
Disappearing of Pulsed-dose rate brachytherapy in favor to High-dose rate: A Part / counterpart debate

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Résumé

Since February 2014, it is no longer possible to use low-dose rate 192 iridium wires due to the end of industrial production of IRF1 and IRF2 sources. The Brachytherapy Group of the French society of radiation oncology (GC-SFRO) has recommended switching from iridium wires to after-loading machines. Two types of after-loading machines are currently available, based on the dose rate used: pulsed-dose rate (PDR) or high-dose rate (HDR). A comparative analysis between PDR and HDR brachytherapy is proposed based on biological, technological, organizational and financial considerations.

Regarding biological considerations, even if the biological effects of pulsed-dose rate brachytherapy are not strictly stackable to those observed after low-dose rate brachytherapy, the former gets closer to latter than to high-dose rate brachytherapy. The results of the comparative studies mainly performed for cervical cancer confirm that there is no significant difference (with even a small advantage for HDR) between low- and high-dose rate brachytherapy.

Regarding technological considerations, currently, there is no difference in terms of technical approaches for the implant between pulsed- and high-dose rate brachytherapy, whatever the indication. Vectors (applicators, tubes, needles) are the same and after-loading machine are quite similar. However, it is important to notice that some specific skin, head & neck or pediatric procedure need the use of tubes with small diameter, which are not available for HDR brachytherapy.

While the organizational management of PDR brachytherapy is very close to low-dose rate brachytherapy in terms of treatment delivery and nursing care, HDR brachytherapy is comparable to linear accelerator treatments, with one or two teams of dedicated technicians, a devoted bunker and specific patient schedules, especially in case of bifractionated irradiations. For brachytherapy that needs hospitalization (mainly for pelvic implants), the HDR procedure can be performed while the patient remains in a standard, non-shielded room, allowing visits and consequently, decreasing the loneliness sensation due to the treatment itself.

Financial investigation remains a critical point when choosing between pulsed- or high-dose rate after-loading machines. A simple analysis can be performed: considering the treatment of 5 patients during 5 consecutive days in a dedicated brachytherapy unit, in case of a PDR procedure, 5 after-loader machines and 5 shielded rooms will be necessary; however, for the HDR technique, only one machine will be used without any dedicated shielded rooms. In

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addition, only one iridium radioactive source will be changed every 3 months for the HDR procedure, instead of 5 in case of the PDR approach.

After the end of low-dose rate ¹⁹²iridium wires production, the Brachytherapy Group of the SFRO proposed to use pulsed- or high-dose rate after-loader machines to replace low-dose rate brachytherapy. It is currently debatable to promote one technique or the other due to the lack of rigorous comparison and in France, the main objective at this time is to be able to continue the practice and the development of brachytherapy around the country