasonic elastography (real-time elastography, sonoelastography) is a new improvement of ultrasound technique and one of the various imaging modalities in the last few years which are being used for characterizing soft tissue masses of breast, thyroid, and lymph nodes. Musculoskeletal pathology was one of the early applications of sonoelastography, but the method is not yet standardized. Other new horizons of applications include Liver, Prostate, obstetrics and gynaecology. We are presenting a pictorial essay of elastography cases in Obstetrics and gynaecology seen in our institution.

KEYWORDS

Elasticity Imaging, Elastography, Sonoelastography,

Introduction:

Ultrasonic elastography (Sonoelastography) was originally described by Ophir et al which measures tissue deformation as a response to an external force, assuming the fact that deformation is lower in rigid tissues, in comparison with the elastic, soft tissues. [1] Its principle is based on tissue deformability on the application of the pressure. A tissue or lesion can behave in different ways, when external pressure is applied on it. Soft tissues will deform much more easily when pressure is applied and hard tissues will deform less. This information is represented on the monitor as a spectrum of colour scale: blue represents hard areas, red representing soft areas and green representing firm areas with intermediate consistency/stiffness. The tissue contrast seen on sonoelastography is due to difference in tissue stiffness. [2] Mainly two types of elastography techniques are used now days in clinical practice strain elastography and shear wave elastography.

Itoh et al introduced Tsukuba scoring method for strain pattern scoring of breast masses. According to this system, 5 scores are given. Score 1 refers to completely green colour-coded masses that have a soft and loose structure. Score 2 is given to those masses coded in blue and green mosaic and emphasizes heterogeneously distributed soft -rigid internal structure. Score 3 masses are blue in the centre and green in the periphery indicating that the mass is harder in its central part and softer on the outside. Score 4 masses are completely blue that shows the whole structure is hard and tight. A score of 5 means blue encoding of an area that is larger than the size of the mass, covering the mass and its surrounding tissue, caused by desmoplastic reaction. In addition, cystic lesions show a specific "BGR" pattern of blue, green and red colour coding. Score 1 and 2 are considered benign, score 3 indicates indeterminate origin while score 4 and 5 are mostly malignant[3]

Elastography in Obstetrics and Gynecology:

Ectopic Pregnancy: - Real-time Sonoelastography is a promising additional method in early detection of ectopic pregnancy. **Blue eye sign** is useful in its detection. Adnexal mass in ectopic pregnancy contains stiff tissue hence it is seen as blue on elastographic scale. (Figure 1)

Preterm labour:

Elastography plays an important role in diagnosis of preterm labour by diagnosing softening of cervix. (Shows green and red colours on elastography instead of dark blue seen in normal stiff cervix. (Figure 2 a and b)

Malignant Ovarian tumours:

Malignant ovarian masses are detected on elastography by identifying stiff tissue (blue) in ovarian mass. Ultrasound elastography could be useful for discrimination of low and high grade serous ovarian carcinoma. Low grade lesions are stiffer than and not as elastic as high grade lesions. (Figure 3a and b)

Benign ovarian cyst:

seen on USG as anechoic lesion with posterior acoustic enhancement and BGR appearance on elastography. (Figure 4)

Endometrioma:

Endometrioma or chocolate cyst is seen on USG as complex cyst showing diffuse low level echoes and on elastography BGR appearance of cyst is shown (Figure 5).

Haemorrhagic ovarian cyst:

is seen as a complex ovarian cyst with retracting clot, septa and debris on USG. On US elastography BGR pattern of cystic lesion is seen. (Figure 6)

Ovarian dermoid cyst:

Pelvic mass seen with cystic areas, fat, calcification and hair strands. On elastography soft as well as stiff tissues are seen due to heterogenous cellular content. (Figure 7)

Uterine fibroids & adenomyosis:

Real-time elastosonography is a promising tool that can provide detailed mapping and characterization of uterine fibroids. This could improve the gynaecological ultrasound evaluation of size, volume and delineation of uterine fibroids before surgery or embolization.

In general, fibroids are darker than, and adenomyosis was brighter than, the adjacent myometrium. Most fibroids had a regular shape with a clearly visible regular capsule, whereas adenomyosis was mostly irregularly shaped and without a clear border. Strain ratio is low in fibroids.(Figure 8 a and b and 9a and b)

Cervical masses:

Transvaginal sonoelastography is useful technique in characterization of cervical pathology and differentiation between normal and abnormal cervix between benign and malignant cervical lesion. High strain ratio is seen in malignancy. (Figure 10a, b and c)

Endometrial lesions:

Sonoelastography is useful in imaging of endometrial lesions like endometrial hyperplasia, endometrial polyp and endometrial

carcinoma. In hyperplasia and polyp elastography will reveal soft colours (green and red) in thickend endometrium and low strain ratio, while in case of endometrial cancer stiff (blue) colour and high strain ratio is seen.(Figure 11,12 a,b,c and 13)

Hydrosalpinx:
is seen on USG as tubular Adnexal cystic lesion separate from ovary. On elastography it shows typical BGR appearance. (Figure 14)

PCOD:
Elastographic features of ovarian stroma using strain ratio may have a role in diagnosis of polycystic ovary syndrome. Elasticity pattern and strain ratio can help in identification of morphological changes making ovaries stiffer than normal ovaries. Type 1 elasticity pattern means blue green in ovarian stroma, type 2 elasticity pattern indicates green yellow in ovarian stroma and type 3 elasticity pattern denotes orange red in stroma. (Figure 15) [1-12]

Fig 1: Blue Eye Sign Of Ectopic Pregnancy: A Patient Presented With Severe Pelvic Pain For Usg. Urine Test For Pregnancy Was Positive. On Usg No Intra-uterine Gestational Sac Was Seen. A Nonspecific Left Adnexal Mass Was Seen Adjacent To Corpus Luteum Cyst Which On Tvs Elastography Showed Stiff Tissue Within (blue Color) Indicating Ectopic Pregnancy Later Confirmed At Surgery.

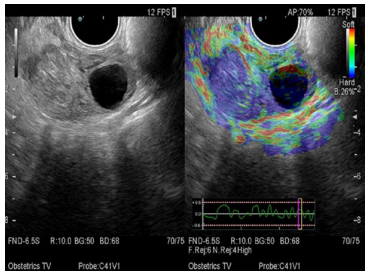


Fig 2(a): Elastography Of Gravid Uterine Cervix Showing Normal Blue Color On Elastography At 20 Weeks Of Praegnancy Indicating Normal Stiffness Of Cervix.

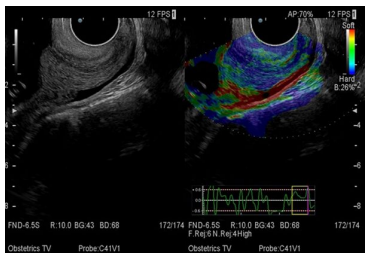


Fig 2(b): Elastography Of Uterine Cervix Of Another Patient Showing Soft Colours (red And Green) At 20 Weeks, Indicating Premature Softening.

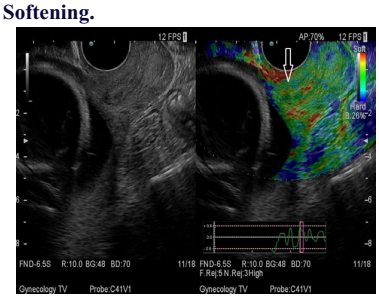


Fig 3 (a): Large Solid Right Adnexal Mass Is Seen In Pelvis Suggestive Of solid ovarian mass

Fig 3(b): On Elastography Solid Tissue Showing Evidence Of Stiff Tissue (blue Color) Within Indicating Malignancy Which Was Confirmed At Histopathology. Necrotic Areas Within Tumor Show Soft Colours On Elastogram.

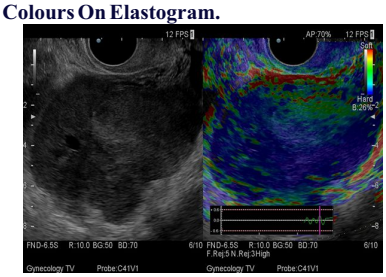


Fig 4: Anechoic Pelvic Lesion With Incomplete Septa Seen On Right Side. Elastogram Shows Typical BGR Appearance Indicating Benign Process.

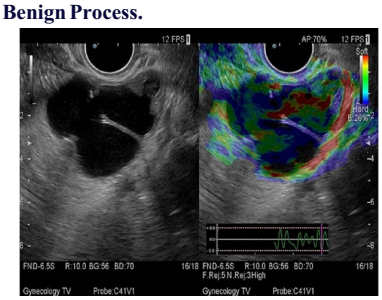


Fig 5: Pelvic Usg Showing Left Ovarian Mass Containing Diffuse Low Level Echoes Within And BGR Appearance On Elastography Confirmed As Endometrioma Later On.

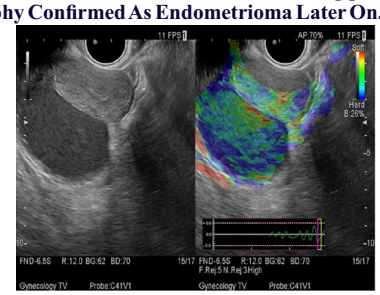


Fig 6: A Complex Ovarian Cyst With Internal Septa And Debris Within, On Elastography BGR Appearance Of Cyst Seen Confirming It As Hemorrhagic Cyst.

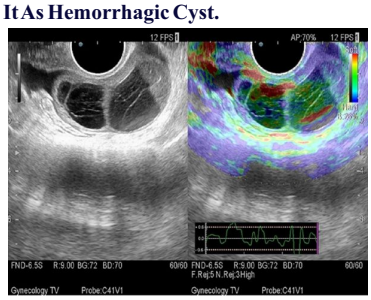


FIG 7: A large pelvic mass with cystic areas, fat, calcification and hair strands indicating a dermoid cyst of ovary. On elastography soft as well as stiff tissues are seen.MRI confirms presence of dermoid on STIR.

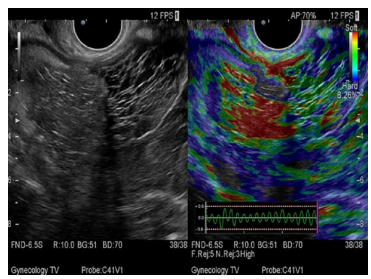


Fig 8(a): Usg Pelvis Shows A Large Encapsulated Cervical Fibroid

Which On Elastography Is Seen As Stiff Lesion (blue). Strain Ratio In This Case Was 1.

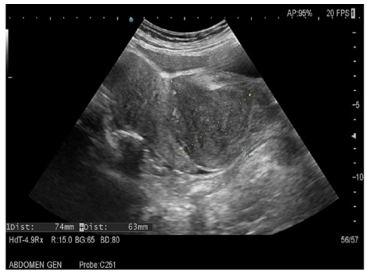


Fig 8(b): Usg Pelvis Shows A Large Encapsulated Cervical Fibroid Which On Elastography Is Seen As Stiff Lesion (blue). Strain Ratio In This Case Was 1.

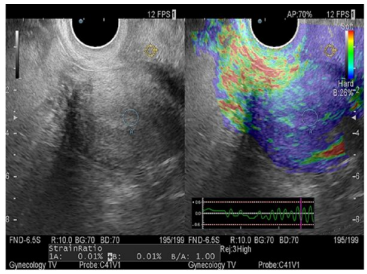


Fig 9(a): TVS Usg Of Uterus Showing Asymmetrical Thickening Of Posterior Myometrium, Diffusely Heterogenous Myometrium, Poor Definition Of Endometrial Myometrium Border, Globular Uterine Fundus, And No Definite Mass In Posterior Myometrium And Few Small Cysts Within Suggestive Of Adenomyosis.

Fig 9(b): On Elastography Soft (red And Green) Tissues Are Identified In Lesion.

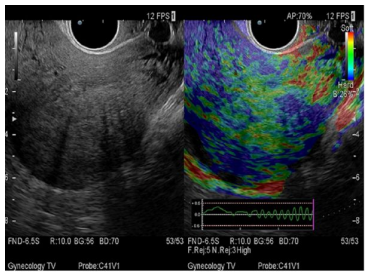


Fig 10(a): Heterogenous Vascular Mass Seen In Uterine Cervix Which Shows Stiff Colours On Elastography. Strain Ratio Was 21 Suggestive Of Malignant Lesion. Biopsy Revealed Carcinoma Cervix.

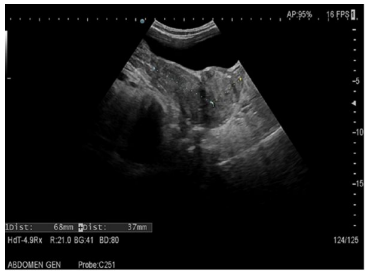


Fig 10(b): Heterogenous Vascular Mass Seen In Uterine Cervix Which Shows Stiff Colours On Elastography. Strain Ratio Was 21 Suggestive Of Malignant Lesion. Biopsy Revealed Carcinoma Cervix.

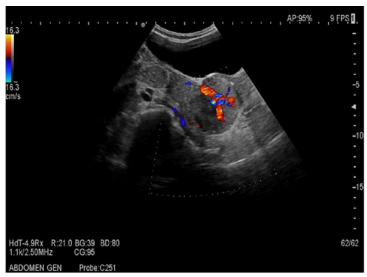


Fig 10(c): Heterogenous Vascular Mass Seen In Uterine Cervix Which Shows Stiff Colours On Elastography. Strain Ratio Was 21 Suggestive Of Malignant Lesion. Biopsy Revealed Carcinoma Cervix.

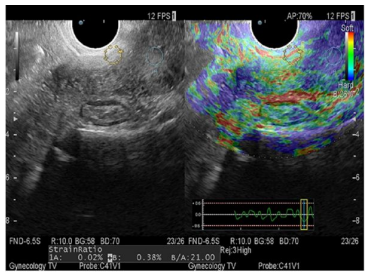


FIG 11: Patient on hormone treatment USG pelvis revealed smooth hyperechoic thickening of endometrium and normal endometrium-myometrium interface. Elastography showing soft endometrial hyperplasia (red and green) confirmed by endometrial biopsy.

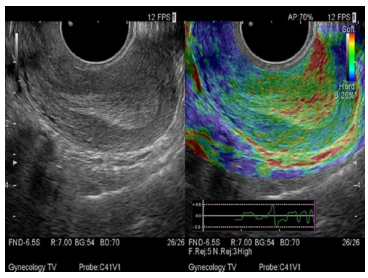


Fig 12(a): Patient With Bleeding Shows Thickened Endometrium With Few Cystic Areas.

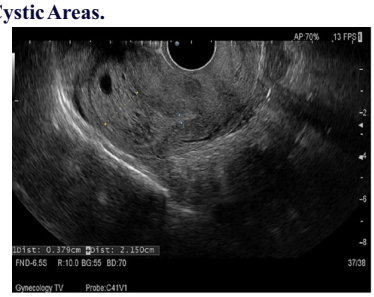


Fig12(b): Vascular Pedicle Could Be Identified On Doppler.

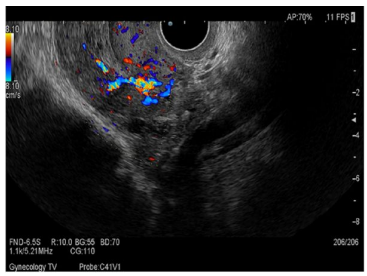


Fig12(c): On elastography lesion showed soft colours and strain ratio of 0.88 indicating benign lesion later on confirmed on histopathological study as polyp.

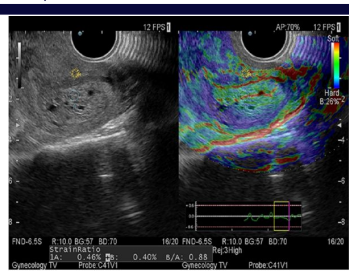


Fig 13: Postmenopausal Patient With Vaginal Bleeding Showing Heterogenous Thickened Endometrium Causing Hypervascularity On Doppler And Stiff Tissue On Elastography Showing Strain Ratio Of 42.67 Indicating Malignant Lesion Later On Confirmed As Endometrial Carcinoma On Biopsy.

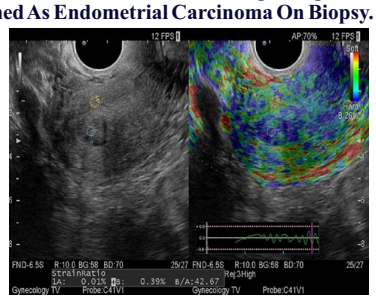


Fig14: An Elongated Anechoic Lesion In Right Adnexa With Adjacent Normal Right Ovary And Typical Bgr Appearance On Elastography Indicative Of Hydrosalpinx.

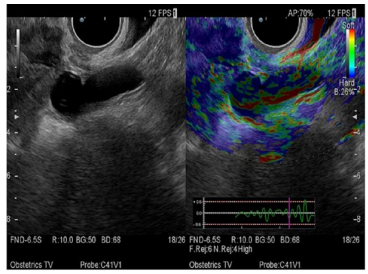
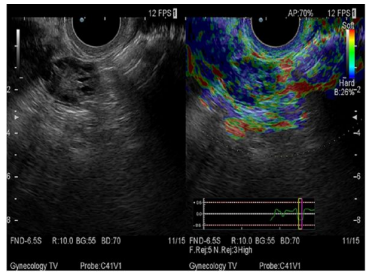


Fig15: A case of PCOD showing stiff color in stroma (blue green) indicating type I elasticity pattern of PCOD.



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