International Journal of Medical Sciences And Clinical Research

VOLUME Vol.05 Issue10 2025
PAGE NO. 97-99
DOI 10.37547/ijmscr/Volume05Issue10-20

Application Of Ultrasound With Elastography In Assessing Ovarian Formations In Girls Of Different Age Groups

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Received: 31 August 2025; **Accepted:** 26 September 2025; **Published:** 31 October 2025

Abstract: Ovarian formations in girls remain one of the most important issues of pediatric gynecology. Timely and accurate diagnosis is essential for preserving reproductive function and avoiding unnecessary surgery. Ultrasound combined with elastography provides valuable non-ionizing information about the morphology and stiffness of ovarian tissues. Our study demonstrated that elastography significantly increases the diagnostic accuracy in differentiating functional cysts, benign, and malignant ovarian tumors.

Keywords: Ultrasound, elastography, ovarian masses, pediatric gynecology, non-ionizing diagnosis.

Introduction: In the structure of tumor-like lesions in girls and adolescents, ovarian pathology occupies a significant place. Although most of these lesions are benign or functional in nature, diagnostic errors often lead to unjustified surgical interventions and a reduction in future reproductive potential.

Ultrasound examination remains the primary imaging modality, allowing assessment of lesion size, contours, and internal structure. However, conventional grayscale ultrasound does not always enable reliable differentiation of the nature of ovarian lesions.

Modern technologies—strain elastography and shear wave elastography—provide an objective assessment of tissue stiffness, which is crucial for determining the nature of the pathological process. Elastographic parameters (stiffness ratio, shear wave velocity) make it possible to distinguish benign from malignant lesions at the preclinical stage.

Aim of the Study

To investigate the diagnostic value of ultrasound examination using elastography in the differential diagnosis of functional, benign, and malignant ovarian lesions in girls of different age groups.

METHODS

The study included 182 patients aged 6 to 18 years who underwent examination and treatment in the Department of Pediatric Gynecology and Abdominal Surgery at the clinic of the Tashkent Pediatric Medical Institute.

The patients were divided into three groups:

- Group I (n = 70): functional cysts (follicular, luteal, corpus luteum cysts);
- Group II (n = 80): benign tumors (mature teratomas, serous and mucinous cystadenomas);
- Group III (n = 32): malignant tumors (dysgerminomas, endodermal sinus tumors, juvenile granulosa cell tumors).

Examination Technique

Ultrasound examination was performed using an Aplio

500 system (Canon Medical Systems, Japan) with a 3.5–5 MHz convex transducer.

The following modes were applied:

- grayscale B-mode scanning;
- color and power Doppler mapping;
- strain elastography and shear wave elastography (SWE).

RESULTS

Group I – Functional cysts (38.5%)

Follicular and luteal cysts demonstrated a typical anechoic structure, thin capsule, and absence of blood flow on color Doppler imaging. The mean lesion size was 5.9 ± 0.7 cm. Elastographically, predominantly blue and green color patterns were observed, with stiffness ratio (SR) values of 1.1–1.8 and shear wave velocity (SWV) of 1.0–1.4 m/s. These findings reflect a soft, fluid-filled structure and are fully consistent with benign lesions.

Group II – Benign tumors (44.0%)

The most common lesions were mature teratomas (56%) and serous cystadenomas (31%). Teratomas exhibited a complex heterogeneous structure with areas of increased echogenicity and acoustic shadowing.

Elastography revealed a mosaic pattern: dense areas (fatty and calcified components) showed SR values of 3.5–6.0 and SWV of 2.8–4.0 m/s, whereas softer areas demonstrated SWV values of 1.5–2.0 m/s.

Serous cystadenomas were characterized by unilocular or multilocular structures with smooth walls and moderate vascularization. Elastographic parameters were SR = 2.0–3.0 and SWV = 1.6–2.3 m/s.

Group III – Malignant tumors (17.5%)

Dysgerminomas (40.6%) and endodermal sinus tumors (25%) predominated. On ultrasound, these lesions appeared as solid, moderately vascularized masses with heterogeneous echostructure. Elastography demonstrated a marked increase in tissue stiffness, with SR values of 6.5–10.0 and SWV of 4.5–6.5 m/s.

The color elastographic map was predominantly red–orange, reflecting the dense consistency of the tumor.

Table 1. Mean elastography parameters in different types of ovarian lesions

Type of lesion	Strain Ratio (SR)	Shear Wave Velocity (m/s)	Color characteristics
Functional cysts	1.1–1.8	1.0–1.4	Blue/green
Serous cystadenomas	2.0–3.0	1.6–2.3	Green/yellow
Mature teratomas	3.5–6.0	2.8–4.0	Mosaic pattern
Malignant tumors	6.5–10.0	4.5–6.5	Red–orange

DISCUSSION

The study results demonstrated that the use of elastography significantly expands the diagnostic capabilities of standard ultrasound examination. Functional cysts are characterized by low stiffness values, which allows their reliable differentiation from true tumors.

Benign tumors show a moderate increase in stiffness and a heterogeneous (mosaic) structure, whereas malignant lesions are characterized by a high stiffness index and a homogeneous rigid structure.

Comparison of the obtained data with the results of international studies (Vorobieva et al., 2023; ACOG, 2019) revealed a high degree of correlation. Elastographic parameters of SR ≥ 3.5 and SWV ≥ 3.0 m/s may be considered threshold values indicating the need for oncologic vigilance.

CONCLUSION

Ultrasound examination with elastography is a safe, informative, and accessible non-ionizing diagnostic method for ovarian lesions in girls. Elastography enables objective assessment of the mechanical properties of tissues, contributes to more accurate differential diagnosis, and helps avoid unnecessary surgical interventions while preserving the reproductive potential of patients.

Incorporation of elastography into the standard diagnostic algorithm should become a mandatory step

in the examination of girls and adolescents with suspected ovarian lesions.

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