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Original article

## Pre- and postoperative radiotherapy for extremity soft tissue sarcoma: Evaluation of inter-observer target volume contouring variability among French sarcoma group radiation oncologists

*Évaluation des variations entre les observateurs dans l'identification des volumes cibles d'une radiothérapie pré- et postopératoire pour les sarcomes des tissus mous des membres : analyse du Groupe sarcome français–groupe d'étude des tumeurs osseuses*

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### ABSTRACT

**Purpose.** – The purpose of this study was to evaluate, during a national workshop, the inter-observer variability in target volume delineation for primary extremity soft tissue sarcoma radiation therapy.

**Methods and materials.** – Six expert sarcoma radiation oncologists (members of French Sarcoma Group) received two extremity soft tissue sarcoma radiation therapy cases 1: one preoperative and one postoperative. They were distributed with instructions for contouring gross tumour volume or reconstructed gross tumour volume, clinical target volume and to propose a planning target volume. The preoperative radiation therapy case was a patient with a grade 1 extraskeletal myxoid chondrosarcoma of the thigh. The postoperative case was a patient with a grade 3 pleomorphic undifferentiated sarcoma of the thigh. Contour agreement analysis was performed using kappa statistics.

**Results.** – For the preoperative case, contouring agreement regarding GTV, gross tumour volume GTV, clinical target volume and planning target volume were substantial (kappa between 0.68 and 0.77). In

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the postoperative case, the agreement was only fair for reconstructed gross tumour volume ( $\kappa$ : 0.38) but moderate for clinical target volume and planning target volume ( $\kappa$ : 0.42). During the workshop discussion, consensus was reached on most of the contour divergences especially clinical target volume longitudinal extension. The determination of a limited cutaneous cover was also discussed.

**Conclusion.** – Accurate delineation of target volume appears to be a crucial element to ensure multicenter clinical trial quality assessment, reproducibility and homogeneity in delivering RT. radiation therapy RT. Quality assessment process should be proposed in this setting. We have shown in our study that preoperative radiation therapy of extremity soft tissue sarcoma has less inter-observer contouring variability.

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## R É S U M É

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**Objectif de l'étude.** – Il s'agissait d'évaluer, durant un atelier national, les variations entre les observateurs de la délimitation des volumes cibles pour la radiothérapie des sarcomes des tissus mous des membres.

**Matériels et méthodes.** – Il a été remis à six oncologues radiothérapeutes spécialisés dans les sarcomes deux cas de radiothérapie de sarcome des tissus mous des membres, l'un préopératoire et l'autre postopératoire. Il leur a été demandé de délimiter les volumes tumoraux macroscopiques ou les volumes tumoraux macroscopiques reconstruits, les volumes cibles anatomocliniques et les volumes cibles prévisionnels. Le cas préopératoire était celui d'un patient atteint d'un chondrosarcome myxoïde extrasquelettique de grade 1 de la cuisse. Le cas postopératoire était celui d'un patient atteint d'un sarcome pléomorphe de grade 3 de la cuisse. L'analyse de l'accord des contours a été réalisée avec le coefficient statistique  $\kappa$ .

**Résultats.** – Pour le cas préopératoire, l'accord des contours des volumes tumoraux macroscopiques, volumes cible anatomocliniques et volumes cibles prévisionnels était fort ( $\kappa$  entre 0,68 et 0,77). Pour celui postopératoire, l'accord était faible pour les volumes tumoraux macroscopiques reconstruits ( $\kappa$  : 0,38) et modéré pour les volumes cible anatomocliniques et volumes cibles prévisionnels ( $\kappa$  : 0,42). Durant la discussion de l'atelier, un consensus de délimitation a été atteint. La détermination d'un volume limité de couverture cutanée a également été au centre des débats.

**Conclusion.** – Afin d'assurer la pertinence, la reproductibilité et l'homogénéité dans la délivrance des trait radiothérapies, la délimitation précise des volumes cible paraît être un élément crucial. Nous avons montré avec notre étude que la radiothérapie préopératoire des sarcomes des tissus mous des membres pourrait engendrer moins de variations entre les observateurs. Les contrôles de qualité dans le cadre des essais multicentriques apparaissent essentiels.

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## 1. Introduction

Extremity soft tissue sarcomas account for 1% of adult and 7 to 15% of pediatric malignancies [1]. Each year, approximately 4000 new cases are diagnosed in France and Europe-wide incidence is around four to five per 100,000 people [2]. The treatment of sarcomas involves highly specialized management in expert centers and the quality of local treatment is one of the main prognostic factors [3].

Each step, from diagnosis to therapy, requires validation by a multidisciplinary team. Surgery remains the cornerstone of extremity soft tissue sarcoma management, the objective being a wide en-bloc local resection without uncovering the tumour [4]. A compromise between the extent of resection and function preservation of the treated limb should always be found.

Local recurrences are common following surgery and a strong rationale was developed for perioperative radiation therapy [5]. Since the randomized phase III trial by Yang et al., wherein surgery alone versus surgery plus adjuvant radiation therapy was studied in 141 patients, adjuvant radiation therapy has become a standard of care with significant locoregional control rates. Adjuvant radiation therapy is mainly proposed for high-grade or deep lesions or those larger than 5 cm [6].

Pre- and postoperative radiation therapy approaches have been compared by O'Sullivan et al. in a phase III randomized study [7]. They based their study on the hypothesis that preoperative radiation therapy would lead to a smaller irradiation volume, therefore, reducing complications whilst preserving better function.

Although the results did not show any difference in local control between the two strategies, the study by O'Sullivan et al. showed a higher rate of late complications (fibrosis, joint stiffness and edema) in the postoperative arm. So far, preoperative radiation therapy can be suggested in four situations [8]: locally advanced extremity soft tissue sarcomas that are hardly- or un-resectable straightaway due to size and localization, risks of a narrow surgical margin, flap surgeries and fast tumour growth receiving neoadjuvant chemotherapy.

Whilst the timing of radiation therapy is still under debate, its establishment as a key treatment of extremity soft tissue sarcoma is not. Moreover, its technical modalities have become a major consideration. Consequently, consensus guidelines have been developed for extremity soft tissue sarcoma management including gross tumour volume (GTV), clinical target volume (CTV) and planning target volume (PTV) definitions [8–10].

Reproducibility in target volume definition is a major issue for quality assurance in any kind of multicenter studies [11]. In this setting, we performed this study to evaluate target volume contouring variability among expert radiation oncologists from the Groupe sarcome français–Groupe d'étude des tumeurs osseuses (GSF–Géto).

## 2. Methods and materials

Six radiation oncologists with experience in treating sarcomas were invited to a national workshop on target volume delineation

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