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Radiation treatment for the right naris in a pediatric anesthesia patient using an adaptive oral airway technique

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ABSTRACT

Radiation therapy for pediatric patients often includes the use of intravenous anesthesia with supplemental oxygen delivered via the nasal cannula. Here, we describe the use of an adaptive anesthesia technique for electron irradiation of the right naris in a preschool-aged patient treated under anesthesia. The need for an intranasal bolus plug precluded the use of standard oxygen supplementation. This novel technique required the multidisciplinary expertise of anesthesiologists, radiation therapists, medical dosimetrists, medical physicists, and radiation oncologists to ensure a safe and reproducible treatment course.

Introduction

Radiation therapy in the pediatric population often requires the use of sedating medications[1] to reduce patient setup error and potential for movement during treatment. At the University of Washington Medical Center, anesthesiologists from our partners at Seattle Children's Hospital provide daily anesthesia for more than 40 patients a year treated in our radiation oncology unit. Often, the patients are anesthetized with propofol, which is an intravenous hypnotic/amnesic agent with a very short half-life. To ensure adequate respiratory support during treatment, patients are treated with supplemental oxygen delivered via the nasal cannula.

This report describes treatment of a 3-year-old patient who was referred for adjuvant radiation for alveolar rhabdomyosarcoma (ARMS) of the right naris after resection and chemotherapy. Superficial treatment using electrons was most appropriate in this case owing to the superficial nature of the disease. Providing bolus within the right (ipsilateral) naris ensured adequate dose to the at-risk area. We describe the multidisciplinary expertise used to develop a safe and reproducible setup for this patient undergoing fractionated radiation therapy.

Case Report

Although its etiology remains unknown, rhabdomyosarcoma (RMS) is the most common soft tissue sarcoma in children and adolescents younger than 20 years.[2] RMS can occur at any age, and approximately two-thirds of new cases are diagnosed in children younger than 6 years.[3] There are 2 main types of pediatric RMS: embryonal RMS (ERMS) and ARMS. Embryonal RMS is the most common type; however, ARMS is often considered the more aggressive type with more frequent recurrence and metastatic spread.

The patient is 3 years old and had a biopsy-proven ARMS of the right naris. The patient had no evidence of metastatic disease. A magnetic resonance imaging (MRI) study preformed before surgery showed a $5 \times 8 \times 7$ mm^3 enhancing nodule within the right anterior/lateral nasal cavity. The tumor was resected with negative margins, and the patient was referred for adjuvant radiation therapy while receiving chemotherapy. Wide surgical margins that would have obviated the need for adjuvant radiation treatment could not be achieved without unacceptable cosmetic and function morbidity.

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Fig. 1. Right nasal plug in place. (Color version of figure is available online.)

Fig. 2. Original bolus and nasal cannula in place. (Color version of figure is available online.)

After a preanesthesia assessment by the anesthesiologist, the patient was brought to the computed tomography (CT) simulation room to acquire a treatment planning CT (TPCT) scan. Owing to the patient's age, anesthesia was required for the TPCT scan and daily radiation therapy. Under the care of the pediatric anesthesiologist, the patient was induced with a bolus of propofol. After the induction bolus, the patient was then placed supine onto the CT couch with a clear "A" head holder. The propofol infusion was started by the anesthesiologist, and it was continued throughout the CT simulation. The plan of treatment included adding bolus material into the right naris to ensure adequate dose coverage and also obstructing the right nostril. Because the right nostril was obstructed, the standard practice of providing supplemental oxygen was not available. Although the left nostril did not have a plug, the radiation oncologist and the anesthesiologist were concerned that it is unsafe to rely on just the contralateral nostril for supplemental oxygen both because the preference is to have both the nostrils available and because the plug in the right nostril could displace the nasal septum, thus reducing the air flow space of the left nostril. The anesthesiologist therefore inserted a 7.0 oral airway into the patient's mouth, and an infant nasal cannula was taped to the external opening of the airway (Figs. 1 and 2). This same anesthesia technique was also used for daily radiation treatment. Once the patient was stable under sedation, a plug was made for the right naris by melting Aquaplast beads and forming them around a piece of dental floss to provide a means of removing the nasal plug after treatments. The plug was checked by multiple providers to ensure it was securely attached to the dental floss (if they were to separate, it would be a challenge to recover the plug). The plug was inserted into the patient's right nostril to fill the air cavity of the nostril with a tissue-equivalent material (Fig. 1). Owing to the stimulating nature of the Aquaplast plug

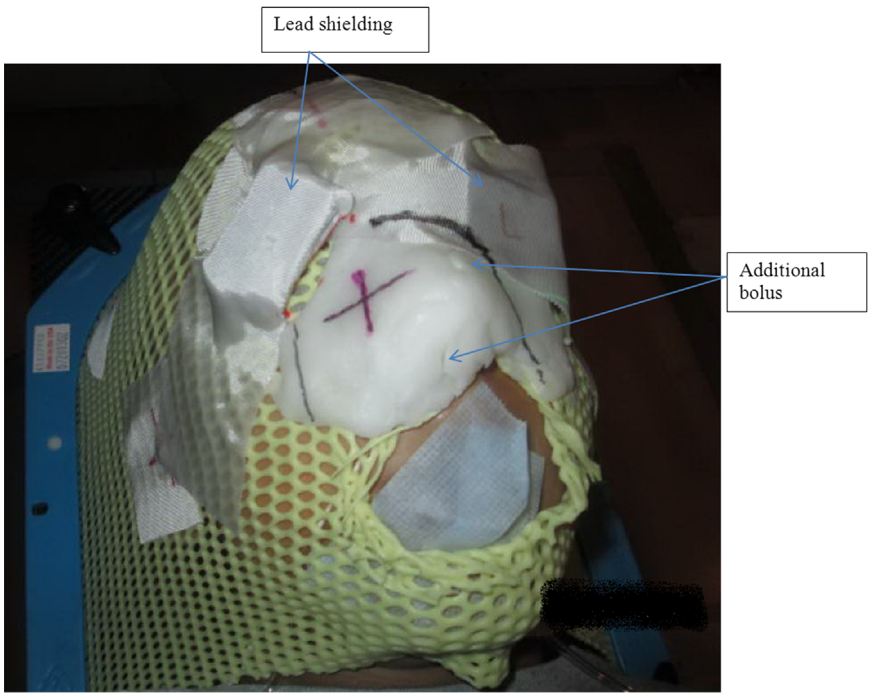

Fig. 3. Additional bolus and eye shielding added to mask. (Color version of figure is available online.)