PERCUTANEOUS RADIOFREQUENCY ABLATION VERSUS MICROWAVE ABLATION IN THE TREATMENT OF LUNG MALIGNANCIES

ESSAY

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ABSTRACT

Radiofrequency ablation and microwave ablation have emerged as minimally invasive therapeutic options for malignant lung tumours. The advantages of thermal ablation include selective tissue damage, minimal treatment morbidity and mortality and lower costs compared to surgery. However the procedure is not free of complications. Microwave ablation has less complications rate and shorter treatment time.

KEY WORDS

Thermal ablation – radiofrequency ablation – microwave ablation – lung cancer – minimally invasive techniques – comparison.

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LIST OF ABBREVIATIONS

ADC	*Apparent diffusion coefficient*
BPF	*Bronchopleural fistula*
CT	*Computed Tomography*
DWI	*Diffusion-Weighted imaging*
GGO	*Ground glass opacity*
HU	*Hounsfield unit*
IASLC	*International Association for the Study of Lung Cancer*
MRI	*Magnetic resonance imaging*
MW	*Microwave*
MWA	*Microwave ablation*
NSAID	*Non steroidal anti-inflammatory drugs*
NSCLC	*Non small cell lung cancers*
PA	*Postero anterior*
PET	*Positron emission tomography*
RF	*Radiofrequency*
RFA	*Radiofrequency ablation*
SCC	*Squamous cell carcinoma*
SCLC	*Small cell lung cancer*
SIADH	*Syndrome of inappropriate ADH production*
STIR	*Short-time inversion recovery*
SVC	*Superior vena cava*
TPCE	*Transpulmonary chemoembolization*
US	*Ultrasonography*
WHO	*World health organization*

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INTRODUCTION

INTRODUCTION

Primary lung cancer is a severe worldwide health problem causing a greater death than breast, prostate, and colorectal cancer combined **(Brescia, 2001).** Surgical resection is the treatment of choice for primary non small cell lung cancers (NSCLCs) and isolated pulmonary metastases from colorectal cancer. However, approximately two-thirds of all NSCLC patients are ineligible for curative resection due to tobacco-related comorbidity, concomitant extrapulmonary diseases and/or advanced age. Surgery is excluded in a similar percentage of pulmonary metastases patients due to the presence of multifocal disease. In any case, the surgical approach is not free from complications, including mortality, and it is difficult to repeat for recurrences **(Licker et al., 2002).** Systemic chemotherapy and radiation therapy are often the only options offered to lung cancer patients, but these approaches produce substantial increases in survival only in small subsets of highly selected cases **(Rossi et al., 2006).**

As compared to lung resection local ablative methods bear indisputable advantages. The surgical trauma may contribute to recurrence, growth of metastases, and metastatic spread. These unwanted consequences of surgery depend on factors such as immunosuppression, shedding of tumor cells into the wounded area and the circulation as well as the production and release of growth factors for wound healing, which influence tumor cell adhesion and growth **(Steinke, 2006).**

The term tumor ablation is defined as the direct application of chemical or thermal therapies to a specific focal tumor in an attempt to achieve eradication or substantial tumor destruction. The term "direct" aims to distinguish these therapies from others that are applied orally or via an intravascular or peripheral venous route. Different modalities are used for tumor thermal ablation including radiofrequency, microwave, laser, high intensity focused ultrasound and cryoablation **(Goldberg et al., 2003).**

Percutaneous radiofrequency thermal ablation (RFA) under CT guidance is a minimal invasive technique that is used over a decade for the treatment of primary and secondary liver tumors. It is a low cost method that provides treatment on an outpatient basis and has low complication rates in experienced hands. RFA under CT guidance without thoracotomy may be considered an interesting alternative of local treatment in inoperable cases of primary and metastatic lung tumors **(Thanos et al., 2006).**

Early clinical experiences with RFA suggest that it could serve as a potential addition (or alternative) to surgery and radiation therapy for the local treatment of primary and secondary malignant lung tumors. Major complications are rare, with post procedural fever, pain, and pneumothorax being most commonly reported **(Nguyen et al., 2006).**

Microwave ablation is the most recent development in the field of tumor ablation. Microwave ablation refers to the use of electromagnetic methods for inducing tumor destruction by using devices with frequencies of at least 900 MHz **(Shibata et al., 2002).** The technique allows for flexible approaches to treatment, including percutaneous, laparoscopic, and open surgical access. The main advantages of microwave technology, when compared with existing thermoablative technologies, include consistently higher intratumoral temperatures, larger tumor ablation volumes, faster ablation times, less procedural pain and no need for using grounding pads. Microwave ablation has promising potential in the treatment of primary and secondary liver disease, primary and secondary lung malignancies, renal and adrenal tumors and bone metastases **(Simon et al., 2005).**

Microwave ablation offers many of the advantages of RF ablation while possibly overcoming some of the limitations. Since microwave ablation does not rely on conduction of electricity into tissue, it is not limited by charring. Therefore, temperatures greater than 100°C are readily achieved, which potentially results in a larger zone of ablation, faster treatment time, and more complete tumor kill. In addition, microwave ablation has a much broader power field than does RF ablation. This may allow for larger zones of thermal ablation and a more uniform tumor kill. With several theoretic and practical advantages, microwave ablation is a promising new option in the treatment of surgically unresectable tumors **(Wright et al., 2005).**

AIM OF WORK

To demonstrate the role and to compare between imaging guided percutaneous radiofrequency ablation and microwave ablation in the treatment of primary and metastatic lung cancer regarding the indications, technique, advantages, limitations and post procedural follow up as well as the lung state before and after each procedure using different imaging modalities.

CHAPTER 1

Pathology of malignant lung neoplasms

I- Primary lung malignancies:

Lung cancer is the most commonly diagnosed cancer worldwide, and its incidence continues to grow. An estimated 1.5 million new cases of lung cancer were diagnosed globally every year, accounting for approximately 12% of the global cancer burden. Among all cancers, lung cancer has the highest mortality rate in most countries (**WHO 2003**).

- **Age distribution for lung cancer**

Lung cancer occurs predominately in persons aged 50-70 years. The probability of developing lung cancer remains very low until the age of 40 years in both sexes. It then slowly starts to rise and peaks among those older than 70 years. The risk of developing lung cancer remains higher among men in all age groups after age 40 years **(Ries et al., 2005).**

- **Sex distribution for lung cancer**

Lung cancer is more common in men than in women. Most western countries have encountered a disturbing trend of increasing prevalence in women and younger patients. Women have a higher incidence of localized disease at presentation and of adenocarcinoma and typically are younger when they present with symptoms. This changing pattern of disease is due to the increase in cigarette smoking among the general population, and women in particular **(Ries et al., 2005).**