Diagnostic Techniques In Ovarian Cancer

Diagnosis of ovarian cancer is impeded by the absence of symptoms in the early stage hence the disease presents with a high mortality rate. Since the discovery of carcinoembryonic antigen (CEA), cancer antigen 125 (CA125) to the development of multivariate assays (Ova1, ROMA, Overa) that have increased specificity and sensitivity, there has been considerable progress in the discovery of biomarkers for the detection of ovarian cancer at an early stage. The use of ultrasound, MRI, PET/CT, PET/MRI, Computer-Aided Detection (CAD) algorithms can help in predicting whether neoplasms are benign or malignant. Since the disease has a higher prevalence in postmenopausal women, annual screening with the use of an all-inclusive biomarker panel and the use of imaging techniques for high-risk populations is expected to make early diagnosis possible. This may in turn help in reducing the mortality rate. This review article briefly describes various biomarkers involved and the use of imaging techniques such as ultrasound, MRI, and CT scan that facilitate the diagnosis of ovarian masses.

Despite being termed ovarian, many high-grade serous tumors are believed to have originated in the fallopian tube as well then metastasize to the ovary. Hence the term ovarian cancer encompasses epithelial cancers having origin in the ovary, fallopian tube, and all other histologically relevant peritoneal cancers. Ovarian cancer is a disease of postmenopausal women, the risk increasing with age and peaking around 70 years1.

Genetic risk factors identified include mutations in BRCA1 and BRCA2 genes and Hereditary Non-Polyposis Colorectal Cancer (HNPCC)/Lynch syndrome which place women at an increased risk of developing ovarian cancer. Nongenetic risk factors that play a role in the development of this disease include age at menarche and menopause, pregnancy, breastfeeding, infertility/fertility drug use, oral contraceptives, menopausal hormones, chronic inflammation, and Non-Steroidal Anti-Inflammatory Drugs (NSAIDs), diet, alcohol, smoking, talc, and asbestos exposure1.2.

According to Globocan 2018 data, in India, ovarian cancer accounts for 3.1% of all cancer cases and 6.2% of female cancers. Among the gynecological malignancies, ovarian cancer is one of the most invasive diseases with an age-standardized mortality rate of 57.5% 3,4. In 2018, 36,170 women were diagnosed with ovarian cancer with 24,015 deaths making it the 9th most common cause of cancer death4.

Commonly associated symptoms with ovarian cancer include abdominal distension, abdominal or pelvic bloating, abdominal mass, loss of appetite, and abdominal or pelvic pain. Other symptoms encountered include diarrhea, isolated abdominal pain, weight loss, change in bowel habits, constipation, urinary frequency or urgency, dyspepsia, and abnormal vaginal bleeding. These symptoms however are quite subjective5. Many women lack the symptomatic phase. The symptoms are of vague nature and are often encountered in healthy women as well. Also, a precancerous lesion in epithelial ovarian cancer has not been detected, and hence examining early changes in the ovary is not possible6.

Cystic solid or solid adnexal masses can be detected by the use of 3D power Doppler angiography vascular indices. This method may be of significance with regards to specificity

over gray-scale and 2D power Doppler US. However, the practicability of its use in routine diagnosis is still questioned. Computer-aided detection (CAD) algorithms make use of images by the US and using artificial intelligence grades the lesions as benign or malignant. Specificity and sensitivity revealed were 99.2 and 99.6% respectively. However, the large population must be screened before establishing it as a definitive diagnostic technique for routine practice17.

Ultrasound (US) combined with the transabdominal approach gave poor resolution. However, with the advent of the transvaginal probe, the accuracy was increased and was used as a gold standard for detecting adnexal masses. ‘Pattern Recognition can be used to identify different types of tumors depending on their peculiar appearance on gray-scale imaging. The application of Color Doppler has been limited in distinguishing neoplasms that have vascularity in the center or those that were recognized as malignant in B-mode sonography17.

The sensitivity of US and MRI to detect malignant ovarian neoplasms is 100% and 97% respectively. However, the specificity and accuracy of detection by MRI are higher as compared to the US. The apparent diffusion coefficient (ADC) obtained by diffusion-weighted MRI (DWI) has also been useful to differentiate benign and malignant masses18.

Another perspective technique to diagnose ovarian cancer is PET/CT which can effectively diagnose malignant and borderline tumors. Compared to pelvic US and CT or MRI, PET/CT has a precision of 92% against 83% and 75% respectively. Sensitivity and specificity for detecting malignant lesions were reported to be 87 and 100% respectively. Given the greater resolution of soft tissues and no artifacts by MRI, it is considered superior to CT. DWI/MRI can be used to assess the metastatic spread of the disease. Compared to PET/CT radiation exposure was reduced to 80% in PET/MRI. A study reported that for recurrent pelvic malignancies both PET/CT and PET/MRI are of significant diagnostic value. When it comes to defining primary tumors, PET/MRI is superior to PET/CT.

In the last few years, a wide range of biomarkers has been tested in various combinations with improved specificity and sensitivity. Thus, designing an appropriate biomarker panel that will precisely detect ovarian cancer in the early stage is the immediate need. Combining the results obtained by ultrasonography and using different models suggested by IOTA may help in a preliminary screening of high-risk populations. The use of non-invasive techniques such as determining the miRNA levels or concentration of cfDNA is also an emerging tool for diagnosis. A large cohort study for precision levels obtained by the use of CAD algorithms in detecting pelvic mass would help in confirmatory diagnosis at the early stage possible. PET/CT and PET/MRI have similar outcomes in the diagnosis of pelvic masses. This suggests that the appropriate use of nucleic acid and protein biomarkers along with medical imaging techniques should help provide a clear diagnostic image of the gynecological malignancies at an earlier stage. This would facilitate early medical intervention probably chemotherapeutic sessions and thereby improving cancer survival rates.

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