بسم الله الرحمن الرحيم

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تم رفع هذه الرسالة بواسطة / سلوي محمود عقل

بقسم التوثيق الإلكتروني بمركز الشبكات وتكنولوجيا المعلومات دون أدنى مسئولية عن محتوى هذه الرسالة.

ملاحظات: لا يوجد

Role of US and Diffusion Weighted MRI in Detection of Thyroid Cartilage Invasion in Patients with Laryngeal Carcinoma

Thesis

Submitted in Partial Fulfillment of the M.D. Degree in
Otolaryngology and Head and Neck Surgery

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قالوا

سبحانك لا علم لنا
إلا ما علمتنا إنك أنت
العليم الحكيم

صدق الله العظيم

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Hala Ali Mohamed Rashad

List of Contents

List of Tables

List of Figures

List of Figures (Cont…)

List of Figures (Cont…)

List of Abbreviations

Abb.	Full term
ADC	*Apparent diffusion coefficient*
AJCC	*American Joint Committee on Cancer*
CECT	*Contrast-enhanced CT*
CNR	*Contrast to noise ratio*
CT	*Computed tomography*
DWIBS	*Diffusion-weighted whole-body imaging with background body signal suppression*
DW-MRI	*Diffusion-weighted MRI*
FDG	*Fluoro-2-deoxy-D-glucose*
HPE	*Histopathology*
IMRT	*Intensity-modulated radiation treatment*
MRI	*Magnetic resonance imaging*
NPV	*Negative predictive value*
PET	*Positron emission tomography*
PPV	*Positive predictive value*
ROC	*Receiver operating characteristic curve*
ROIs	*regions of interest*
RT	*Radiotherapy*
SNR	*Signal to noise ratio*
TLM	*Transoral laser microsurgery*
TNM	*Tumour–node–metastasis*

Abstract

Background: Cartilage invasion is one of the critical determinants of tumour staging for laryngeal cancer and of particular importance in assessing the suitability for partial laryngectomy and/or chemoradiation therapy
Compared to CT, diffusion-weighted magnetic resonance imaging (MRI) has a similar ability to define the interface between fat and tumor, but is superior for assessing muscle and cartilage invasion. Diffusion-weighted MRI may be indicated if there are equivocal findings in the CT, including possible cartilage invasion. ultrasonography has the advantage of its non-invasive and real-time imaging features and it has been used to evaluate laryngeal tumours and it could assist tumour staging in patients with advanced laryngeal cancer**.**
Aim of the work:
To compare between the role of US and diffusion weighted MRI in the detection of thyroid cartilage invasion in patients with laryngeal malignancy by correlating the radiological findings with the postoperative histopathological findings of the total or partial laryngectomy specimen.

Patients and Methods:A prospective study was carried out between December 2018 to septemper2021. The study included 36 patients. Thirty five patients underwent total laryngectomy and one patient underwent partial laryngectomy. Histopathology reports of resected specimens and pre-operative staging were blind to the consultant radiologist who reviewed the scans to comment on thyroid cartilage invasion with special emphasis on inner and outer lamina invasion by conventional MRI criteria, and DWI and ultrasound.

Results:our study showed that DWMRI has sensitivity of 81.2%, specificity 50%, PPV of 86.7%, NPV of 40% and accuracy of 75% in detection of inner lamina invasion and it has sensitivity of84.6 %, specificity of 71.4%, PPV of 84.6%, NPV of 71.4% and accuracy of 80% in detection of outer thyroid lamina invasion. In our study, we found that ultrasound has sensitivity of 78.6%, specificity of 60%, PPV of 84.6%, NPV of 50% and accuracy of 73.7% in detection of inner cortex invasion. & it has sensitivity of 75%, specificity of 66.7%, PPV of 90%, NPV of 66.6% and accuracy of 78.9%in detection of outer thyroid cortex invasion.

Conclusion: Diffusion-weighted MRI and ultrasound showed high validity and precision in detecting inner and outer thyroid lamina

invasion. This can have an important impact on the decision making for management of laryngeal carcinoma.

- **Key Words:** Laryngeal neoplasm, Magnetic resonance imaging,Ultrasound,Thyroid cartilage/pathology

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INTRODUCTION

Cancer larynx is the next most frequent tumor of the head and neck after cancer skin. In the USA, the typical patient is a man in his 50s or 60s with a history of smoking and/or alcohol use. But, the male preference for this illness has lately declined from a male: female ratio of 15: 1 to fewer than 5: 1 presently. This transform in demographics has been attributed to enlarged rates of smoking between females and their increasing existence in similarly toxic work atmosphere. Considerable difference in the distribution of carcinoma at the different laryngeal Areas exists worldwide. Supraglottic and glottic tumors are the most common subsites whereas subglottic carcinomas are uniformly rare. In the USA, glottic carcinomas are the most common (glottic 59%, supraglottic 40%, and subglottic 1%) ***(Chu and Byrne, 2008).***

Eighty-five percent of laryngeal cancers can be credited to smoking and alcohol use. Tobbaco use is the main risk factor for laryngeal carcinoma, with alcohol use being an independent and synergistic effect ***(Sadri et al., 2006).***

Cartilage infiltration is one of the significant determinants of tumor staging for cancer larynx and of particular value in assessing the fitness for partial laryngectomy and/or chemoradiation therapy in an attempt to save voice. According to the present American Joint Committee on Cancer (AJCC) staging guidelines, minor cartilage infiltration is

classified as T3, whereas infiltration through cartilage is T4. These definitions are intrinsically challenging due to the individual nature of cartilage invasion. For example, inadequate evidence in the 1990s suggested that CT has the affinity towards "over-calling" thyroid cartilage infiltration, mainly because of reactive inflammation.

Cartilage infiltration affects the nature of surgery and has been shown to affect the response to radiotherapy ***(Becker et al., 1997)***. On the other hand, MRI may be less suitable to visualize sclerosis or cortical sclerosis of non-ossified cartilage, which is patchily present in the larynx and may represent tumor infiltration,Also, MRI can be affected by movement in the area of the larynx due to its comparatively long imaging time. Therefore, contrast-enhanced CT (CECT) is frequently favored over MRI although the specificity may be lesser (around 70%) depending on the used imaging criteria. Both MRI and CECT, regularly remains not easy to distinguish inflammation and edema from cartilage infiltration.In addition, CECT has limited accuracy for recognition of early extra laryngeal spread of laryngeal cancer ***(Li et al., 2011).***

Diffusion-weighted magnetic resonance imaging (**DWI** or **DW-MRI**): is the use of particular MRI sequences as well as software that creates images from the resultant data that uses the diffusion of water molecules to make contrast in MR images. It permits the mapping of the diffusion process of

molecules, principally water, in biological tissues, in vivo and non-invasively ***(Taylor et al., 1985).***

An apparent diffusion coefficient (ADC) image, or an ADC *map*, is an MRI image that more particularly shows diffusion than conventional DWI, by eliminating the T2 weighting that is otherwise intrinsic to conventional DWI. ADC imaging does that by acquiring several conventional DWI images with different amounts of DWI weighting, and the change in signal is proportional to the amount of diffusion. in contrast to DWI images, the standard grayscale of ADC images is to represent a lesser magnitude of diffusion as darker ***(Mark, 2017).***

Compared to CT, diffusion-weightedMRI (DW-MRI) has the same capability to define the border between fat and tumor, but is better for assessing muscle and cartilage invasion ***(Becker et al., 1997),*** DW-MRI is used if there are vague findings on multidetector CT, including possible cartilage invasion.

High-frequency ultrasonography is regularly used as an imaging method to assess the involvement of cervical lymph nodes, soft tissues and thyroid gland in patients with cancer larynx, but seldom to estimate the tumour itself and its infiltration of the intralaryngeal structures, mostly owing to the calcified thyroid cartilages in adults and the interference of air within the laryngeal cavities. However, attempts have been made to employ ultrasonography in this area, mainly to take benefit of its non-invasive and instantaneous imaging features. Since the 1970s,