بسم الله الرحمن الرحيم

MONA MAGHRABY

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

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جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

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علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

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MONA MAGHRABY

Role of 68Ga-labelled PSMA PET/CT in assessment and staging of Prostate Cancer.

Thesis

Submitted for Partial Fulfillment of Master Degree in Radiodiagnosis

By

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بسم الله الرحمن الرحيم

قالوا

سبحانك لا علم لنا
إلا ما علمتنا إنك أنت
العليم الحكيم

صدق الله العظيم

سورة البقرة الآية: ٣٢

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Ahmed Magdi Ahmed Mohammed

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Abstract

Purpose: To determine the diagnostic sensitivity and specificity of Gallium 68-prostate-specifc membrane antigen positron emission tomography/computed tomography (68Ga-PSMA PET/CT) imaging for diagnosis and staging of patients with prostate cancer (PC).

Materials and Methods: Thirty patients with pathologically confirmed prostate cancer who underwent PET/CT study. They were selected from Department of Radiology at Ain Shams University Hospital from November 2020 to May 2021. The patients' ages ranged between 53 and 89 years old (mean age 66.43 ± 8.9 years). All patients underwent a 68Ga-PSMA PET/CT examination. For each patient, we determined the disease stage, the Gleason score, and the maximum standardized uptake value (SUVmax) for primary prostatic tumor and extraprostatic metastases. The diagnostic sensitivity and specificity of 68Ga-PSMA PET/CT for diagnosis and staging of PC were established by histopathology as the reference standard.

Results : All patients underwent 68Ga PSMA PET/CT scan (100 %). Median SUVmax for the primary tumor was 12.88 (range, 6.7–25). Nineteen patients had associated PSMA-avid lymph nodes, median SUVmax for those was 11 (range, 3.7–29). 68Ga-PSMA PET/CT detected extraprostatic metastases in 19 (63.3%) patients. The most common site of extraprostatic metastases was the bone (17 patients). The sensitivity of 68Ga-PSMA PET/CT examination in the diagnosis of PC was 90.9% and specificity was 68.4%.

Conclusion: 68Ga-PSMA PET/CT is a valuable tool with high diagnostic sensitivity (90. 9%) and good specificity (68.4%) for diagnosis and staging of patients with newly diagnosed PC.

Keywords: 68Ga-PSMA · PET/CT · Prostate cancer ·

Introduction

Prostate cancer (PCa) is the most common worldwide tumor in men **(Scher. HI et al., 2000)**. The natural course of prostate cancer (PCa) starts as a disease localized to the prostate, which is followed by non castrate rising prostate specific antigen (PSA). The remaining states are non castrate metastatic state and finally castration resistant metastatic state that leads to death within years **(Siegel. R et al., 2014)**. Regarding prostate cancer, different imaging tools have been used, with guidelines currently recommend MRI for local staging and CT/bone scan for exclusion of distant metastasis. Yet, CT/bone scan has low sensitivity and specificity for detection of metastatic disease, with small foci often missed, or non specific lesions as degenerative bone disease or reactive inflammatory changes in lymph nodes **(Mottet. N et al., 2017).** 68 Gallium Prostate specific membrane antigen, positron emission tomography (68Ga-PSMA PET) has excellent diagnostic performance for primary and secondary staging due to its ability to detect lesions even at very low serum PSA levels **(Perera. M et al., 2016).** PSMA is a transmembrane protein that generally has increased expression in prostate cancer cells in comparison with normal cells in both local and metastatic lesions in all tumor stages, that's make it an attractive target for molecular imaging. Moreover, tumor aggressiveness has been correlated with the degree of PSMA expression **(Afshar-Oromieh. et al., 2016).** The detection rate in nodal disease was reported to be higher compared with using conventional cross-sectional imaging. In addition, the mean size of nodes that were detected by PSMA

PET was smaller than detected by CT or MRI. The high quality of these studies should be emphasized as they were able to directly compare radiological findings to histological diagnosis **(Rauscher. I et al., 2016).** PSMA has also markedly emphasized the ability to visualize osseous metastases even when not visible with Technietium-99m-methylene disphonate (Tc-MDP) bone scanning or 18F-Fluoride PET CT. In comparison with 68Ga-PSMA PET/ CT, the sensitivity and specificity of detecting skeletal disease were also reported to be more when using PSMA **(Pyka. T et al., 2016).** 68Ga-PSMA PET/CT is of good application value in the diagnosis and risk stratification of primary prostate cancer **(Chen Liu. et al., 2018).**

Aim of the Work

The purpose of our study is to evaluate the potential role of 68Ga-labelled PSMA PET/CT in assessment and staging of prostate cancer and correlate those positive findings with biopsy.

Review of Literature
Anatomy

Clinical importance:

Accurate localization of prostate cancer within the gland may have implications for both diagnosis and treatment, including the potential for focal therapies which have been developed in recent years. Detailed anatomic knowledge forms the basis of different approaches to surgical dissection (interfascial, intrafascial, extra-fascial). In addition, knowledge of the boundaries of the prostate and the fascial anatomy is also essential for accurate pathological staging of prostatectomy specimens. ***(Myers et al., 2010).***

The prostate is an ovoid structure with the appearance of an inverted bilobed cone, located between the urinary bladder superiorly and the pelvic floor inferiorly. The urethra traverses this gland, entering at the broad base of the cone just below the bladder neck and exiting near the narrowed apex of the cone at the level of the urogenital diaphragm. The rounded anterior surface is behind the pubis and the posterior surface is flattened with a midline depression (the median sulcus) that lies against the rectal ampulla. The lateral and inferior surfaces of the gland are in contact with the levator ani muscles. The ejaculatory ducts enter the posterior surface laterally and pass obliquely toward the midline, where they end at the verumontanum on the posterior surface of the prostatic urethra **(Rogers et al., 2002).**

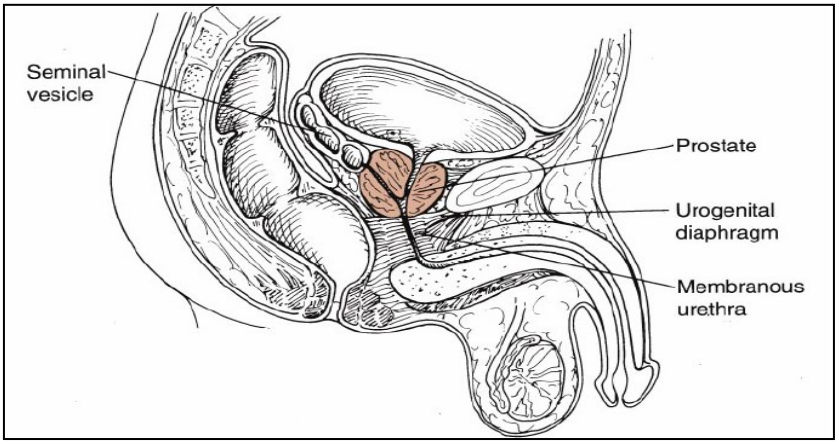

Fig (1): Diagrammatic representation of the pelvic Anatomy. ***(Rogers et al., 2002)***

The boundaries of the prostate:

The prostate gland is not surrounded by a true capsule but rather a "pseudocapsule" comprising a condensation of fibromuscular stroma at the outer edge of the prostate which has a variable appearance ***(Walz et al., 2016).***

Surrounding this are the periprostatic fascial layers and the neurovascular bundles. Anteriorly, the prostate is also covered by smooth muscle bundles arising from the outer longitudinal detrusor muscle of the bladder (detrusor apron) and by the dorsal vascular complex.

PeriprostaticFascia:

The anterior surface of the prostate, detrusor apron, and dorsal vascular complex are covered by a layer of visceral endopelvic fascia, which is fused in the midline with the anterior fibromuscular stroma of the prostate. Laterally, the prostate is covered by a layer of fascia termed the prostatic fascia and external to this is the levator ani fascia.