Ultrasonography is more effective than computed tomography in excluding invasion of the carotid wall by cervical lymphadenopathies

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Abstract

Twelve patients with head and neck cancer, bulky lymphadenopathies, and clinical suspicion of carotid artery infiltration, had preoperative CT and US. The results of both techniques were correlated with surgical findings (one case of invasion and 11 of non-invasion), to evaluate the role of CT and US in the preoperative diagnosis of tumor invasion of the carotid wall. While CT showed a high level of failures (11 false positives and one true positive), US (one true positive, one false negative, and 10 true negatives) appears to be an easy and helpful method for predicting non-invasion of the carotid wall. However, the usefulness of US in detecting invasion cannot be evaluated, due to the limited number of positive cases.

Key words: Ultrasound, comparative study; Computed tomography, comparative study; Artery, carotid; Artery, radiography; Neoplasm, staging

1. Introduction

In head and neck cancer (HNC), to achieve exhaustive staging and correct management of the disease, it is necessary to evaluate for (1) the presence or absence of subclinical neck nodes, (2) the number, size, and exact location of lymphadenopathies, and (3) the spreading of cervical masses to adjacent structures such as muscle, bone, nerves, or vessels. The value of different diagnostic imaging modalities, CT, MRI, and US, on these three subjects has been studied in many reports [1-3].

The information that diagnostic imaging can offer about potential tumoral invasion of neck blood vessels acquires more importance in the late stages of HNC. In particular invasion of the carotid artery needs an adequate and rigorous preoperative evaluation.

The purpose of this study was to evaluate the utility of CT and US in the diagnosis of invasion of the carotid wall in patients with cervical lymph node metastases who are clinically suspected of invasion.

2. Materials and methods

From May 1991 to June 1992 we retrospectively reviewed 12 patients with HNC, bulky cervical lymphadenopathies stage N3, and possible involvement of the carotid artery. Lymphadenopathies were predominantly located in the upper jugular and midjugular chain. In only three cases was the tumor observed in the lower jugular chain. Histopathology corresponded to 11 squamous cell carcinomas and one amelanotic melanoma.

All patients received surgical treatment of the neck disease, and underwent preoperative CT and US evaluation of potential carotid wall involvement. Eight patients received radical neck dissection and postoperative radiation therapy. In the remaining four cases, the cervical masses were recurrences after previous surgery (two cases) or radiation therapy (two cases). CT and US were carried out in order to evaluate these recurrences.

CT scanning was performed, after an i.v. injection of 100 ml of non-ionic contrast, in a Somaton HIQ unit. Slices were obtained at each 5–7 mm, in a 512 × 512
matrix, and a window level adequate to evaluate soft tissues. US studies were performed in a diasonic unit, by applying a tunable focus directly over the neck, using a 7.5-MHz transducer. On CT images, the absence of a fat interface between the carotid and the neck mass was considered a sign of tumoral invasion of the vascular wall [4]. On US, the absence of echogenity of the vascular wall, or the loss of its bright hyperechogenic layer, was considered signs of tumoral infiltration [5].

The results of CT and US were subsequently correlated with surgical findings.

3. Results

At surgery, there was only one case where tumoral invasion of the carotid wall was demonstrated. In the remaining eleven, the carotid wall was a surgical plane free from tumoral invasion.

In the whole group of patients, CT scans showed an absence of intervening fat planes between carotid artery and tumor mass, despite the intravenous contrast. Thus, CT results were considered positive in all twelve cases.

On US studies invasion of the carotid wall was considered present in two patients. The remaining ten cases were negative, showing the typical echographic image of the carotid wall.

The correlation between diagnostic procedures and surgical findings shows a series of 11 negative cases and one positive case of vascular wall invasion. There were 11 false positive findings and one true positive finding on CT. On US there was one true positive finding, 10 true negative findings, and one false negative finding. Some examples are shown in Figs. 1–3.

4. Discussion

Infiltration of the artery wall by cervical nodes is a not very frequent complication, but may appear in advanced diseases, and does not offer a good prognosis [6,7]. These cases often counter-indicate surgery or complicate it, making the cardiovascular surgical intervention necessary [8]. This makes preoperative diagnosis of carotid wall infiltration even more important.

Some authors consider CT an effective and reliable method for investigating the potential invasion of carotid artery [4,9]. However, there are opinions that
Fig. 3. Images corresponding to a positive case. CT shows left carotid artery merged within the tumoral mass (a). US shows the loss of echogenity of the vascular wall (arrows) in the common carotid artery, in both traversal (b) and longitudinal scans (c). (d) Longitudinal image of the carotid artery. The loss of echogenity of the vascular wall was probably due to the attenuation of the ultrasound beam by the big tumoral mass. Surgery showed a vascular wall free of tumoral invasion.

question its contribution [6,10]. They find CT unhelpful in evaluating carotid invasion and point to the difficulty of differentiating tumoral structures adjacent to the artery, since both images may seem to merge. According to these and other studies [6,10,11], the number of false positives observed in our series shows the futility of CT in verifying the potential presence of tumor invasion of the carotid wall.

US is considered a non-invasive technique and very appropriate for the study of the carotid wall [10–13], superior to CT in the evaluation of tumor invasion [12], where the loss of echogenicity of the arterial wall is the most significant feature when suspecting invasion [11]. In our short series, it can be pointed out that the presence of echogenicity confirms the absence of infiltration. Even though the number of patients with invaded arteries is small for the establishment of sensitivity, the specificity is high (0.9) and the negative predictive value reaches the maximum possible.

There has been only one false positive using US (Fig. 3d), in which the attenuation of the ultrasound beam by the tumor mass is a possible reason of the hypoecho genetic image of the arterial wall. This has been previously described as a false positive [10].

The significance of the increase in echogenicity in the arterial wall of the two patients who suffered recurrences after previous radiotherapy was appreciated by us. Similar descriptions have been reported elsewhere [13]. This increase in echogenicity could be due to the formation of atheromatous plaques induced by radiation therapy [14].

Predicting the attachment of neck tumoral masses to the carotid may be difficult with any imaging study, depending on the criteria chosen [3]. In our series, CT was characterized by a high number of false positive diagnoses (11 patients) whereas there was only one false positive diagnosis with US. As invasion was only present in one patient, US seems to be a useful tool in determining non-invasion of the carotid wall. More positive cases must be studied in order to establish that US is also useful for determining invasion.

5. References
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