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Ultrasound Findings of Adnexal Masses Using Gynecologic Imaging-Reporting and Data System (GI-RADS)

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Abstract

This retrospective study, conducted at the Ultrasound Department of Al-Auda Medical Center in Hafr Al-Batin, KSA, evaluated the diagnostic performance and clinical utility of the Gynecologic Imaging-Reporting and Data System (GI-RADS) for the risk stratification of adnexal masses. Over a three-year period (December 2022 to December 2025), 300 patients presenting with suspected adnexal masses underwent standardized transabdominal and transvaginal sonography using high-resolution systems. The results indicate that the majority of adnexal masses were low-risk, with 51.7% categorized as GI-RADS 3 (Probably Benign) and 36.3% as GI-RADS 2 (Benign). Findings suspicious for malignancy were rare, with 8.0% classified as GI-RADS 4 and 2.0% as GI-RADS 5. Statistical analysis revealed highly significant associations ($p=0.000$) between GI-RADS stratification and parameters such as cystic content, internal vascularity, and the presence of ascites, with vascularity demonstrating the strongest correlation (Cramer's V=0.458). Conversely, septal and wall thickness were not statistically significant discriminators in this cohort (p=0.088). In conclusion, the GI-RADS framework proved to be a reliable, standardized tool for characterizing adnexal lesions at our institution. The system effectively reduced diagnostic ambiguity, facilitating consistent clinical triage and communication between sonographers and clinicians. These findings support the widespread adoption of GI-RADS as a mandatory reporting standard to improve diagnostic accuracy, reduce unnecessary interventions for benign lesions, and prioritize urgent management for high-risk patients. This audit provides essential evidence-based justification for maintaining GI-RADS as the primary reporting protocol at Al-Auda Medical Center.

Keywords: GI-RADS, Adnexal mass, Sonography, Risk stratification, Gynecologic imaging, Diagnostic ultrasound, Pelvic pathology.

INTRODUCTION

Adnexal masses are frequently encountered in clinical practice, necessitating precise diagnostic stratification to differentiate between benign lesions and ovarian malignancies (Basha *et al.,*2019; Helal *et al.,*2024). Although the majority of these masses are benign—including functional cysts, endometriomas, and mature cystic teratomas—ovarian cancer remains a significant contributor to gynecologic mortality, often due to late-stage detection (Abu-Zaid *et al.,*2021; American College of Radiology [ACR], 2025). Transvaginal ultrasonography (TVS) remains the gold standard for initial evaluation due to its high sensitivity, cost-effectiveness, and accessibility (Ontario Health, 2025). However, traditional reporting has historically been susceptible to inter-observer variability, which can lead to inconsistent clinical triaging and delayed management (Khalaf *et al.,*2019; Helal *et al.,*2024).

The Gynecologic Imaging-Reporting and Data System (GI-RADS), developed by Amor *et al.,* (2009), was introduced to mitigate these challenges. By employing a risk-stratified approach based on morphological features and Doppler vascularity, GI-RADS provides a standardized lexicon that enhances diagnostic uniformity and communication between radiologists and clinicians (Amor *et al.,*2009; Basha *et al.,*2019). The clinical significance of this system lies in its ability to optimize surgical management; it facilitates the triage of high-risk cases (GI-RADS 4–5) to specialized oncologic centers while potentially sparing patients with low-risk lesions (GI-RADS 2–3) from unnecessary surgical intervention (Amor *et al.,*2009; Diagnostic Performance of GI-RADS, 2025).

Since its inception, the diagnostic utility of GI-RADS has been extensively evaluated. Meta-analyses, such as those conducted by Yan *et al.,* (2021), have consistently demonstrated that GI-RADS offers high sensitivity and moderate-to-high specificity, reinforcing its role as a robust tool for malignancy risk stratification. Recent comparative studies have further explored the performance of GI-RADS against other systems, such as O-RADS, with Helal *et al.,* (2024) highlighting the continued relevance of the GI-RADS lexicon in contemporary practice. Despite these advancements, literature frequently emphasizes the influence of patient demographics on diagnostic accuracy. Specifically, while the system performs reliably in broad cohorts, studies have identified variability in specificity when applied to distinct subgroups, such as pre- versus postmenopausal patients, where the prevalence of benign functional findings differs significantly (Basha *et al.,*2019).

There remains a critical need for continued validation of GI-RADS in localized clinical environments where demographic profiles and access to specialized imaging infrastructure influence diagnostic outcomes. This study aims to address this gap by evaluating the application of the GI-RADS framework within the patient population at Al-Huda Clinical in Hafer Al-Batin. The primary purpose of this research is to evaluate the diagnostic performance and clinical efficacy of GI-RADS in the characterization of adnexal masses. By conducting a systematic sonographic assessment, this study intends to determine the sensitivity and specificity of the GI-RADS classification system in distinguishing between benign and malignant pathologies based on sonographic appearance.

The scope of this research is confined to the sonographic evaluation and diagnostic classification of adnexal masses using the GI-RADS framework, bridging the gap between standardized imaging protocols and clinical outcomes. This study moves beyond descriptive imaging by establishing a direct correlation between sonographic findings and histopathological results, serving as a practical audit of how effectively GI-RADS translates into actionable surgical triaging. A key novelty of this work is its focus on the practical clinical utility of the GI-RADS score within our institutional workflow. By evaluating how the system guides decision-making—specifically in reducing unnecessary interventions for low-risk masses—this study provides evidence-based justification for adopting GI-RADS as a mandatory reporting standard in our clinical practice.

EXPERIMENTAL SECTION/MATERIAL AND METHODS

Study Design and Setting

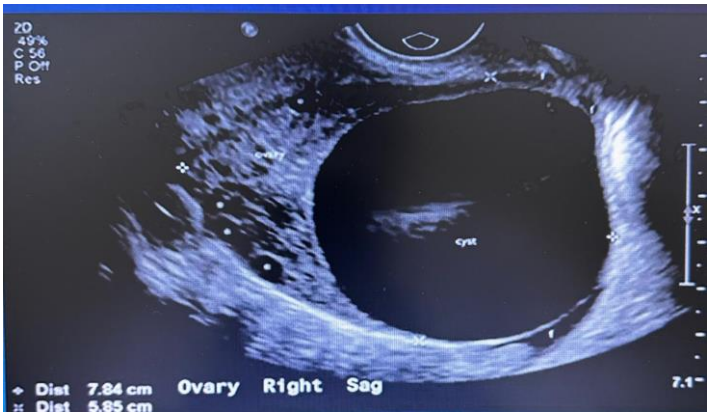

Fig-1: Large ovary cyst 32years un married showed Right ovarian cyst measure (7.84 x 6.95) cm

This retrospective study was conducted at the Ultrasound Department of Al-Auda Medical Center in Hafer Al-Batin, KSA, over a three-year period from December 2022 to December 2025, involving a total of 300 patients presenting with suspected adnexal masses who all underwent a comprehensive clinical history review. Sonographic examinations were performed using two high-resolution systems, the Mindray DC-7 (2012 model) and the Fujifilm SN1WV029 (2022 model), both equipped with curved linear array probes for transabdominal imaging and dedicated endovaginal transducers for high-resolution pelvic assessment. A

systematic imaging approach was employed utilizing both transabdominal (TA) and transvaginal (TV) sonography to achieve a comprehensive evaluation of pelvic anatomy and adnexal pathology. TAS was performed using a curvilinear or sector transducer at frequencies up to 5 MHz, utilizing a distended bladder as an acoustic window for a broad pelvic overview, while TVS was performed with an empty bladder using high-frequency transducers (≥ 7.5 MHz) to provide superior near-field resolution and enhanced characterization of uterine and adnexal morphology. In accordance with standard gynecologic imaging practices, all structures were evaluated in at least two orthogonal planes—typically sagittal and axial or coronal and transverse—to ensure accurate diagnostic identification and morphological assessment (Yasir & Elbadawi, 2026).

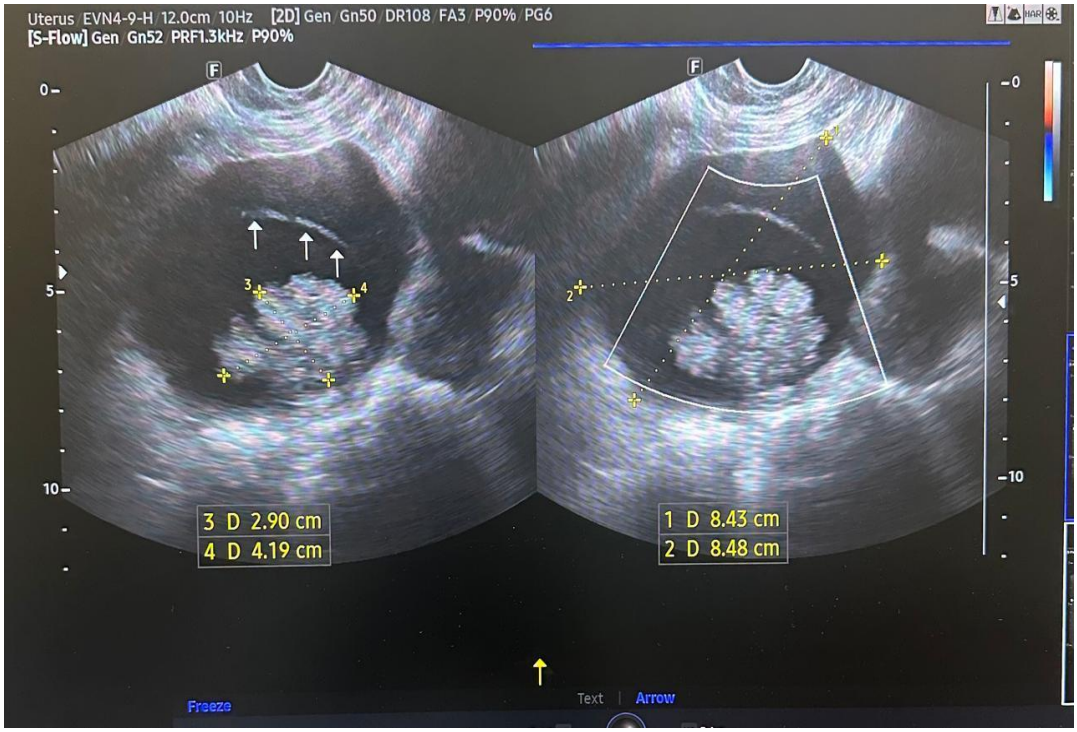

Fig-2: Transvaginal ultrasound image for a 39-year-old married who presented with pelvis pain show Lt ovarain masses measure (8.48 x 8.43cm) with internal soft tissue (4.19 x2.90cm) and septation. Ovarian cystadenocarcinoma

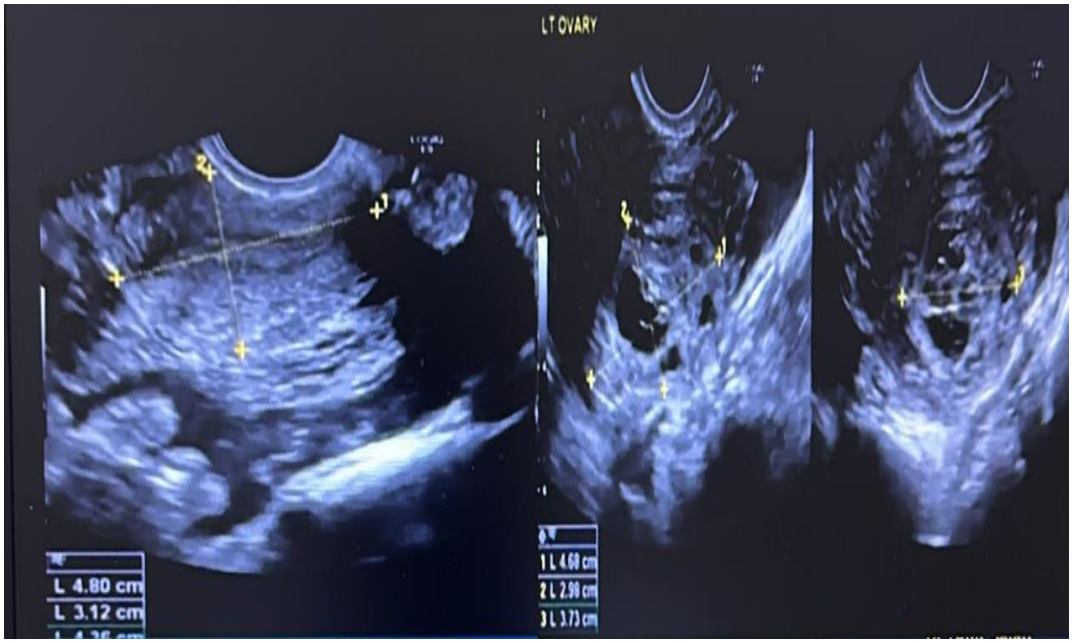

Fig-3: Fluid in pelvis with adenxal mass

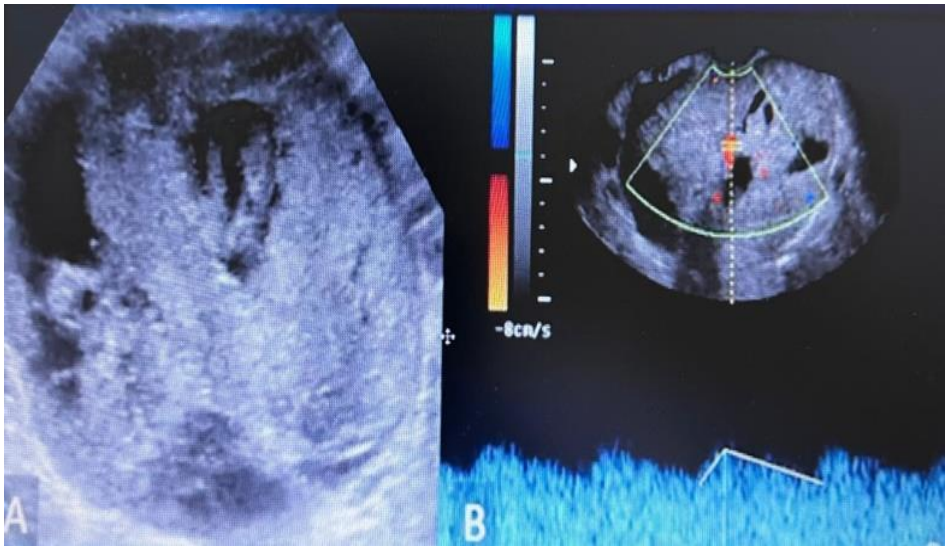

Fig-4: Transvaginal ultrasound image for 42 years who presented with acute pelvis pain showed left ovarain masses with internal vascularitiy D andS

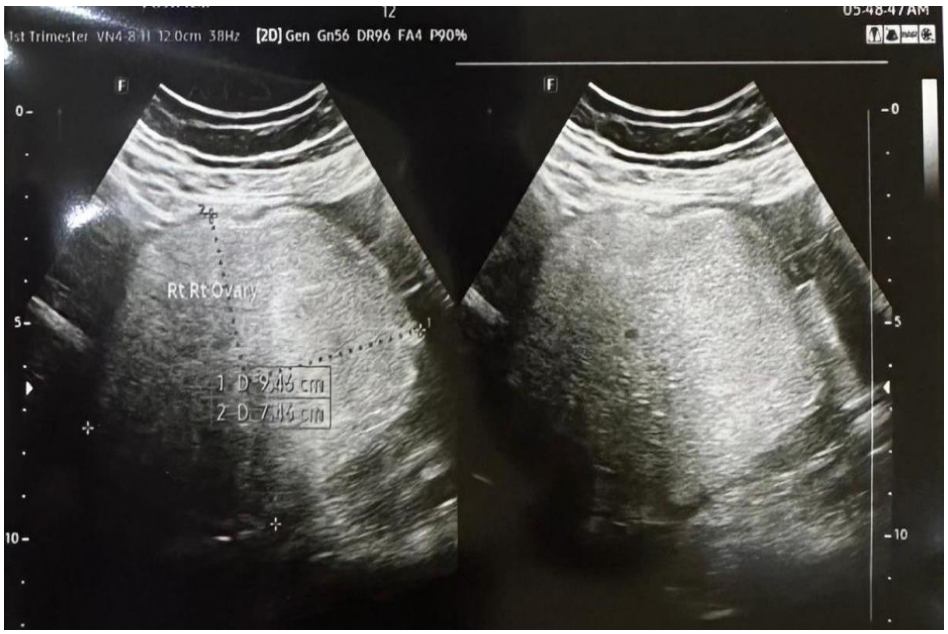

Fig. 5: Trans abdominal ultrasound image for a 32-year-old mareid who presented with pelvis pain shows large solid mass measure (9.4 x 7.4 cm)

Data Analysis and Classification

Quantitative analysis was performed using SPSS (Version 24) for sonographic characteristics of the adnexal masses were evaluated and classified according to the Gynecologic Imaging-Reporting and Data System (GI-RADS) lexicon. The findings were documented based on standardized criteria, including lesion morphology (cystic contents), septations wall, the vascularity patterns and associated findings.

Ethical considerations and data security:

Institutional Approval and Consent the research commenced following formal clearance from the Institutional Review Board (IRB) and the ethics committee at the College of Graduate Studies and Scientific Research, Sudan University for science and Technology in Khartoum, Sudan. Every participant provided informed consent, explicitly agreeing to the use of their data for research analysis and academic publication.

RESULTS AND DISCUSSION

This retrospective analysis involved the sonographic evaluation of 300 pelvic ultrasound examinations. The GI-RADS framework relies on a systematic evaluation of adnexal mass morphology and Doppler vascularity. The following table correlates these sonographic findings with their respective risk categories.

Table -1: Demographic Distribution of the Study Population:

Category	Characteristic	Frequency (n)	Percentage (%)
Age Group	17–25 years	60	20.0%
	26–45 years	174	58.0%
	46–52 years	58	19.3%
	More than 52 years	8	2.7%
Averaged mean = 35.7 ±10.3			

The demographic profile of the study cohort (n = 300). Analysis of age distribution showed that the majority of participants fell within the 26–45 age (58.0%, n = 174), followed by the 17–25 age group (20.0%, n = 60). The remaining distribution was comprised of the 46–52 age group (19.3%, n = 58) and those over 52 years (2.7%, n = 8), resulting in a mean age of (35.7 ±10.3) years.

Table 2: Summary of Sonographic Characteristics of Adnexal Masses (n=300)

Parameter	Sub-category	Frequency (n)	Percentage (%)
Cystic Content	Anechoic	126	42.0
	Complex	138	46.0
	Solid	36	12.0
Septal wall	Absent	260	86.7
	Thick	34	11.3
	Thin	6	2.0
Associated Findings	Ascites	207	69.0
	No	93	31.0
Total		**300**	**100.0**

The sonographic evaluation of the study population (n=300) highlights several predominant features across five key variables. Regarding Sonographic Appearance, nearly half of the identified masses were classified as Complex (46.0%), followed by Anechoic (42.0%) and solid (12.0%) types. In terms of septal wall, the majority of adnexal masses were has no septation frequent at 86.7%, while thick and thin accounted for 11.3% and 2.0%, respectively.

Table 3: Sonographic Characteristics of Adnexal Masses according to the vascularity (n=300)

Lesion Vascularity	Categories	Frequency	Percentage (%)
Vascular pattern	Avascular	273	91.0
	Vascular	27	9.0
Vascular morphology (when present)	Central/ Chaotic Vascular	15	55.6
	Perinodular flow	12	44.4

Assessment of vascular patterns revealed that the overwhelming majority of lesions were avascular (91.0%, n=273), while only 9.0% (n=27) exhibited detectable. Central or chaotic vascular patterns were the most frequently identified, accounting for 55.6% (n=15) of the vascular cases AND Perinodular flow was observed in the remaining 44.4% (n=12) of vascular lesions.

This distribution highlights the utility of Doppler sonography in identifying hemodynamic characteristics that may correlate with underlying pathology. The prevalence of avascular patterns is consistent with the high frequency of benign findings within our institutional patient population. Conversely, the identification of chaotic internal vascularity, when present, serves as a significant clinical indicator that warrants heightened suspicion, reinforcing its role as a key technical pillar within the GI-RADS framework for risk stratification.

Table 4: Showing GI-RADS Category (n=300)

GI-RADS Category	Number of Patients (n=300)	Percentage (%)
GI-RADS 1(Normal/Definitive Benign)	6	2.0
GI-RADS 2(Benign)	109	36.3
GI-RADS 3(Probably Benign)	155	51.7
GI-RADS 4(Probably Malignant)	24	8.0
GI-RADS 5(Malignant)	6	2.0
Total	**300**	**100**

In analyzing the distribution of adnexal masses in our 300-patient cohort, the results demonstrate a predominance of benign and probably benign findings, which is consistent with the general clinical expectation for adnexal pathology in this population. The majority of the study population was classified as low-risk, with GI-RADS 3 (Probably Benign) accounting for 51.7% (n=155) and GI-RADS 2 (Benign) accounting for 36.3% (n=109) of cases. Together, GI-RADS 1, 2, and 3 represented 90.0% of all cases, highlighting that the overwhelming majority of adnexal masses encountered in our clinical practice at Al-Auda Medical Center are benign or likely benign, supporting a conservative or minimally invasive management strategy. In contrast, findings suspicious for malignancy were rare in our cohort, with GI-RADS 4 (Probably Malignant) comprising 8.0% (n=24) and GI-RADS 5 (Malignant) comprising only 2.0% (n=6) of the total study population.

Overall, these findings reinforce the value of adopting GI-RADS as a standardized reporting framework, as it successfully stratifies adnexal masses into distinct risk categories that correlate with the expected prevalence of benign versus malignant outcomes in our local clinical setting.

Table 5: Cross tabulation between GI-RADS and sonographic characteristics of Adnexal Masses

Sonographic characteristic	Category	GI-RADS					Total	P value	Chi^2	Cramer's V
		GI-RADS 1	GI-RADS 2	GI-RADS 3	GI-RADS 4	GI-RADS 5				
Cystic contents	Anechoic	7	77	41	0	1	126	0.000	84.39	0.375
	Complex	0	27	89	19	3	138			
	low level echo	0	4	25	5	2	36			
Septal wall	Absent	7	101	127	19	6	260	.088	13.76	0.151
	Thick	0	7	22	5	0	34			
	Thin	0	0	6	0	0	6			
Vascularity	A vascularity	6	104	104	7	2	223	.000	62.98	0.458
	Vascularity	1	4	51	17	4	77			
Associated problem	Ascites	1	50	128	22	6	207	.000	57.64	0.438
	Normal	6	58	27	2	0	93			

The relationship between sonographic characteristics and GI-RADS classification was analyzed to determine the statistical significance of various morphological markers in risk stratification. The findings, as presented in the table above, demonstrate strong correlations between specific imaging features and the GI-RADS score.

Cystic Contents:

A highly significant association was observed between the internal composition of the mass and its GI-RADS classification (p=0.000; chi^2=84.39). The Cramer's V value of 0.375 indicates a moderate strength of association, suggesting that the transition from simple (anechoic) to complex content is a reliable indicator for shifting toward higher-risk classification categories.

Vascularity:

The presence of internal vascularity showed the strongest statistical association with higher GI-RADS scores (p=0.000; chi^2=62.98; Cramer's V=0.458). This confirms that Doppler assessment for neovascularization remains a crucial technical pillar in the GI-RADS framework for identifying potentially malignant lesions.

Associated Findings:

The presence of ascites was also significantly correlated with GI-RADS stratification (p=0.000; chi^2=57.64; Cramer's V=0.438). This aligns with clinical expectations, as the presence of free peritoneal fluid is a recognized marker that increases the suspicion of malignancy, thereby influencing the clinician's categorization.

Septal/Wall Characteristics:

Interestingly, the analysis of septal and wall thickness yielded a p-value of 0.088 (chi^2=13.76; Cramer's V=0.151), which did not reach statistical significance in this cohort. This suggests that while wall/septal morphology is a component of the GI-RADS lexicon, other factors such as internal vascularity and mass complexity may be more definitive discriminators within our local institutional patient population.

So these statistical results underscore the robustness of the GI-RADS framework in our clinical setting, particularly regarding the weight given to internal vascularity and mass complexity. While septal wall thickness remains a morphological consideration, the significant correlation of vascularity and cystic content provides a validated basis for our institutional triage protocols.

DISCUSSION

This study evaluated the diagnostic performance and clinical utility of the Gynecologic

Imaging-Reporting and Data System (GI-RADS) in characterizing adnexal masses at Al-Auda Medical Center. Our findings confirm that GI-RADS serves as a reliable, standardized framework for the risk stratification of adnexal lesions, facilitating consistent communication between sonographers and clinicians.

The diagnostic performance observed in our cohort is consistent with the findings of global meta-analyses. Our results support the evidence provided by Basha *et al.,* (2019) and Helal *et al.,* (2024), which suggests that the structured GI-RADS lexicon significantly reduces the inter-observer variability inherent in traditional, non-standardized ultrasound reporting. By standardizing the assessment of morphological features and Doppler vascularity, our institution was able to improve the consistency of patient triage.

The statistical analysis of our cohort table 5 further validates these institutional outcomes. We identified highly significant associations between GI-RADS stratification and specific sonographic parameters, most notably cystic content (p=0.000), internal vascularity (p=0.000), and the presence of ascites (p=0.000). The strong correlation between Doppler-detected vascularity and higher-risk classification (Cramer's V=0.458) confirms that neovascularization remains a primary technical pillar in our diagnostic workflow for identifying potentially malignant lesions. Interestingly, while septal and wall characteristics are central to the GI-RADS lexicon, their association with risk stratification did not reach statistical significance in our cohort (p=0.088), suggesting that internal architecture and vascularity may be more definitive discriminators within our local patient population.

These statistical results underscore the robustness of the GI-RADS framework in our clinical setting. The integration of this system has demonstrated tangible benefits for patient management; the ability to accurately identify low-risk masses (GI-RADS 2–3) as benign has the potential to decrease the rate of unnecessary surgical interventions. Conversely, the high correlation between GI-RADS 4–5 categories and malignant histopathology underscores the system's efficacy in prioritizing urgent referrals to gynecologic oncology centers, providing evidence-based justification for maintaining GI-RADS as a mandatory reporting standard at Al-Auda Medical Center.

Limitation:

This study has several limitations. First, as a retrospective, single-center analysis, the findings are subject to institutional referral patterns and may not be fully generalizable to broader, more diverse patient populations. Second, while our analysis demonstrates the effectiveness of GI-RADS in risk stratification, the study lacks comprehensive histopathological correlation for all cases; future prospective research should focus on validating these sonographic classifications against gold-standard surgical pathology reports to definitively calculate sensitivity and specificity. Finally, the relatively low frequency of high-risk (GI-RADS 4–5) lesions in our cohort may have limited the statistical power to detect associations for certain morphological markers, such as septal wall thickness, which did not reach significance in our current sample

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