Vaginal Rhabdomyosarcoma Brachytherapy Cylinder Prototype: Clinical and Dosimetric Experience

Rachele Grazziotin Reisner, Elizabeth Nakano Góes de Souza, Carlos Manoel Mendonça de Araujo, Célia Pais Viégas.
Radiation Oncology Department, Instituto Nacional de Câncer- INCA- Rio de Janeiro, Brazil.

PURPOSE

Vaginal rhabdomyosarcoma is a rare type of pediatric cancer, originating in the soft tissues of the genital canal.

Brachytherapy plays an important role in the treatment when complete remission can't be achieved with chemotherapy.

This study reports on the clinical and technical aspects of customized high-dose-rate brachytherapy applicator for genital canal rhabdomyosarcoma in children.

Due to the lack of appropriate cylinders that meet the need of children patients, a nylon genital canal was developed to assure quality of treatment.

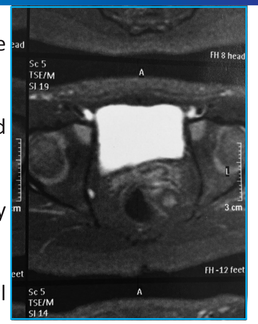


Figure 1: Disease in Vaginal Cavity after Chemotherapy.

MATERIAL AND METHODS

An impression of the vaginal cavity was taken under anesthesia and the nylon prototype was built based on this impression with such dimensions: 15 mm extension and 8 mm of diameter (figure 2).
A probe from the manufactor was used inside the prototype to assure proper connection to the high dose rate machine channel.

Figure 2: original pediatric vaginal applicator developed at INCA

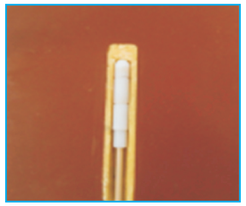


Figure 3: pediatric vaginal applicator into solid water phantom open sagital view.

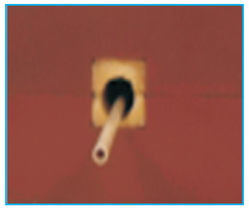


Figure 4: pediatric vaginal applicator into solid water phantom closed sagital view.

Figure 5: TLDs at applicator surface.

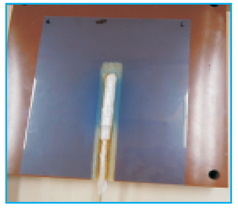


Figure 6: Radiocromic film at phantoma suface.

A pelvic CT scan was taken for image acquisition of the planning process, under anesthesia, with the applicator in place. The images were acquired for contouring and conformal planning.
Two patients (15 and 24 month-old) were submitted to treatment protocol using 30 Gy in 10 fractions, under anesthesia, delivered daily.
Solid water was used to dosimetric analysis.
The solid water object had dimensions of 30x30x10 cm, density 3.1 g/cm with and internal orifice of 3x3x18 cm and a hollow wax bolus to a proper fit of the cylinder dimensions.
The applicator was inserted into solid water phantom, simulating treatment parameters and 300 cGy was prescribed at the cylinder surface (figure 3 and 4) ® Dosimetric films (GAFCHROMIC) and Thermoluminescent dosimeters (TLD) [Li:Mg,Ti were used (figure 5 and 6).

RESULTS

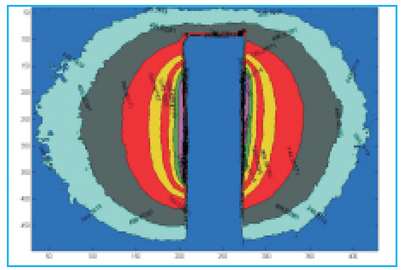
The measured doses were, respectively, 248.91 cGy and 249.76 cGy with TLD and film (figure 6 and 7). In the planning system, the distance between the curves of 300 cGy and 249 cGy was 1.4 mm (figure 8), comparable to the TLD data. Thus, the high dose gradients in brachytherapy explains this difference between measured and prescribed doses. The results obtained with the dosimeteres were 80% of the prescribed dose and were consistent with the nominal planning system.

Patients have been through follow-up periods of 8 and 5 years. So far, there have been no recurrence nor any acute or late toxicity reported.

The older 11 years old patient has presented normal hormonal levels and menarche.

The youngest 7 years old patient has had no recurrence either.

Both remain under observation.



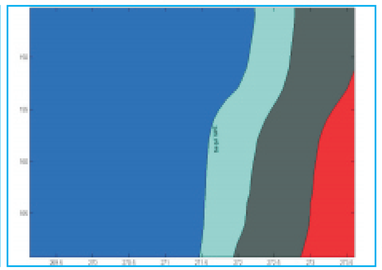


Figure and 7: Dose distribution on radiocromic film2

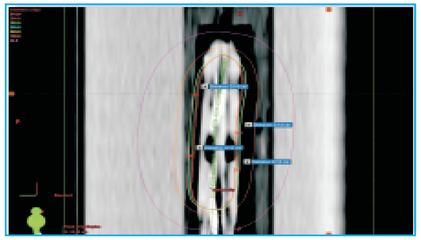


Figure 8: Dose distribution on Brachyvision

CONCLUSION

A costumized applicator for brachytherapy has proven to be an acceptable option, due to a lack of retail applicators appropriate for treating children.

Computerized tomography compatibility and proper dose distribution have been some of the advantages found in the use of such applicator.

Projeto Gráfico: Serviço de Edição e Informação Técnico-Científica / INCA