eISSN: 2229-3213 pISSN: 2229-3205
The Journal of Applied Science and Social Science
Volume 16,Issue 02 February, 2026

THE ROLE OF NON-IONIZING IMAGING METHODS IN THE DETECTION AND EVALUATION OF OVARIAN LESIONS IN GIRLS AT DIFFERENT AGE PERIODS

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Abstract: Ovarian masses in girls of various age groups represent a significant interdisciplinary problem in modern pediatric gynecology, pediatrics, and abdominal surgery. Although these masses are benign in most cases, late or inaccurate diagnosis can lead to complications, impaired ovarian reserve and reproductive potential, and the unnecessary use of overly radical surgical treatments.

Key words: Ovarian lesions, pediatric gynecology, non-ionizing diagnostic methods.

Relevance. Ovarian masses in girls of various age groups represent a pressing interdisciplinary problem in modern pediatric gynecology, pediatrics, and abdominal surgery. Despite the relatively low prevalence of this pathology, its diagnostic detection has increased in recent years, driven by the introduction and improvement of modern medical imaging techniques. Timely and accurate diagnosis is crucial in choosing a rational treatment strategy, reducing the risk of complications, avoiding unnecessary radical surgical interventions, and preserving the reproductive potential of patients.

Non-ionizing diagnostic methods—ultrasound combined with Doppler ultrasonography and elastography, as well as magnetic resonance imaging—are highly informative and safe, providing a comprehensive assessment of the morphological and functional characteristics of ovarian tumors with minimal impact on the child's body and the complete absence of ionizing radiation, which is of fundamental importance in pediatric practice. Therefore, further study and optimization of the use of non-ionizing diagnostic methods for ovarian tumors in girls represents an important clinical and socially significant task.

Materials and Methods. The study included 196 patients with ovarian lesions, divided into three clinical groups based on morphological verification of the lesions. The first group consisted of 72 patients with functional ovarian cysts, the second group consisted of 93 patients with benign tumors, and the third group consisted of 31 patients with malignant ovarian tumors.

An ultrasound examination (US) was performed transabdominally using the Aplio 500 expert-class ultrasound system. The examination protocol included assessment of the size, structure, and echogenicity of the lesions, capsule condition, the presence of septa and solid components, and color and power Doppler imaging to analyze vascularization. Compression and shear wave elastography were used when necessary.

Magnetic resonance imaging of the pelvic organs was performed using a Magnetom Sonata (Siemens, Germany) with a 1.5 T magnetic field strength. The MRI protocol included standard T1- and T2-weighted sequences in three planes, as well as additional imaging modalities as indicated to clarify the nature and extent of the pathological process.

Results. The first group included patients with functional ovarian cysts, accounting for 36.7% of the total number examined. Functional cysts were the most common pathology, occurring at various ages and caused by hormonal factors. This category included follicular, luteal, and corpus luteum cysts, which form during the physiological menstrual cycle. Follicular cysts were the most frequently diagnosed, accounting for 82% of all functional cysts.

In all cases (100%), ultrasound examination revealed functional cysts as single-chambered anechoic formations with a thin, smooth capsule, without septa or parietal inclusions. The average cyst diameter was 6.06 ± 0.8 cm, with a maximum size of 8 cm. Elastographic examination revealed low stiffness values: on elastograms, cysts were predominantly displayed in blue and green shades, with a stiffness index (Strain Ratio) did not exceed 2.0, and the shear wave velocity was 1.0–1.5 m/s, consistent with the fluid nature and soft structure of these

formations. The uniformity of the elastographic pattern without areas of increased rigidity confirmed the functional, benign nature of the cysts and facilitated their differentiation from tumor processes.

According to magnetic resonance imaging data, functional cysts were defined as single-chamber thin-walled formations with a hyperintense signal on T2-weighted images and, as a rule, a hypointense signal on T1-weighted images; in some cases, an increased signal on T1-weighted images was noted in the presence of a hemorrhagic component.

The second group comprised 47.4% of patients and included patients with benign ovarian tumors. The most common of these were mature teratomas (dermoid cysts), detected in 57% of patients in this group. These tumors were characterized by slow growth and complex tissue composition, as reflected in the imaging data.

Ultrasound examination revealed that mature teratomas had a multicomponent structure with pronounced echogenicity heterogeneity , the presence of hyperechoic inclusions (fat, hair, calcifications), and acoustic shadowing caused by dense structures. Elastography demonstrated pronounced stiffness heterogeneity: areas of high density with Strain values. Ratio 3.0–6.0 and shear wave velocity 2.5–4.5 m/s corresponded to dense tumor components and alternated with soft tissue zones.

On magnetic resonance imaging, mature teratomas were characterized by a well-defined heterogeneous structure with a hyperintense signal on T1-weighted images, suppressed in fat-suppressed modes , the presence of fat- fluid levels and areas of calcification.

The second most common benign tumor was serous cystadenoma , diagnosed in 32% of patients in this group. It was a unilocular or multilocular cystic lesion with a thin wall and homogeneous fluid content. Ultrasound examination in some cases revealed small papillary growths up to 4 mm in size along the inner surface of the capsule. MRI confirmed a multilocular cystic structure with a hyperintense signal on T2-weighted images and a hypointense signal on T1-weighted images; papillary structures were visualized as parietal lesions.

The third group consisted of patients with malignant ovarian tumors (15.8% of cases). Dysgerminomas were the most frequently diagnosed malignant tumors , accounting for 38.7%. These tumors were predominantly solid, well-encapsulated, with an average size of 8.4 ± 0.68 cm.

On ultrasound examination , dysgerminomas were visualized as solid or solid-dominant lesions with heterogeneous echostructure and moderate vascularization according to color Doppler mapping. Elastography revealed high tumor tissue stiffness: Strain values The ratio ranged from 6.0 to 10.0, and the shear wave velocity ranged from 4.5 to 6.0 m/s. The elastographic pattern was heterogeneous, with a predominance of red and orange hues, reflecting high tumor density, and areas of decreased stiffness, corresponding to areas of necrosis.

According to magnetic resonance imaging data, dysgerminomas were characterized by clear contours, the presence of fibrovascular septa with a hypointense signal on T2-WI and an iso- or moderately hyperintense signal of the main solid component.

Cystadenocarcinomas identified in this group were distinguished by a complex cystic-solid structure, the presence of thickened uneven walls and intracavitary papillary growths more than 4 mm high, which corresponded to the malignant nature of the process.

Conclusion. Ovarian tumors in girls and adolescents are characterized by significant morphological and imaging polymorphism, which complicates their timely and accurate diagnosis. The combined use of non-ionizing imaging techniques—ultrasound with Doppler and elastography combined with magnetic resonance imaging—provides high diagnostic yield and enables reliable differentiation between functional cysts, benign, and malignant ovarian tumors.

Knowledge and systematic analysis of the characteristic imaging features of various types of tumor formations contribute to increased accuracy of preoperative diagnostics, informed selection of optimal treatment tactics, and a reduction in the risk of unjustifiably radical surgical

interventions, which is of fundamental importance for preserving the reproductive potential and quality of life of pediatric and adolescent patients.

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