Role of Positron Emission Tomography (PET/CT) in Diagnosis of Ovarian Cancer

Essay

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Presented by

Emad Sanad Andrawis
(M.B., B.Ch.)

Under Supervision of

Prof. Dr. Faten Mahmoud Kamel
Professor Radiodiagnosis
Faculty of Medicine - Ain Shams University

Dr. Ihab Mohamed Mahmoud Rassem
Lecturer of Radiodiagnosis
Faculty of Medicine - Ain Shams University

Faculty of Medicine
Ain Shams University
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List of Abbreviations

BGO	**Bismuth Germinate Oxide**
CM	**Centimeter**
CT	**computed tomography**
DL	**DECILETER**
EOC	**Epithelial Ovarian Cancer**
FDG	**Flourodeoxyglucose**
IU	**International Unit**
keV	**Kilo electron volt**
LN	**Lymph Node**
LOR	**Line Of Response**
LSO	**Lutetium Oxyothosilicate**
MALT	**Mucosa Associated Lymphoid tissue Lymphomas**
MRI	**Magnetic Resonance Imaging**
O_2	**Oxygen**
OC	**Ovarian Cancer**
PET	**Positron Emission Tomography**
PMT	**Photomultiplier tubes**
RMI	**Risk of Malignant Index**
SEC	**Second**
SPECT	**Positron Emission Computed Tomography**
SUV	**Standarized Uptake Value**
US	**Ultrasound**
^{18}F	**radioactive flourine**
2D	**two dimensional**
3D	**three dimensional**

INTRODUCTION

Ovarian carcinoma is the leading cause of death among women with gynecologic malignancies. In ٢٠٠٣, there were ٢٤, ٥٠٠ new cases of ovarian cancer in the US with ١٤, ٣٠٠ deaths attributed to this disease ***(Jemal el al., ˜ ˜ ˜ ˜).***

Most ovarian tumors are first discovered in the advanced stage. Ovarian cancer commonly seeds the peritoneal surfaces of the abdomen and pelvis, and is often seen on the serosal and mesenteric surfaces of the large and small bowels as well as on the hepatic surface. The right and left hemi diaphragms are also common metastatic sites. Epithelial ovarian cancer also has the potential to spread through the lymphatics and commonly involves para-aortic lymph nodes without affecting the pelvic nodes. Ovarian cancer rarely metastasizes via the blood to the liver, lung, bone, or brain ***(Kim, ˜ ˜ ˜ ˜).***

Positron emission tomography (PET) is non invasive nuclear medicine study that has been in existence for almost ٣٠ years, but has been acceptance in oncologic imaging rapidly during past five years ***(Grossman et al., ˜ ˜ ˜ ˜).***

Positron emission tomography (PET) is a unique form of diagnostic imaging that observes in vivo biological changes using radiopharmaceuticals that closely mimic endogenous molecules. ١٨F-FDG. which allows the evaluation of glucose

metabolism is the most commonly used tracer in oncology. ١٨F-FDG uptake in the tumors is proportional to the glycolytic metabolic rate of viable tumour cells indicating the increased metabolic demands of tumour for glucose ***(Kostakoglu et al.,*** ***).***

The average serum CA-١٢٥ in the ٩٧ studied patients was ٧٨٤ U/ml. PET/CT demonstrated areas of abnormally increased metabolic activity considered highly suspicious for malignant tumor in ٦٠ patients (٦٢٪). In ٣٧ patients (٣٨٪) the tumors were considered benign on PET/CT. Histopathology showed benign tumors in ٤٠ patients and malignant tumors in ٥٧ patients. The sensitivity and specificity for PET/CT in diagnosing a malignant pelvic tumor were ١٠٠٪ (٥٧/٥٧) and ٩٢,٥٪ (٣٧/٤٠), respectively. Combined PET/CT demonstrates high diagnostic value in identifying primary ovarian cancer in patients with a pelvic mass of unknown origin and RMI>١٥٠. We suggest PET/CT as the image modality of choice when US shows a pelvic tumor and additional information prior to surgery is needed ***(Rieber et al.,*** ***).***

Positron emission tomography (PET) is an imaging technology that can reveal functional information distinguishes it from other imaging modalities such as magnetic resonance imaging (MRI) and computed tomography (CT) that provide primarily anatomic information ***(Rohern et al.,*** ***).***

Positron emission tomography (PET) is a well established method for detecting and staging malignant tumors including gynecologic cancers ***(Zimney el al.,).***

The advantages of Positron emission tomography (PET) over other imaging modalities for tumor detection are its functional characteristics, high resolution, and non-invasiveness ***(Kubota et al.,).***

AIM OF THE WORK

The aim of the work is to evaluate the rule of Positron emission tomography (PET) in diagnosis of ovarian cancer.

ANATOMY OF THE OVARY

The ovaries are paired almond shaped reproductive and endocrine organs that lie in the ovarian fossa, situated in the lateral pelvic side walls ***(Vinnicombe and Husband, ٢٠٠٣).***

Ovarian Embryology:

I) Indifferent stage:

Both testis and ovary pass through an indifferent stage, during which they are similar histologically till the ٧th week of development. Although they are genetically determined, they are composed of :

- Primitive germ cells : endodermal cells from the yolk sac migrate to the gut, then pass along the mesentery of the gut to lie among the cells of the sex cords (Fig.١).
- Sex cords: the coelomic epithelium (mesodermal) between the mesonephros and the dorsal mesentery differentiate into germinal epithelium.The later proliferate to form strands called sex cords (Fig.٢ A).
- The sex cords occupy the periphery of the indifferent gonad and form the cortex, while the centre of the gonad is occupied by mesenchyme and few sex cords to form the medulla.

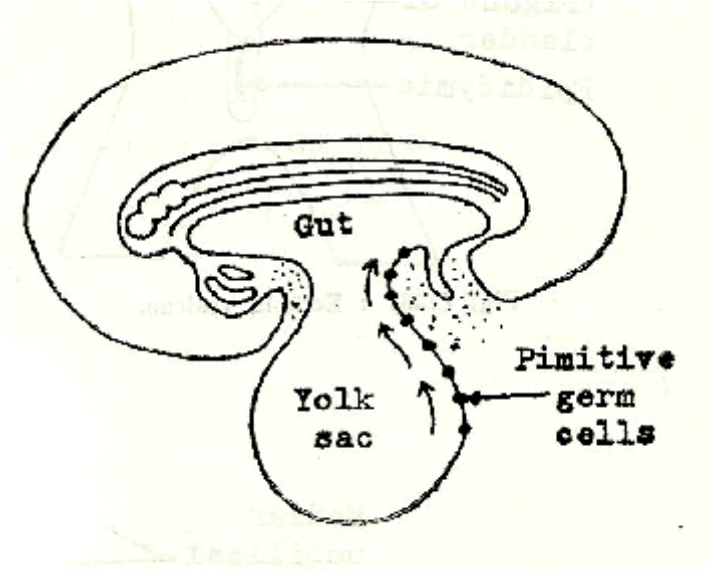

Figure (١): A diagram to show migration of the primitive germ cells from the yolk sac to the gonads ***(Quoted from Allam,).***

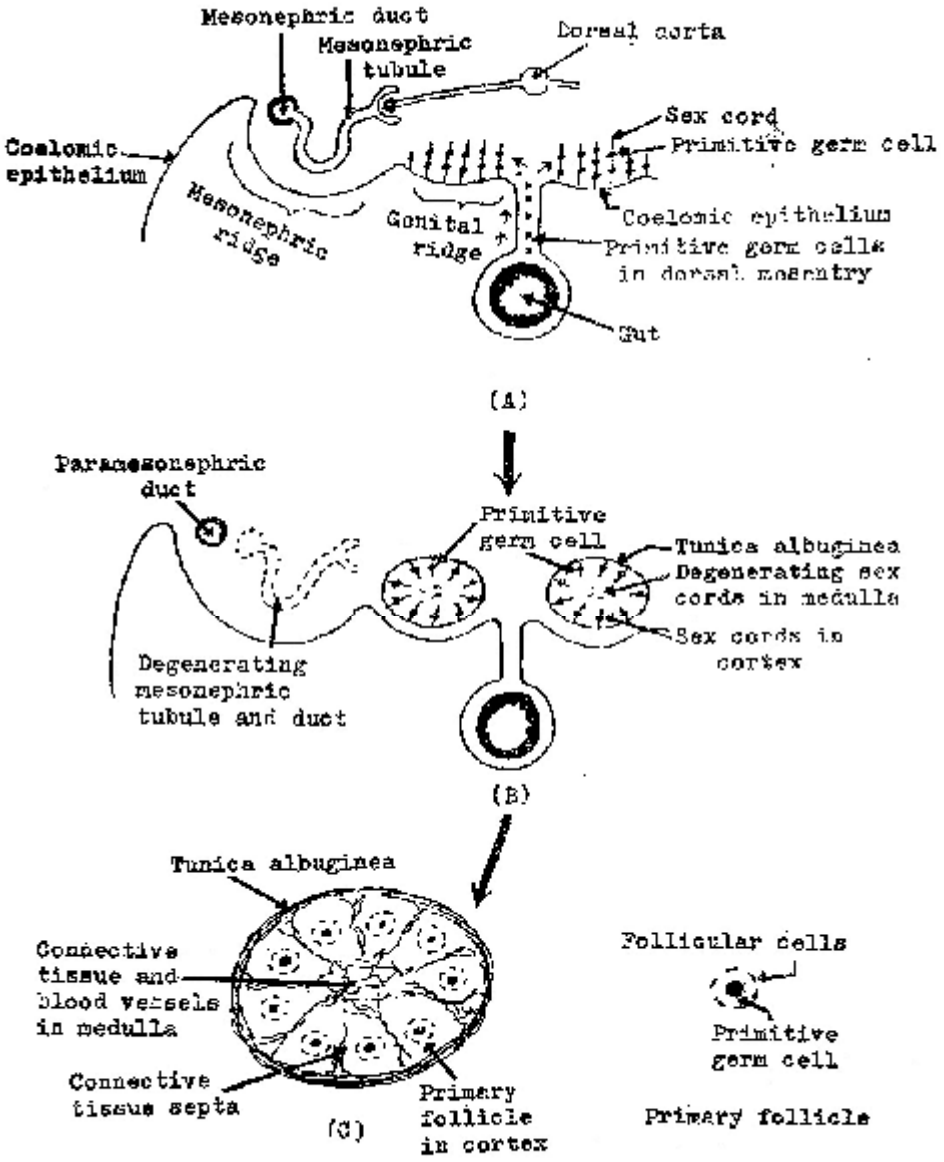

Figure (٢): A diagram to show the development of the ovary. **(A)** Indifferent stage. **(B, C)** stages of differentiation ***(Quoted from Allam,).***

II) Differentiation of the ovary : (Fig.٢ B&C)

- An incomplete fibrous capsule called tunica albuginea separates the sex cords from the coelomic epithelium.
- The sex cords in the medulla degenerate and become replaced by vascular connective tissue.
- The sex cords in the cortex are divided by connective tissue septa into small masses called primary follicles. Each primary follicle consists of a single layer of flat cells called follicular cells (derived from the coelomic epithelium) around one primitive germ cell (oogonium).
- Unlike the testis, the ovary fails to join the adjacent mesonephric tubules and duct.
- The ovaries descend to enter the pelvic cavity .

Location:

Each ovary has medial and lateral surfaces, anterior and posterior border and superior and inferior poles, Usually the ovary lies with its long axis vertical, but this is dependent on parity and bladder and bowel filling ***(Vinnicombe and Husband, ٢٠٠٣).***

The ovaries can be quite variable in position and are influenced by the uterine location and the ligament attachments. In the anteflexed midline uterus, the ovaries are usually