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Operative Techniques

Testicular transposition in children undergoing brachytherapy for bladder and/or prostate rhabdomyosarcoma☆

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ABSTRACT

Background/Purpose: Fertility preservation is a major goal in treatment of children with cancer. We describe a new technique of testicular transposition (TT) in patients treated with pulse-dose-rate (PDR) brachytherapy as part of the multimodal conservative treatment of bladder neck and/or prostate rhabdomyosarcoma (BP RMS).
Methods: Medical records of consecutive patients treated between September 2016 and August 2017 were studied. These patients underwent a TT performed during BP RMS surgery by the same suprapubic incision. The external oblique aponeurosis was not incised. The spermatic cord was mobilized up to the external inguinal ring, and the gubernaculum attachments were severed from the scrotum. The testis was then flipped over with care taken to avoid injury of the vessels or the vas, wrapped in a silicone material and sutured under the abdominal skin with a transfixing stitch facing the anterior superior iliac spine. At the end of brachytherapy, the testis was relocated in the scrotum and during the same general anesthesia, plastic tubes and stents were removed. Surgical outcome and dosimetric parameters were examined.
Results: Eight patients were identified. Median age was 24 months (range 11–80 months). All had embryonal BP RMS and received chemotherapy according to RMS 2005 protocol prior to local treatment. All patients underwent conservative surgery followed by brachytherapy (60 Gy) and had testicular transposition of one testis. None had surgical complications. After converting doses to biologically equivalent doses in 2-Gy fractions (EQD2), the dose delivered to 75% of the transposed testis was 1.5 GyEQD2 (1–3 GyEQD2), versus 5.4 GyEQD2 (3.9–9.4 Gy EQD2) for the untransposed testis ($p < 0.001$).
Conclusion: Testicular transposition is feasible in order to potentially preserve fertility and future quality of life in children undergoing brachytherapy for BP RMS.
Type of Study: Level IV Treatment Study: Case Study with no Comparison Group.

The number of children surviving cancer has increased due to the improvement of treatments and long-term quality of life after cure is a major consideration. The long-term sequelae of patients after childhood cancer treatment with chemotherapy and radiotherapy include impaired puberty and fertility [1]. Although definitive dose/effect correlations are lacking, direct radiation to the testes causes prolonged germ cell dysfunction. Spermatogonias are affected by a dose of 0.15 Gy and doses more than 4 Gy may lead to definitive sterility. For doses <4 Gy, a recovery of spermatogenesis can be seen, with a time to recovery that is dependent on the dose and can take years. Leydig cells are more resistant and endocrine function can be maintained after exposure to dose up to 20 Gy in prepubescent males [2–4]. Patients and parents should be counseled about the risks of infertility even if the risk is low and fertility restoration techniques are still in the field of research [5–8]. Several methods of fertility preservation and gonadal protection exist. Regarding irradiation, testicular shielding is the most common method to avoid radiation damage limiting scatter radiation exposure dose by nearly 90% [9,10] but ineffective in case of brachytherapy for children with bladder and / or prostate rhabdomyosarcoma (BP RMS). The radiation dose is highly dependent on the anatomic distance from the center of the radiation field. By relocating the testis out of the irradiated volume, testicular transposition avoids direct radiotherapy or scatter to the adjoining structures.

☆ The authors declare that they have no competing interests.

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The aim of this article was to describe a new technique of TT in prepubertal boys treated with pulse-dose-rate (PDR) brachytherapy for BP RMS, with focus on early term outcome. The dosimetric impact on testes is reported.

1. Patients and methods

1.1. Patients

Medical records of patients with BP RMS treated between September 2016 and August 2017 were studied. All these children had been referred for conservative treatment of a BP RMS after receiving chemotherapy, according to RMS 2005 protocol. The eligibility criterion for this retrospective analysis was that they had undergone a TT at time of a conservative surgery, which indications have been detailed before [11,12].

1.2. Surgical technique

All parents gave their written informed consent prior to intervention. These patients underwent a conservative surgery, with per operative implantation of plastic tubes through a transperineal approach and encompassing the prostate and bladder neck, as previously reported [12,13]. At the end of surgical intervention, all patients underwent TT of one testis during BP surgery and through the same suprapubic incision. The cord structures and testis were elevated from the floor of the canal without incision of the external oblique aponeurosis and the gubernaculum attachments were severed below the testis from the scrotum. The testis was then flipped over with care taken to avoid injury of the vessels or the vas and wrapped in a silicone material (Figs. 1 and 2).

Fig. 1. After severing of the gubernaculum attachments, the right testis is flipped over the external oblique aponeurosis. Notice that the TT is done through the tumor's surgery wound.

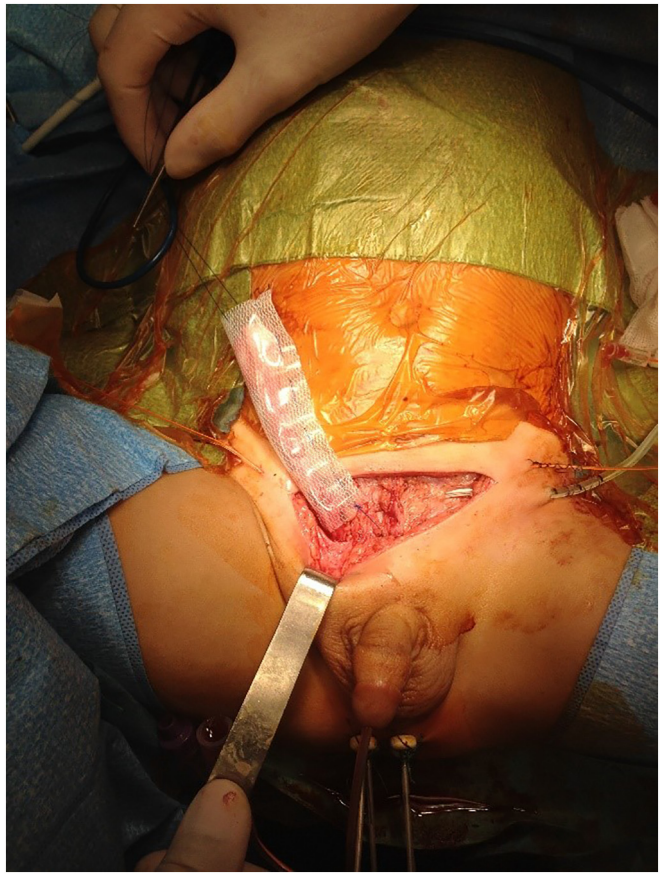

Fig. 2. The testis is wrapped in a silicone material.

It was then sutured under the abdominal skin facing the anterior superior iliac spine with a transfixing stitch knotted on the outside on a pledget in an atraumatic manner without tension on the testis (Fig. 3). This maneuver moved the testis from the radiation field and placed it in a position where it could be identified by palpation. One week later, they were transferred to the brachytherapy unit.

1.3. Brachytherapy and dosimetric analysis

Patients had a computed tomography acquired in supine position; slice thickness 1.5 mm. Axial images were imported to the Plato PBD treatment planning (Nucletron, Veenendaal, the Netherlands). A three dimensional set was reconstructed and the application was digitized. Dwell positions in the implant catheters were defined depending on the volume to be treated (the prostate and the bladder neck). Doses were prescribed to the reference isodose. Dwell time positions could be modified in order to decrease the dose to the anterior rectal wall or improve coverage of the prostate and bladder neck. A dose of 60 Gy through continuous hourly pulses of 0.42 Gy was delivered. The testes were delineated, and dose was registered, but the optimization process did not take into account the dose to the testes.

At the end of brachytherapy, the testis was relocated in the scrotum during general anesthesia for retrieval of the tubes and stents with a small opening of the previous skin surgical wound.

1.4. Follow-up and statistical analysis

During the brachytherapy, children were seen daily by a pediatrician. After the treatment, they were followed up every 3 months clinically and with a pelvic MRI. The intraoperative and postoperative complications were scored according to the Common Terminology Criteria for Adverse Events version 4 (CTCAE v4) and were reported.

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