ISSN: 2581-5989
PubMed - National Library of Medicine - ID: 101738774

International Journal of Dental Science and Innovative Research (IJDSIR)
IJDSIR : Dental Publication Service
Available Online at:www.ijdsir.com
Volume – 6, Issue – 2, March - 2023, Page No. : 14 – 17

A customised brachy therapy radiation carrier for orbital rhabdomyosarcoma: A case report

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Citation of this Article: Akshayalingam Meenakshi, Mariappan Jeevetha, "A customised brachy therapy radiation carrier for orbital rhabdomyosarcoma: A case report", IJDSIR- March - 2023, Volume –6, Issue - 2, P. No. 14 – 17.

Type of Publication: Case Report

Conflicts of Interest: Nil

Abstract

Radiation therapy is the therapeutic use of ionizing radiation and can be applied via external beam or brachytherapy. Mould brachytherapy is short distance radiation delivery via custom fabricated carrier device known as mould. This report describes the fabrication of customized brachytherapy appliance for a 4 yr old patient having rhabdomyosarcoma of right orbit.

Keywords: Brachytherapy, Mould Brachytherapy Appliance, Catheters, Rhabdomyosarcoma Of Right Orbit

Introduction

Orbital tumors have an incidence rate of 1.39 per million person /year, with majority consisting carcinoma, melanoma, sarcoma, and lymphoma. The management of orbital tumors would depend on the type of tumor and its extent of invasion. Surgical intervention include exenteration, enucleation or excision with wide margin. However, patient with advanced disease usually preclude total resection of all grosstumors, which is most common indication for post operative radiation therapy, as shown in multiple studies reporting adjuvant radiotherapy reducing local recurrence rate. Radiation therapy can be administered either with external beam radiotherapy or brachytherapy, each with its own advantage and disadvantage. Currently, published reports on orbital brachytherapy show various type of applicators , ranging from intracavitary mold applicators to intraorbital (interstitial brachytherapy). The most optimal applicators would be a patient specific 3D printed applicator,as this would conform with anatomy of the patient. However ,due to financial reasons ,it is not very practical to use, especially in ow resource centers, in addition ,interstitial brachytherapy would entail expertise not available to most centers. Here, we reported technical details of a contemporary approach

for orbital brachytherapy used in our college, which can applied in low resource settings without compromising dose coverage.

Case Report

A 4 yr old child reported to institute of child health and hospital for children, Chennai with right progressive proptosis, right eye echymosis. Her past medical history reveals she had trivial trauma following which child developed watery eyes , treated conservatively in local hospital in oosur for 1 month, child went to vasan eye care in oosur for increasing in size of the eye swelling then referred to Narayanan Nethralaya (bangalore). Child was evaluated and CT-ORBIT showed soft tissue mass, proceeded with biopsy of right eye, diagnosed as embryonal rhabdomyosarcoma, and then started chemotherapy , 18 weeks of VAC given thrice, and discontinued came to ICH. They done exenteration of right ocular mass and planned for brachytherapy(Fig 1) For surface mould brachytherapy , the patient was referred to Tamilnadu government dental college and hospital ,Chennai for fabrication of carrier device.

Fig 1 : Exenteration of right orbit

Procedure for fabrication of radiation device involving right orbit

The extent of right orbit was marked and impression of right orbit was made using modelling wax.The impression poured with Type III dental stone to prepare a definitive cast . Four longitudinal lines were marked at superior side of the wax pattern which indicate the position of catheter(Fig 2). The lines are parallel to each other at a distance of approx. 4mm.

Fig 2: orbital impression with markings for IV tube placement

The number , placement and position of catheter were consulted with radiation oncologist and design of the prosthesis was customised according to those requirement. Instead of catheter , we placed a IV tube at a certain length in that parallel line(Fig 3) We made a IV tube through and through . Through that created path catheter tube should pass. The final appliance was fabricated with autopolymerizing acrylic resin.

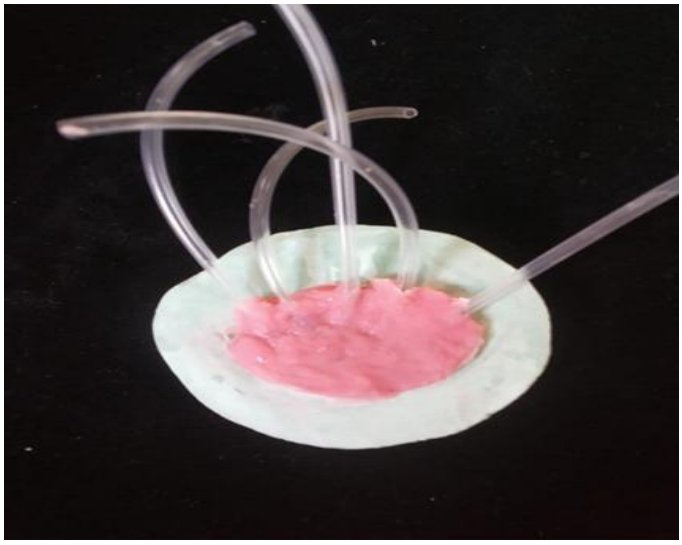

Fig 3: Acrylic mould with IV tube placed

After finishing , the fit of the prosthesis was assessed in patients right eye. In order to stabilize the appliance , we secured with Velcro strap , that winds around the child's head (Fig 4)

Fig 4: Final fitting of surface mould for orbit

Thus a carrier device was fabricated fulfilling the entire requirement needed for a brachytherapy mould.

Mock radiation test and CT scan was carried out to check the reliability of the device, before starting the procedure. After the source patency was confirmed, the radiation carrier was placed in patient's orbit and the catheters were connected the machine. A fractionated scheme of 3.5 gray /4 fractionations; for 4 days was used as decided by the radiation oncologist. Subsequent follow-up was done after 6 weeks.

Discussion

Radiation therapy for orbital tumors can be performed with either beam radiotherapy or brachytherapy . External beam radiotherapy can reach deeper structures and is not limited by the constraint of accessibility to treatment site. However, such treatment has been associated with toxicities of normal tissues surrounding treated area,including retinopathies , cataracts ,eyelash loss , eyebrow loss(1,2) On the other hand , due to steep dose fall off , brachytherapy can deliver adequate therapeutic dose to surrounding normal tissues . Brachytherapy also leads to decreased late toxicity compared to external beam radiation therapy (3,4). Since surrounding normal tissues do not receive a significant dose of radiation and because the radiation source emerges from the orbital cavity without an entry and exit of dose through normal tissues. However, this present a drawback of not being able to penetrate deeper tissues , and is technically more difficult to administer . Moreover, it is further complicated by irregular tissue contours, lack of specific site applications and deformed anatomy (5,6)

With careful selection of patient and optimal planning , brachy therapy of the orbit seems to be effective if the treated area is adequately covered, and limited dose received by other organ are maintained .A long term follow up is recommended since radiation therapy can produce a late adverse effect , especially for re-irradiated patients.

Types of radiation prosthesis

Carrier prosthesis for holding radioactive sources or radiation beam cones (positioning stents),prosthesis for

displacing normal tissues ,prosthesis for protecting radiosensitive tissues (prosthetic shields), and prosthesis for measuring radiation doses.

Conclusion

The current case report describes a method for the fabrication of mould brachytherapy appliance that is simple and non -invasive with good patient acceptability which can be used for treating rhabdomyosarcoma involving right orbit.

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