Role of Contrast Enhanced MRI Correlation with Diffusion Weighted Imaging in Charactarization of Benign Ovarian Lesions

Thesis

Submitted for Partial Fulfillment
of Master Degree in **Radiology**

By

Mohamed Mahmoud Ali Hassan
M.B.B.Ch, Ain Shams University

Under Supervision of

Prof. Mohsen Gomaa Hassan Ismail
Professor of Radio Diagnosis
Faculty of Medicine – Ain Shams University

Dr. Ahmed Sami Abd Elrahman
Lecturer of Radio Diagnosis
Faculty of Medicine, Ain Shams University

Faculty of Medicine - Ain Shams University
2019

سورة البقرة الآية: ٣٢

Acknowledgments

First and foremost, I feel always indebted to ***Allah*** *the Most Beneficent and Merciful.*

I wish to express my deepest thanks, gratitude and appreciation to ***Prof. Mohsen Gomaa Hassan Ismail****, Professor of Radio Diagnosis, Faculty of Medicine, Ain Shams University, for his meticulous supervision, kind guidance, valuable instructions and generous help.*

Special thanks are due to ***Dr. Ahmed Sami Abd Elrahman****, Lecturer of Radio Diagnosis, Faculty of Medicine, Ain Shams University, for his sincere efforts, fruitful encouragement.*

I would like to express my hearty thanks to all my family for their support till this work was completed.

Mohamed Mahmoud Ali Hassan

List of Contents

List of Tables

List of Figures

List of Figures cont...

INTRODUCTION

Ovarian cancer is a leading cause of death among gynecological malignancies, and the fifth most common cause of cancer deaths in women ***(Mironov et al., 2007).***

DWI sequences characterize the restriction of random (Brownian) movement of water molecules within tissues. The strength of diffusion weighting is characterized by the diffusion gradient factors can provide quantitative measurement of ADC values in a region of interest ***(Coats et al., 2009).***

To date, MRI tends to be an accurate imaging technique for ovarian cancer because of its noninvasive nature and there is no risk of radiation exposure, and no need of patient preparation. MRI is substantially better than ultrasonography and CT.DWI is a newly developed magnetic resonance functional imaging technique based on water molecules movement rather than structure.

For ovarian or uterine tumors, clinical adoption of DWI has been hampered by the significant overlap observed in the apparent diffusion coefficient (ADC) values of benign and malignant lesions ***(Li et al., 2012).***

Results demonstrated that for ovarian cancer detection, DWI had both moderately high specificity (86%) and sensitivity (81%). Actually, high sensitivity and NPV of DWI

indicated higher correct diagnostic rate for patients in early stages ***(Das et al., 2014).***

There was overlap of ADC value between malignancy and benign lesions. Pathologic structures of benign tumors such as fibromas, Brenner tumors, and cystadenofibromas probably contributed to the apparent discrepancy significantly. Inside the extracellular matrix of benign fibrous tumors the presence of dense network of collagen fibers and abundant collagen producing fibroblastic cells decreased ADC value ***(Zhang et al., 2012).***

Malignant tissues exhibited increased ADC value due to the existence of necrosis or cystic areas and fluid collection intervening papillary components ***(Xia Yuan et al., 2017).***

Aim of the Work

The purpose of this study was to assess the contribution of diffusion-weighted MR imaging (DWI) for characterizing benign ovarian complex masses.

Chapter 1

ANATOMY OF THE OVARIES

The ovary is an ovum- producing reproductive organ. Ovaries in female are homologous to testes in males in that they are both gonads and endocrine glands ***(Lewis et al., 2003).***

Gross anatomy:

The ovaries are ovoid, almond shaped structures that vary considerably in size depending on age, hormonal status, and the stage of menstrual cycle. The adult ovary is about 2.5-5 cm long, 1.5-3 cm wide, and 1-2 cm thick. The ovaries are of grayish-pink color. It lies in a shallow depression, named the ovarian fossa. This fossa is bounded above by the external iliac vessels, in front by the obliterated umbilical artery, and behind by the ureter ***(Faysal et al., 2004).***

In general the ovarian position is influenced by uterine size, ovarian size, degree of filling of urinary bladder, degree of distention of the recto sigmoid colon and the presence of a pelvic mass **(*Faysal et al., 2004*).**

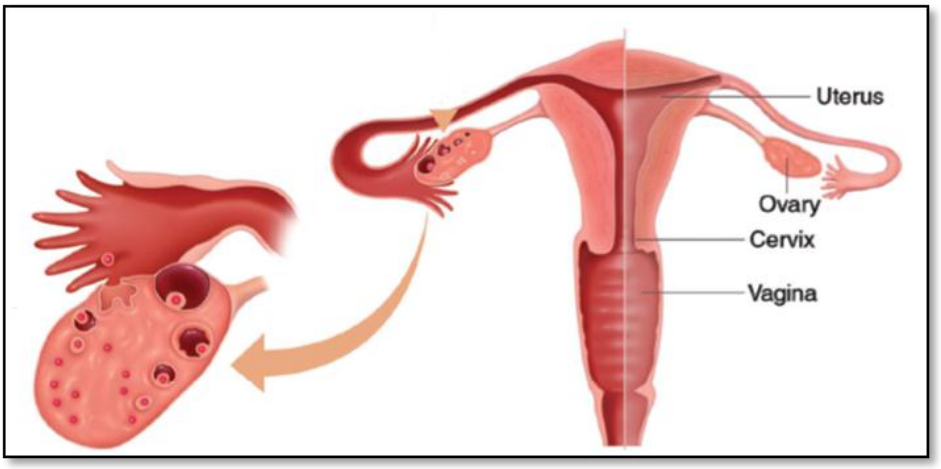

Figure 1: Illustration shows the ovarian fossa ***(Faysal et al., 2004).***

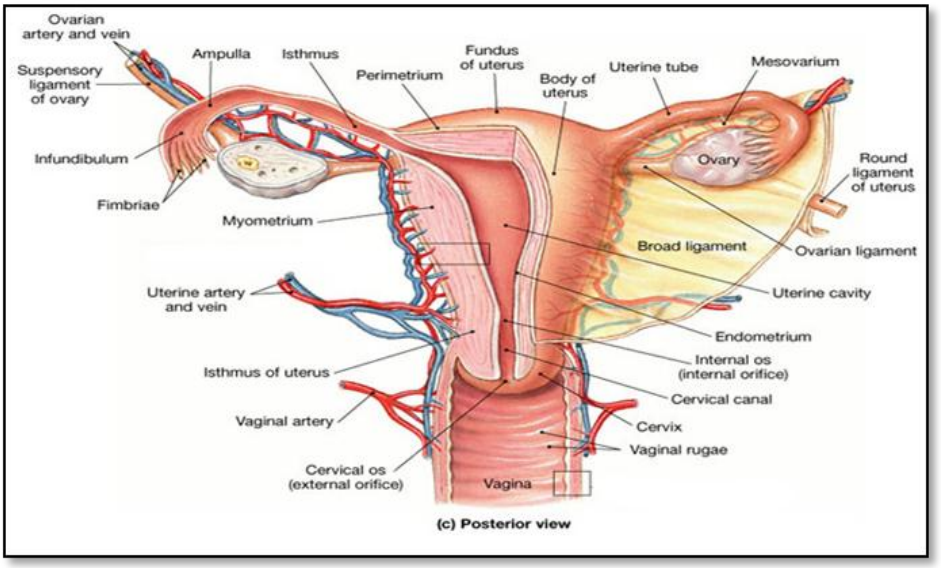

Figure 2: Illustration shows the ovarian anatomy ***(Faysal et al., 2004).***

Ligaments:

Utero-Ovarian Ligament

The utero -ovarian ligament (proper ligament of the ovary) is a cordlike structure invested with the posterior layer

of the broad ligament. It consists of smooth muscle and connective tissue. The ovarian ligament extends from the lower ovarian pole to the lateral uterine wall. It is located between the mesosalpinx and the mesovarium ***(Dooms et al., 1986).***

Infundibulo-pelvic Ligament

The Infundibulo-pelvic ligament (suspensory ligament of the ovary) is a fan-shaped band of fibromuscular visceral connective tissue containing arteries, veins, lymphatics, and visceral nerves extending from the upper ovarian pole to the lateral pelvic wall. This ligament passes from the abdominal cavity into the pelvic cavity at the level of the pelvic brim, superficial to the bifurcation of the common iliac artery, just lateral to where the ureter passes over the bifurcation of the common iliac vessels ***(Ascher et al., 1997).***

Mesovarium

The mesovarium is a short peritoneal fold from the posterior surface of the broad ligament to the anterior ovarian wall. It facilitates the passage of ovarian vessels and nerves into the ovarian hila. The mesovarium, the infundibulo pelvic ligament, and the utero-ovarian ligament together support the ovary in its position along the pelvic sidewall ***(Doherty et al., 2000).***

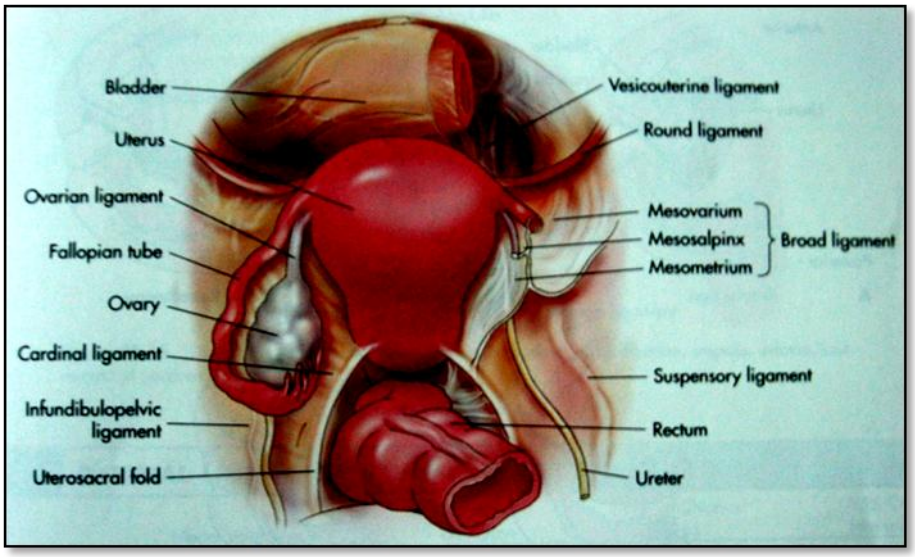

Figure 3: Ovarian ligaments ***(Faysal et al., 2004).***

Microscopic anatomy:

The ovaries are covered on the outside by a layer of simple cuboidal epithelium called germinal (ovarian) epithelium. This is actually the visceral peritoneum that envelops the ovaries. Underneath this layer, there is a dense connective tissue capsule, the tunica albuginea. The substance of the ovaries is distinctly divided into an outer cortex and an inner medulla. The cortex appears more dense and granular due to the presence of numerous ovarian follicles in various stages of development. Each of the follicles contains an oocyte, a female germ cell. The medulla is loose connective tissue with abundant blood vessels, lymphatic vessels, and nerve fibers. Vesicular ovarian follicles (Graafian follicles) are follicles containing the ova. Immediately beneath the superficial covering is a layer of stroma, in which are a large number of

minute vesicles, of uniform size, about 0.25 mm in diameter. These are the follicles in their earliest condition and the layer where they are found has been termed the cortical layer. They are especially numerous in the ovary of the young child, after puberty, and during the whole of the child-bearing period. Large and mature follicles are also found in the cortical layer in small numbers, and also corpora lutea the remains of follicles which have burst and are undergoing atrophy and absorption ***(William et al., 2006).***

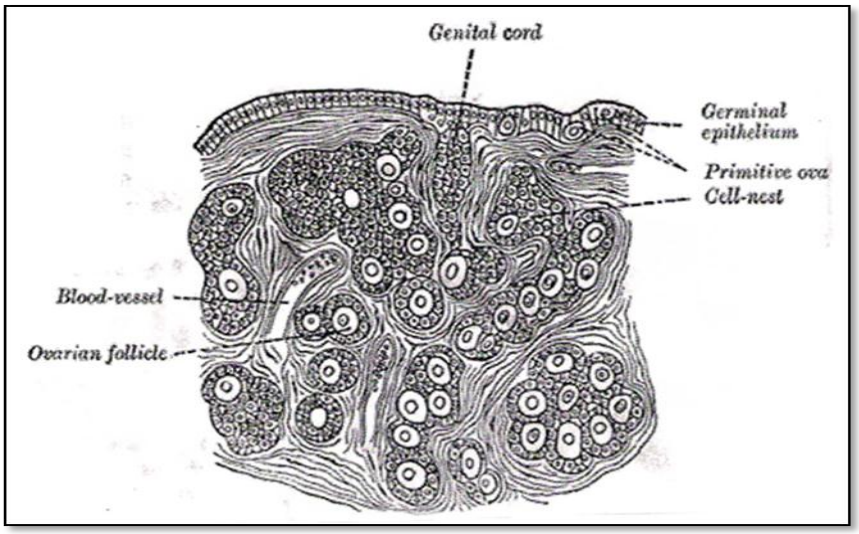

Figure 4: Illustration shows the structure of the ovary ***(William et al., 2006).***

Embryology:

- The ovary is composed of four main components, each with different embryologic origins: surface epithelium, stroma, germ cells, and sex cord.
- Coelomic epithelium forms the ovarian surface epithelium.