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# Magnetic resonance imaging and computed tomography in the assessment of mandibular invasion by squamous cell carcinoma of the oral cavity. Influence on surgical management and post-operative course

Évaluation IRM et tomodensitométrie de l'envahissement mandibulaire par les carcinomes épidermoïdes de la cavité orale. Influence sur la prise en charge chirurgicale et sur les suites postopératoires

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## Summary

**Introduction.** Preoperative evaluation of the bone for invasion by oral cavity squamous cell carcinoma remains challenging. The aim of our study was to compare the accuracy of MRI and CT in detecting mandibular invasion by oral squamous cell carcinoma of the oral cavity, with histologic results as the reference standard, and to assess the influence on surgical management and post-operative course.

**Patients and methods.** Patients who were clinically suspected of having bone invasion from oral cavity carcinoma were retrospectively included. A single senior radiologist reviewed MRI images and CT-scans, independently, for the presence or absence of mandibular invasion. The different surgical procedures were compared in terms of length of hospital stay and occurrence of surgical complications.

**Results.** Histological mandibular invasion occurred in 9 of 35 patients (25.7%). None of the preoperative imaging tests failed to detect bone invasion which resulted in a sensitivity of 100% for both MRI and CT. CT had slightly higher specificity than MRI (61.9% and 57.1% respectively) in predicting bone invasion, but no statistically significant difference was found ( $P = 0.32$ ). Specificity of CT and MRI was higher in the edentulous group (75% and 62.5% respectively) than in the dentate group (53.8% both), although no

## Résumé

**Introduction.** L'évaluation préopératoire de l'envahissement osseux d'un carcinoma épidermoïde de la cavité orale reste difficile. Le but de notre étude a été de comparer la précision de l'IRM et du scanner dans la détection de l'envahissement mandibulaire des carcinomes épidermoïdes de la cavité orale, le contrôle histologique des marges servant de contrôle, et d'évaluer l'influence de cette détection sur le geste réalisé et sur les suites postopératoires.

**Matériel et méthode.** Les patients porteurs d'un carcinome épidermoïde de la cavité orale cliniquement suspects de présenter un envahissement osseux ont été inclus rétrospectivement dans l'étude. Un radiologue sénior unique a revu l'ensemble des images scanner et IRM de manière indépendante à la recherche d'un envahissement mandibulaire. Les différents gestes chirurgicaux effectués ont été comparés en termes de durée d'hospitalisation et de la survenue de complications postopératoires.

**Résultats.** Un envahissement mandibulaire a été diagnostiqué histologiquement chez 9 patients sur 35 (25,7 %). Ces envahissements osseux ont tous pu être diagnostiqués sur l'imagerie préopératoire, résultat en une sensibilité de 100 % tant pour l'IRM que pour le scanner. Le scanner était légèrement plus spécifique que l'IRM

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statistically significant difference was found. The length of hospital stay was increased in the segmental resection group ( $25 \pm 14.5$  days) compared to the marginal resection group ( $13 \pm 4.6$  days;  $P = 0.004$ ) and to the hemimandibulectomy group ( $15 \pm 7.2$  days;  $P = 0.014$ ). Occurrence of post-operative complications, across all categories, was increased in the segmental resection group (70%,  $n = 7/10$ ;  $P = 0.006$ ) compared to the marginal resection group (8.3%,  $n = 1/12$ ) and to the hemimandibulectomy group (23.1%,  $n = 3/13$ ;  $P = 0.04$ ).

**Conclusion.** MRI and CT being equivalent in detecting mandibular invasion, we suggest MRI as single imaging technique in the preoperative assessment of oral cavity SCC. Specificity could be increased if combined with PET/CT, in order to reduce the number of unnecessary mandibular interruptions.

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**Keywords:** MRI, CT-scan, Squamous cell carcinoma, Oral cavity, Mandibular neoplasm, Bone marrow

## Introduction

In 2012, in Europe, oral cavity and pharyngeal malignant tumors concerned 99,600 new cases and were responsible for 43,700 deaths. They represent the 8th most frequent cancer among men and women [1]. The 5-year survival rate varies between 30 and 65%, depending on the stage of the disease, and the most common histologic type is squamous cell carcinoma (SCC) in over 95% of oral malignant tumors [2]. The most often involved localizations are the tongue and lower gingiva [3,4]. Gingival and floor of mouth carcinomas easily invade the underlying mandibular bone, due to close anatomical relationship. In dentate patients, tumors enter the mandible through the point of abutment, which is often at the junction of the reflected and attached mucosa, whereas in non-dentate patients, tumors tend to invade the edentulous ridge through the occlusal surface [5,6]. The prevalence of mandibular involvement in SCC of the oral cavity ranges from 12 to 56% [7]. Routine preoperative assessment consists of clinical examination, conventional radiography, CT-scan and MRI-imaging. Clinical examination, even when precisely undertaken, does not always allow the detection of subtle bone invasion, and orthopantomogram can only detect osteolysis when at least 30% of bone mineralization is lost [8]. CT-scan is known to be an accurate imaging test in the detection of incipient cortical bone invasion, however, CT shows poor results in detecting small tumors or superficially spreading

(respectivement 61,9 % et 57,1 %) dans la prédiction d'un envahissement osseux mais de manière statistiquement non significative ( $p = 0,32$ ). La spécificité du scanner et de l'IRM a été plus grande dans le groupe des patients édentés (respectivement 75 % et 62,5 %) comparé au groupe des patients dentés (53,8 % pour les 2 examens) mais sans différence statistiquement significative. La durée d'hospitalisation a été augmentée dans le groupe ayant bénéficié d'une résection segmentaire (RS) ( $25 \pm 14,5$  j) comparé au groupe ayant bénéficié d'une résection marginale (RM) ( $13 \pm 4,6$  j ;  $p = 0,004$ ) et au groupe ayant bénéficié d'une héli-mandibulectomie (HM) ( $15 \pm 7,2$  j ;  $p = 0,014$ ). La survenue de complications postopératoires, quelle qu'elles soient, a été augmentée dans le groupe RS (70 %,  $n = 7/10$  ;  $p = 0,006$ ) comparé aux groupes RM (8,3,  $n = 1/12$ ) et HM (23,1 %,  $n = 3/13$  ;  $p = 0,04$ ).

**Conclusion.** L'IRM et le scanner étant équivalent en ce qui concerne la détection des invasions mandibulaires, nous suggérons de privilégier l'IRM pour le bilan préopératoire des carcinomes épidermoïdes de la cavité orale. La spécificité pourrait être augmentée par l'ajout d'un PET scanner de manière à réduire le nombre d'interruptions mandibulaires inutiles.

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**Mots clés :** IRM, Scanner, Carcinome épidermoïde, Cavité orale, Néoplasme mandibulaire, Moelle osseuse

tumors [9]. Moreover, its accuracy can be highly limited by metallic dental restorations responsible for beam-hardening artifacts. On the contrary, MRI is less disrupted by dental artifacts [10]. It is known to be more reliable than CT in the evaluation of medullary bone involvement [9] and in delineating tumor borders in soft tissues especially after gadolinium injection [10]. However, its specificity is decreased by relatively numerous false positive results due to inflammatory conditions including periodontal disease, recently extracted teeth or peritumoral edema [11–13]. In such cases, MRI tends to overestimate tumor volume [14]. No single imaging technique has proven its accuracy in predicting mandibular invasion, yet it is essential for the surgeon to obtain a precise preoperative study of this invasion because the surgical procedure and the extent of mandibular resection depend on its degree. Knowledge of an invasion necessitating segmental mandibulectomy allows the surgeon to perform adequate resection without risking close or invaded margins. On the contrary, accurate assessment of bone invasion may prevent unnecessary interruption of the mandibular arch. Knowing that this interruption may have significant cosmetic and functional consequences, especially when the anterior arch is concerned, the assessment of bone involvement is of major importance. Indeed, the type of mandibular resection and reconstruction can have a significant impact on oral functions such as chewing and swallowing, oral continence and patients' quality of life. The objective of immediate reconstruction by bony

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