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Letters

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Letters to the Editor: Comments on *A Case of Radiation Myelopathy After 2 × 8.5 Gy for Inoperable Non-small Cell Lung Cancer*, Dardoufas *et al.*, *European Journal of Cancer*, 31A, Nos 13/14, pp. 2418–2419, 1995

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An alternative explanation for the radiation myelopathy seen in a patient described by Dardoufas and colleagues [1] is that when radiotherapy is given as a parallel opposed pair with equal weighting on both beams, the midplane dose (mpd) is actually the minimum dose within the volume. Those parts of the volume closer to the entry point of either beam, such as the cord, actually receive higher doses.

Dardoufas and colleagues do not state the antero–posterior (AP) separation, but from the MRI illustration, the affected part of this man's cord was 5 cm below the surface. Using depth dose data from our 8 MV linear accelerator, an appropriate equivalent square actual cord dose at common AP diameters of chests is, at 20 cm, 8.65 Gy/fraction (plus 1.75%) and, at 25 cm, 8.93 Gy (plus 5.1%) of mpd and the discrepancy becomes greater with larger separation.

Using the same range of α/β ratio for late effects on cord of 1–2, the equivalent cord dose actually given to the cord is 44.6–53.8 Gy at 2 Gy/fraction for 17 Gy, but the received equivalent dose to cord in patients with a 20 cm separation is 46.1–55.7 Gy (plus 3.3%), and at a 25 cm separation 48.8–59.1 Gy (plus 9.5%). The biological effect is greater than expected if both total dose and dose per fraction are increased.

The cord tolerance dose is of crucial importance to radiation oncologists but is not precisely known. Schultheiss and Stephens suggest a threshold dose for radiation myelopathy of 50 Gy in 2 Gy fractions and estimate the dose required for a 5% risk of myelopathy at 5 years to be 57–61 Gy [2]. Emami and colleagues [3] estimate the dose for 5% myelopathy at 5 years to be 50 Gy for cord lengths of up to 10 cm.

There are some uncertainties extrapolating linear quadratic isoeffect formulae to very low numbers of fractions, but the actual dose to cord in this patient seems compatible with common estimates of dose sufficient to cause myelopathy without invoking any special mechanisms, and draws attention to variation in doses throughout the volume when prescribed to parallel opposed fields.

1. Dardoufas C, Plataniotis GA, Damatopoulou A, *et al.* A case of radiation myelopathy after 2 × 8.5 Gy for inoperable non-small cell lung cancer. *Eur J Cancer* 1995, **31A**, 2418–2419.
2. Schultheiss TE, Stephens L. Permanent radiation myelopathy. *Br J Radiol* 1992, **65**, 737–753.
3. Emami B, Lyman J, Brown A, *et al.* Tolerance of normal tissue to therapeutic irradiation. *Int J Radiat Oncol Biol Phys* 1991, **21**, 109–122.

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We were interested to read the case report by Dardoufas and colleagues (*Eur J Cancer* 1995, **31A**, 2418–2419), describing a case of radiation myelopathy (RM) following the use of the 2 × 8.5 Gy regimen for inoperable non-small cell lung cancer.

We have recently reported on the experience of this problem in three randomised trials run by the Medical Research Council Lung Cancer Working Party (*Clin Oncol*, in press). We identified 3 cases with clinical features suggestive of RM out of a total of 524 patients who received this regimen. We calculated the cumulative risk of RM to be 0.6% and 2.2% at 1 and 2 years, respectively, and suggested that α/β for human spinal cord is approximately 2 Gy.

We would like to comment on the radiobiological analysis made in the letter of Dardoufas and colleagues. It is incorrect to assume that the spinal cord will receive the same dose as that prescribed to the midplane (mpd). Because the spinal cord lies approximately 5 cm from the posterior surface, the dose received may be anything from 2 to 10% higher than the mpd, depending on the beam energy and antero–posterior (AP) separation. There may also be variation in AP separation in the superior–inferior direction. In our analysis, we assumed that the dose to the spinal cord might on average be 5% greater than the dose to mpd.

Table 1 shows the calculated values for the equivalent dose

Table 1. Values of biologically equivalent dose (LQED2) to spinal cord for the regimen of 17 Gy in two fractions, for different values of α/β and different percentage increases of cord dose above mid-plane dose (mpd)

Increase in spinal cord dose over mpd (%)	Fraction size (Gy)	LQED2 $\alpha/\beta = 1$	$\alpha/\beta = 1.5$	$\alpha/\beta = 2$
0	8.5	53.8	48.6	44.6
5	8.93	59.1	53.2	48.8
7.5	9.14	61.8	55.5	50.9
10	9.35	64.5	58	53.1

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