Role of advanced MRI techniques in predicting and evaluating the response of breast cancer to neoadjuvant chemotherapy

Essay

Submitted for partial fulfillment of master degree in Radiosiagnosis

by

Mouna Abdulaziz A elkhoja

M.B.B. Ch. – faculty of Medicine , Tripoli University

Under supervision of

Prof. Dr. Dalia Zaki Zidan

Professor of Radiodiagnosis

Faculty of Medicine, Ain Shams University

Dr. Nermeen Nasry Halim

Lecturer of Radiodiagnosis

Faculty of Medicine, Ain Shams University

Faculty of Medicine

Ain Shams University

2016


قُلْ إِنَّ صَلَاتِي.
وَنُسُكِي
وَمَحْيَايَ وَمَمَاتِي
للهِ رَبِّ الْعَالَمِينَ
صدق الله العظيم
سورة الأنعام الآية (١٦٢)

First thanks to **ALLAH** to whom I relate any success in achieving any work in my life.

I wish to express my deepest thanks, gratitude and appreciation to **Prof. Dr. Dalia Zaki Zidan,** Professor of Radiodiagnosis Faculty of Medicine Ain Shams University, for his meticulous supervision, kind guidance, Valuable instructions and generous help.

Special thanks are due **Dr. Nermeen Nasry Halim,** Lecturer of Radiodiagnosis Faculty of Medicine Ain Shams University for her sincere efforts and fruitful encouragement.

Also I would like to thank my **Family** and who stood behind me to finish this work and for their great support.

Mouna Abdulaziz A elkhoja

List of Contents

List of Tables

List of Figures

Fig. No.	Title	Page No.

List of Figures (*Cont.*)

Fig. No.	Title	Page No.

List of Figures (*Cont.*)

List of Figures (*Cont.*)

List of Figures (*Cont.*)

List of Figures (*Cont.*)

Introduction

Worldwide, breast cancer is the most frequently diagnosed life-threatening cancer in women and the leading cause of cancer death among women ***(Swart, 2010).***

In Egypt, breast cancer is the most common cancer among women, representing 18.9% of total cancer cases (35.1% in women and 2.2% in men)***(Omar et al., 2003).***

Although its incidence continues to rise, mortality has declined over the past several years. The decline has been attributed to both early diagnosis and more effective treatment ***(Jean et al., 2009).***

Diagnostic imaging can make the largest contributions towards improving the management and outcome of women with breast cancer by new effective methods of following therapy and establishing prognosis ***(Powe 1997, Hoh et al., 1993).***

This is especially important in locally advanced breast cancer which remains a challenging clinical problem ***(Whitman and Strom, 2009)***.

Neoadjuvant chemotherapy (NAC) followed by surgery was introduced about 2 decades ago to treat patients with locally advanced breast cancer, which represents approximately 20% of all women who receive a diagnosis of breast cancer ***(Jean-Paul et al., 2003)***.

While neoadjuvant chemotherapy achieves the same survival rates as postoperative chemotherapy in women with operable breast carcinoma, the advantages of neoadjuvant treatment over conventional adjuvant chemotherapy are manifold ***(Rosen et al., 2003 Yeh et al., 2005).***

First, and most importantly, chemotherapy given before surgery may shrink the large tumors to improve the resectability in some (inoperable to operable) and to allow for breast conservation surgery in others (fewer mastectomies) ***(Rosen et al., 2003 Yeh et al., 2005).***

Second, it allows for assessment of tumor response in each patient ***(Rosen et al., 2003 Yeh et al., 2005).***

NAC gives high clinical response rates (70-98%) and can even achieve pathological complete response (PCR) in a subgroup of patients (3-34%). The prediction of PCR from the early response can contribute to a timely adjustment of treatment protocol to help reach this goal, and to avoid unnecessary toxicity of ineffective treatments .While on the other hand it permits early detection of resistant tumors to choose alternative and possibly more efficacious treatments, such as other types of chemotherapy or early surgery***(Mei-Lin et al., 2008 Hyeon-Man et al., 2009).***

Third, the upfront nature of this treatment provides the earliest chance to treat micro-metastatic disease and saves time, unlike conventional adjuvant chemotherapy that may be delayed for several months because of surgical scheduling and the need for wound healing ***(Rosen et al., 2003 Yeh et al., 2005).***

Lastly, the intact neo-vasculature can be exploited to the advantage of the patient. Because surgical excision may alter the tumor's vasculature, neoadjuvant chemotherapy may have the advantage of enhancing the local effect through a non-disturbed blood supply ***(Rosen et al., 2003, Yeh et al., 2005).***

Following neoadjuvant chemotherapy, accurate assessment of early tumor response or size of post therapy residual tumor burden and location is necessary for planning

the future medical or surgical roadmap of the patient. Monitoring of response has traditionally been based on physical examination, mammography, and sonography of the breast. However, these techniques were found to result in unsatisfactory accuracy due to the development of chemotherapy-induced fibrosis ***(Loo et al., 2008).***

Advanced MRI imaging techniques as Magnetic resonance spectroscopy (MRS) - Pharmacokinetic assessment in DCE (MRI) - Diffusion weighted imaging (DWI) have shown to be of great importance in monitoring patient's response to chemotherapy, and in differentiating responders from non-responders early during therapy***(Rosen et al. 2003 Pickles et al.,2005)***.

They also play an important role in assessment of tumor extent after the end of the cycles of chemotherapy ***(Balu-Maestro et al., 2002).***

Aim of work

The purpose of this study is to evaluate the diagnostic ability of advanced MRI imaging techniques in predicting the effect of neoadjuvant chemotherapy on breast cancer early in the treatment regimen and evaluating its effect during and after the course.