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Dear Editor,

I have read your article with great interest [1]. There is a growing clinical experience with pulsed dose rate (PDR) technique as well as brachytherapy (BT) modality, that combine the physical advantages of high dose rate (HDR) technology and radiobiological advantages of conventional continuous low dose rate (LDR) BT. In general, in order to achieve an equivalent of LDR effect while using PDR treatment strategy, similar total dose with comparable overall treatment time using similar overage dose rate should be considered. However, as you wrote, some radiobiological aspects of PDR continue to be debated. Beside the actual recovery, half-lives (T1/2) of both cancer and normal (especially late-responding) tissues in which the most significant intervals between pulses for particular tissues are undefined. Moreover, apart from monoexponential repair kinetics, various cases of multiphasic recovery are noted. In addition, the pulse dose of 1Gy, as recommended by Fowler and Mount [2], is frequently used because of shorter treatment time. However, according to Brenner and Hall [3] as well as Fowler and van Limbergen [4], the maximum dose per pulse, repeated every hour, should not exceed 0.6 Gy.

With all the above mentioned limitations of the biologically effective dose (BED), the BED calculation is the only way to replace HDR and LDR BT by PDR technique in clinical practice. The clinical radiobiology of BT with the linear-quadratic (LQ)-based methodology for BED applied to BT was described by Dale and Jones [5]. For finding BED, the physical variables used in the model include: the total dose, the number of pulses, the length of the pulse, the interval of pulses, and the α/β value.

The example of practical application of BED is postoperative BT applied in treatment of corpus uteri cancer. With recently published PORTEC-2 trial results exclusive BT should be an adjuvant treatment of choice for patients with endometrial carcinoma of high-intermediate risk [6]. In this study, BT was delivered with a vaginal cylinder with the reference isodose covering the proximal half of the vagina. The prescribed dose specified at 5 mm distance from the surface of the cylinder was delivered with HDR and LDR BT with a dose equivalent of 45-50 Gy to the vaginal mucosa: 21 Gy in three fractions of 7 Gy, 1 week apart for HDR; 30 Gy at 0.5-0.7 Gy/h for LDR and 28 Gy at 1 Gy/h in one session for the medium dose rate.

In institutions equipped with only PDR unit (such as the author's site) the PDR technique has to be adopted. Using LQ model by Dale and Jones, the BED for tumor α/β 10 (calculated from formula assuming mono-exponential recovery kinetics and T1/2 for all cells of 1.5 hour, and the reference dose rate of 0.46 Gy/h for LDR) is approximately: 36.6 Gy for LDR of 30 Gy/0.7 Gy and 33.5 Gy as an equivalent of 28 Gy/1 Gy (doses for late-responding tissue: BEDα/β3 of 32.6 Gy and 41.1 Gy, respectively). With PDR equations (assuming the same recovery factors), the dose of 17 Gy (BEDα/β10 – 23.5 Gy) or 18 Gy (BEDα/β10 – 24.9 Gy), both at 1 Gy/pulse/hour, at a distance of 0.5 mm from the applicator should be administered (with respective BEDα/β3 doses of 38.8 Gy and 41.3 Gy, which are comparable to LDR). The dose to the vaginal mucosa consisting of average 164% of the prescribed dose is thus 45.5 Gy or 48.3 Gy, and mimics the PORTEC-2 dose.

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