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# Letters

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## Comments on *Variations in Tumour Oxygen Tension ($pO_2$) During Accelerated Radiotherapy of Head and Neck Carcinoma*, Lartigau *et al.*, *Eur J Cancer* 1998, 34, 856–861

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WE READ with interest the recent paper by Lartigau and associates entitled "Variations in tumour oxygen tension ($pO_2$) during accelerated radiotherapy of head and neck carcinoma" [1]. The authors reported an increase of $pO_2$ during the first two weeks (32 Gy) of accelerated radiotherapy. This result is remarkable as we recently found a significant decrease of $pO_2$ after 30 Gy in a conventionally fractionated radiochemotherapy schedule for patients with head and neck carcinoma [2].

The authors compared the oxygen distribution in primary tumours and in metastatic neck nodes and stated "...that the relative increase in tissue oxygenation was more pronounced for primary tumours than for neck nodes...." However, these two groups are not comparable as they were treated in different ways: four of six primary tumours but only one of eight metastatic neck nodes were treated with carbogen-breathing. Moreover, the authors wrote that "...reoxygenation seems to occur during hyperfractionated radiotherapy such as the protocol used in our study, with which there is a marked increase in tumour oxygenation...". This statement suggests that an increase in $pO_2$ is an indicator of reoxygenation and consequently the reader might conclude that a decrease in $pO_2$ indicates a lack of reoxygenation.

However, an increase of $pO_2$ (measured by using the Eppendorf-histograph) indicates only that the relationship between well and poorly oxygenated tissue (cells?) has changed in favour of a higher proportion of well oxygenated tissue (cells?). Such an improvement in $pO_2$ does not necessarily indicate reoxygenation. Providing the well oxygenated tissue does proliferate faster than the hypoxic tissue, the proportion of well oxygenated tissue (and so the $pO_2$) increases as well.

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Reoxygenation, however, is followed by an absolute decrease in hypoxic cells. The change of the relationship between well and poorly oxygenated cells (or tissue) is less important. In our recent study there was a significant decrease of the median $pO_2$ after 30 Gy [2]. This finding was in accordance with reoxygenation, as proposed by the standard textbook of Hall [3]. Therefore, any change of the $pO_2$ during therapy is compatible with reoxygenation or lacking reoxygenation.

1. Lartigau E, Lusinchi A, Weeger P, *et al*. Variations in tumour oxygen tension ($pO_2$) during accelerated radiotherapy of head and neck carcinoma. *Eur J Cancer* 1998, **34**, 856–861.
2. Stadler P, Feldmann HJ, Creighton C, Kau R, Molls M. Changes in tumour oxygenation during a combined treatment with split course radiotherapy and chemotherapy in patients with head and neck cancer. *Radiother Oncol*, 1998, **48**, 157–164.
3. Hall EJ. The oxygen effect and reoxygenation. In Hall EJ, ed. *Radiobiology for the Radiologist*, 4th Edn. Philadelphia, J.B. Lippincott, 1994, 133–152.

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## Response from E. Lartigau and M. Guichard

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We thank Dr P. Stadler for his comments on our paper [1]. Our results on an increase in $pO_2$ during radiotherapy were not remarkable, as comparable results have been found in previously published papers with measurements performed in various tumour types [2–5]. Such an increase in oxygen tension is not surprising when treatment of tumours result in clonogenic cell kill and variations in interstitial pressure and blood flow.

Dr Stadler's results have been published [6] and the treatment protocol is certainly not comparable to the one we used [7]. Many differences could in part explain the differences observed on the biological endpoint, i.e. increase in $pO_2$: continuous highly accelerated radiotherapy versus combined chemo-radiotherapy with split course, measurements during radiotherapy or at the end of the split course etc.

We agree with Dr Stadler that the two groups (primary tumours and metastatic neck nodes) evaluated in our study were not comparable, that is why the sentence was extremely careful "...due to the limited number of patients, it is difficult to compare...". Similarly, we avoided using the term 'reoxygenation', because of its very strict biological definition [8]

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