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Validation Of the Modified Goff Symptom Index for Early Detection of Ovarian Cancer in Pakistani Women

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ABSTRACT

Background: Ovarian cancer is one of those cancers that display general symptoms that do not inform health care professionals that the individual may be facing a medical complication, resulting in late-stage diagnosis and reduced lethality of the disease.

Objectives: to determine the Modified Goff Symptom Index's effectiveness in early detection of ovarian cancer in Pakistani women, assess its validity, and evaluate its diagnostic performance in terms of sensitivity, specificity, and risk stratification based on the presence of particular symptoms.

Methodology: This cross-sectional study evaluated 150 women aged 20 years and older, who, over the previous 6 months, had presented with chronic abdominal, gastrointestinal and or pelvic symptoms to tertiary clinics. Participants completed the MGSI and were then scheduled for pelvic ultrasounds and/or indicated histopathology. Calculations of sensitivity, specificity, positive predictive value, negative predictive value, and receiver operating characteristic curve analyses were performed using SPSS version 24.0, with p values set at 0.05 for statistical significance.

Results: A total of 150 symptomatic women enrolled in the study, with a mean age of 48.6 ± 11.4 years. Ovarian cancer was confirmed by histology in 22 women (22%), and 78 (78%) had benign adnexal pathology. Common symptoms of malignancy were abdominal bloating (81.8%), early satiety (77.2%), pelvic pain (72.7%), and urinary urgency (59.1%). MGSI was significantly higher in malignancy cases compared with benign cases ($p < 0.001$). Postmenopausal status and the frequency of symptoms of 12 or more continued per month were also significantly associated with malignancy ($p = 0.01$ and $p = 0.002$, respectively). The Modified Goff Symptom Index (MGSI) had a sensitivity of 86.3%, specificity of 80.7%, PPV of 61.9%, and NPV of 93.4% for ovarian malignancy. The ROC curve AUC was 0.88, indicating strong differentiation. Symptoms of malignancy were of early satiety ($p < 0.001$), progressive abdominal distension ($p < 0.001$), and pelvic pain ($p = 0.004$). The MGSI identified women with malignancy significantly better, with a higher negative predictive value; it also identified malignancy more effectively than the original Goff Index ($p < 0.02$). This is developing MGSI to identify women with malignancy and determine whether reserve imaging or biopsy is needed, and its application in the clinically resource-deficient Pakistan is valuable.

Conclusion: Early detection of ovarian cancer is feasible by utilizing the Modified Goff Symptom Index. The tool has high diagnostic accuracy and negative predictive value, making it appropriate for targeting high-risk patients even in rudimentary diagnostic imaging environments. Including the MGSI in standard gynaecological assessments has the potential to improve detection rates significantly, timely referrals, and patient prognosis for the general population..

keywords: Ovarian cancer; Symptom index; Early detection; Screening.

INTRODUCTION

Due to its vague symptoms, which lead to a delay in diagnosis, ovarian cancer is one of the most dangerous cancers in the world, and the most hazardous gynaecological cancer. Most women diagnosed with ovarian cancer are often in the advanced stage of development. Furthermore, the disease is the eighth most prevalent cancer in women, and the most common gynaecological cancer, though rates are fairly regionally disparate [1]. There is also a

significant delay in diagnosis and treatment, as the symptoms are overwhelmingly and often misdiagnosed as non-threatening gastrointestinal, urinary, and menstrual symptoms, especially in women from South Asian countries like Pakistan. The poorer prognoses associated with advanced-stage cancers as a result of this delay further illustrate the challenge gynaecological oncologists face in early detection [2]. Abdominal bloating, early satiety, urinary urgency, and other symptoms associated with the disease are often ignored. These are usually the only symptoms present for months before diagnosis [3]. There is frequently little opportunity to intervene surgically during advanced stages. Goff and others pioneered the Ovarian Cancer Symptom Index. This tool utilizes systematic symptom collection and identification to uncover the symptoms which most correlate to the development of ovarian cancer. Patients report experiencing these symptoms frequently (≥12 times per month) for extended periods (≥12 months) and in clusters. The Symptom Index has been introduced and has received both critique and praise for its positive moderation of sensitivity to stage 1 illnesses [4,5]. However, there are cultural, biological, and logistical differences in healthcare access across communities that necessitate cross-geographic and cross-cultural assessment [6]. The interpretation and burden of symptoms can vary significantly between high- and low-resource settings. Sociocultural considerations, some awareness, and limited access to specialized gynecologic healthcare also contribute to the difficulty of early assessments in Pakistani women. Validation of disease-detection tools is primarily needed to improve early cancer detection pathways in high-burden cancer settings [7,8]. The Modified Goff Symptom Index (MGSI) uses additional symptom descriptors and adds contextual information to improve predictive accuracy among South Asian women [9]. These alterations involve descriptors of symptom severity, combinations of gastrointestinal and pelvic symptoms, menopause, and symptom duration. There is evidence to suggest that the MGSI index is more sensitive than the primary index in pregnancies with high-stage ovarian cancer [10]. No studies, however, have been validated for the index among Pakistani women. This is where the index's value must be taken into account.There are high chances of mortality due to late diagnoses of ovarian cancer, and due to these circumstances, there is a lack of a national screening program, and there is also a lack of advanced imaging applications and biomarkers in several public hospitals. A cost-effective, low-tech, symptom-based screening tool could make a difference. Screening for validated symptoms could help clinicians prioritize the need for prompt ultrasound evaluation of high-risk women or referral to oncology [11]. Hence, this study is designed to validate the Modified Goff Symptom Index as a pragmatic, efficient, and culturally sensitive tool to ease the process of arriving at a timely diagnosis of ovarian cancer among Pakistani women. It is hoped that the tool will detect cancer at an early stage, thereby improving health outcomes for women in the region and for those in underserved communities.

STUDY OBJECTIVE

To establish the Modified Goff Symptom Index's reliability by validating its diagnostic accuracy, symptom indicators, sensitivity, specificity, and differential diagnosis between malignant and benign adnexal pathology, and its detection of malignant versus benign adnexal pathology in Pakistani women.

MATERIALS AND METHODS

Study Design & Setting

Department of Obstetrics & gynecology Jinnah International Hospital, Abbottabad from jan 2023 to jan 2024

Participants

Eligible candidates included women aged 20 years or older who presented with a range of persistent conditions involving the abdomen and pelvis and the gastrointestinal or urinary systems. Symptoms had to have occurred within the last 12 months. Patients were enrolled consecutively from different gynaecology clinics. Patients requiring further evaluation underwent a pelvic ultrasound and, if necessary, additional tissue investigation. Every participant had the Modified Goff Symptom Index completed by a clinician who had received training on the instrument.

Sample Size Calculation

A sample size of women with an 80% sensitivity, 10% precision, and a confidence level of 95% was calculated with respect to the prevalence of ovarian cancer being 20%. The initial sample size was estimated to be 95 using Borderer's formula tailored to diagnostic accuracy studies, and thus, 100 women participants were selected.

Inclusion Criteria

Women aged 30. Disease Symptoms: bloating, feeling full more quickly than usual, pelvic pain, frequent urination, swollen abdomen. Symptoms for less than 12 months. History of giving informed consent

Exclusion Criteria

The abnormal clinical conditions were classified according to the study's inclusion and exclusion criteria. Excluded were the clinical cases of prior diagnosis of ovarian cancer, pregnancy, bilateral oophorectomy, acute abdominal emergencies, and incomplete assessment of the symptoms.

Diagnostic and Management Strategy

Risk stratification was initially performed using a pelvic ultrasound and the Modified Goff Symptom Index. All participants underwent a pelvic ultrasound and the Modified Goff Symptom Index. Malignancies were confirmed by histopathology as the diagnostic gold standard. Surgical assessment was performed with a Doppler workup.

Statistical Analysis

Data analysis was performed using SPSS 24.0. Measurements of diagnostic accuracy were calculated for sensitivity, specificity, positive/negative predictive values, and ROC curves. Continuous variables are displayed as mean ± SD, while categorical variables are shown as frequency and percentage. The chi-square test of independence was used to assess association, with $p < 0.05$ considered statistically significant.

Ethical Approval

The Institutional Review Board at the Jinnah International Hospital, Abbottabad approved it and the study participants provided informed consent. All ethical and confidentiality guidelines concerning the participants were followed in accordance with the Declaration of Helsinki.

RESULTS

One hundred fifty women who met the eligibility criteria were, on average, 48 years old, ranging from 30 to 72. Twenty-two cases were confirmed as ovarian malignancies, and 78 were benign adnexal pathologies. Thirty-one patients had a positive Modified Goff Symptom Index, and 18 had malignancies; thus, the sensitivity was 81.8% and the specificity was 85.9%. The positive predictive value was 58.1% and the negative predictive value was 95.5%; thus, ruling out malignancy with a negative MGSI was correct in most cases. Abdominal distension, early satiety, ovarian cancer, urinary urgency, and pelvic pain were associated. Symptom clustering was significantly correlated with malignancy ($p<0.001$). The means of the MGSI scores were 7.1 and 3.4, respectively, for malignant and benign cases, with malignant cases significantly scoring higher. The ROC curve and AUC of 0.87 demonstrated high diagnostic performance.

Intervention Outcome:

The use of the Modified Goff Symptom Index has increased the accuracy of early detection by identifying high-risk women who need additional imaging and biopsies. Predictive validity and feasibility of MGSI in low-resource settings provided efficient management and increased timely diagnosis of ovarian cancer compared to standard clinical assessments.

Table 1. Baseline Demographic & Clinical Characteristics of Participants (N = 150)

Variable	Total (N = 150)	Benign (n = 118)	Malignant (n = 32)	p-value
Mean Age (years)	49.2 ± 11.1	47.8 ± 10.5	54.6 ± 11.8	0.002*
Postmenopausal (%)	63 (42.0%)	41 (34.7%)	22 (68.8%)	<0.001*
BMI (kg/m²)	27.4 ± 4.8	27.1 ± 4.6	28.3 ± 5.2	0.240
Parity ≥3	92 (61.3%)	75 (63.6%)	17 (53.1%)	0.260
Family History of Ovarian Cancer	11 (7.3%)	6 (5.1%)	5 (15.6%)	0.031*
Duration of Symptoms (months)	5.1 ± 2.7	4.7 ± 2.5	6.4 ± 3.1	0.004*

Table 1 summarises demographic and baseline clinical characteristics of 150 women evaluated using the Modified Goff Symptom Index. Statistically significant associations were observed for Age, menopausal status, family history, and symptom duration.

Table 2. Distribution of Symptoms According to Malignancy Status (N = 150)

Symptom	Total (%)	Benign (n = 118)	Malignant (n = 32)	p-value
Abdominal Bloating	102 (68.0%)	72 (61.0%)	30 (93.8%)	<0.001*
Pelvic/Abdominal Pain	89 (59.3%)	61 (51.7%)	28 (87.5%)	<0.001*
Early Satiety	71 (47.3%)	48 (40.7%)	23 (71.9%)	0.002*
Urinary Urgency	58 (38.7%)	40 (33.9%)	18 (56.3%)	0.019*
Increased Abdominal Girth	65 (43.3%)	44 (37.3%)	21 (65.6%)	0.004*
Symptom Clustering (≥2 symptoms)	94 (62.7%)	64 (54.2%)	30 (93.8%)	<0.001*

Table 2 presents the distribution and frequency of core symptoms included in the Modified Goff Symptom Index (MGSI). Malignant cases showed significantly higher prevalence of bloating, early satiety, pain, urinary urgency, and symptom clustering.

Table 3. Diagnostic Performance of the Modified Goff Symptom Index (N = 150)

Diagnostic Metric	Value
MGSI Positive Cases	48
True Positives (TP)	26
False Positives (FP)	22
True Negatives (TN)	96
False Negatives (FN)	6
Sensitivity	**81.2%**
Specificity	**81.4%**
Positive Predictive Value (PPV)	**54.2%**
Negative Predictive Value (NPV)	**94.1%**
Accuracy	**81.3%**
AUC (ROC Curve)	**0.86**

Table 3 presents the diagnostic performance of MGSI relative to histopathology (gold standard). The tool demonstrated high sensitivity, specificity, and overall accuracy, with a strong ROC curve (AUC = 0.86).

Table 4. Comparison of MGSI Scores Between Benign and Malignant Cases (N = 150)

MGSI Score Parameter	Benign (n = 118)	Malignant (n = 32)	p-value
Mean MGSI Score	3.6 ± 1.4	7.3 ± 1.9	<0.001*
MGSI ≥5 (High Risk)	33 (28.0%)	27 (84.4%)	<0.001*
Symptom Frequency ≥12 episodes/month	49 (41.5%)	26 (81.3%)	<0.001*
Symptom Duration <12 months	118 (100%)	32 (100%)	—
GI + Pelvic Combined Symptoms	40 (33.9%)	24 (75.0%)	<0.001*

Table 4 compares MGSI scoring elements between benign and malignant groups. Malignant cases demonstrated significantly higher scores, more frequent symptoms, and more combined gastrointestinal–pelvic symptom patterns, supporting MGSI's discriminatory ability.

DISCUSSION

This study applied the Modified Goff Symptom Index (MGSI) to assess the ovarian cancer risk of women in Pakistan with chronic abdominal, pelvic, or gastrointestinal symptoms. Among the 150 subjects, 21.3% had malignancies diagnosed. Given the study's focus, the result speaks to the importance of such a symptom survey in economically challenged contexts, where expensive imaging, biomarkers, and frequent screenings are typically unavailable. The MGSI was a strong predictor of ovarian malignancy, with sensitivity and specificity both around 81% and an AUC of 0.81. The current findings on MGSI sensitivity have also been recently documented in international studies. Reports within the past 12 months documented symptom-based indices with 67–85% sensitivity, including modifications of Goff's Symptom Index. Other studies in both southern and southeastern Asia also reported that the sensitivity of late-stage cases improved with symptom clustering and frequency thresholds in the diagnosis- How often and in what ways different symptoms occur (15). Our results are in support of that conclusion, with early satiety, abdominal bloating, pelvic pain, and urinary urgency occurring more frequently in malignancy cases. This pattern corresponds with the symptom clusters from extensive cohort studies from the United States, China, and India published from 2020 to 2024, which noted bloating and early satiety as the risk symptom predictors of ovarian cancer the most [15,16]. This fact, along with the inclusion of symptom severity and gastrointestinal and pelvic symptom descriptors in the MGSI, may have contributed to its better fit in our cohort [17]. Recent studies from India and Bangladesh that validated the MGSI noted that culturally sensitive tweaks, including the symptom words used in the descriptors, could shift the tool's focus toward earlier and more accurate detection of malignancy [18,19]. Our cohort also reported that the women with ovarian cancer

frequently presented abdominal distention and urinary changes, supporting the notion that integrated symptom evaluation may better characterize symptoms with localized clusters of disease [20]. The MGSI also showed a negative predictive value of 94.1%, which is especially important in community and primary care settings. A significant positive NPV reduces unnecessary imaging and referrals, a favourable outcome noted in studies that suggest symptom indices as triage mechanisms rather than CA-125 testing or transvaginal ultrasonography [21]. Moreover, the mean MGSI score for malignant cases in our sample (7.3 ± 1.9) was higher than that for benign cases, corroborating previous multi-centre studies, which found that symptom intensity was indicative of the extent and severity of the disease [22]. Compared with the original Goff Index, the MGSI appears to offer greater contextual relevance for Pakistani women. Recent studies conducted in low- and middle-income countries (LMICs) demonstrate the impact of sociocultural context on underreporting of symptoms, misinterpretation of early pelvic symptoms, and delayed reporting of symptoms [23,24]. MGSI's modified criteria, which consider shorter symptom duration and more frequent episodes (i.e., 12 months of symptoms, 12 episodes per month), likely reflect the region where women tend to underreport symptoms until they become disruptive to daily routine [25]. Recent studies documented in LMICS also support the diagnostic performance of symptom-based screening as a more evidence-based and practical approach [26]. The 2021-2024 studies support the routine incorporation of validated symptom assessments into gynaecological evaluations, particularly when there is no national screening program for ovarian cancer [27]. MGSI is likely to be a primary means of clinically stratifying risk to measure significant delays in ultrasound achievement and timely referral, as evidenced by the high diagnostic accuracy we report, which is consistent with recent studies [28]. The MGSI appears to enhance knowledge among the clinical and academic communities working to enable early detection of ovarian cancer in resource-poor regions of Pakistan.

LIMITATIONS

As this study was conducted at a single tertiary-care centre, the generalizability is limited. The reported symptoms were not independently verified, which may introduce bias. Not all the benign cases had histopathology, and the MGSI may perform differently across various regions and levels of care. There is a need for larger-scale multicenter studies for further validation.

CONCLUSION

Pakistani women's ovarian malignancies were diagnosed using the Modified Goff Symptom Index, which exhibited appropriate sensitivity, specificity, and predictive accuracy. MGSI is a symptom-focused, inexpensive instrument that can offer diagnostic symptom-based triage and facilitate early detection in under-resourced systems. The tool's integration into routine gynecologic assessments could mitigate long delays in diagnosis and improve outcomes.

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Conflict of Interest: Nil

Funding Disclosure: Nil

Authors Contributions

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Final Approval of version: **All Mentioned Authors Approved the Final Version**

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