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Outcomes of Dacryocystorhinostomy in Patients with Head and Neck Cancer Treated with High-dose Radiation Therapy

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Abstract

Purpose—To evaluate the outcomes of dacryocystorhinostomy (DCR) in head and neck cancer patients treated with high-dose radiotherapy.

Methods—The clinical records of 43 consecutive patients with head and neck cancer who underwent DCR after high-dose external-beam radiotherapy plus ablative surgery and/or chemotherapy between December 2001 and April 2011 were retrospectively reviewed.

Results—There were 23 males and 20 females. The median age was 56 years (range, 2-92 years). Thirty-one patients were Caucasian, 6 Hispanic, 4 Asian, and 2 African American. Thirty patients (70%) presented with epiphora, 3 (7%) with dacryocystitis, and 10 (23%) with both epiphora and dacryocystitis. Symptoms were unilateral in 34 patients (79%) and bilateral in 9 (21%). The most common primary cancer diagnoses were squamous cell carcinoma (n=14), sarcoma (n=8), adenoid cystic carcinoma (n=4), and basal cell carcinoma (n=3). The most common primary tumor locations were the sinonasal cavity (n=16), maxillary sinus (n=9), palate (n=3), and ethmoid sinus (n=3).

Thirty-seven patients (43 eyes) had DCR with silicone tube placement, and 6 patients (7 eyes) had DCR with Pyrex glass tube placement. Following DCR, 31 patients (72%) had resolution of their symptoms, and 12 patients (28%), 9 with silicone tubes and 3 with Pyrex glass tubes, had persistent or recurrent epiphora (DCR failure). The most common reason for failure was significant residual canalicular and nasal mucosal scar tissue. Nine of these 12 patients underwent additional surgery, most commonly with placement of a Pyrex glass tube. Seven (35%) of the 20 patients who underwent DCR less than 12 months after radiotherapy and 5 (21%) of the 23 who underwent DCR at least 12 months after radiotherapy had recurrent symptoms.

Conclusions—DCR in head and neck cancer patients previously treated with high-dose radiotherapy is generally successful, especially when delayed until at least 12 months after the completion of radiotherapy. A common reason for DCR failure after high-dose radiotherapy is severe canalicular and nasal mucosal scarring.

INTRODUCTION

Nasolacrimal duct and canalicular obstruction is a common complication of treatment for head and neck malignancies.¹⁻³ Treatments that can cause such obstruction include radiation therapy, which is a common primary and adjuvant treatment for many head and neck

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cancers; surgery; and chemotherapy. In particular, scarring and secondary nasolacrimal duct obstruction is a well-known complication of treatment with either external radiation therapy⁴⁻⁶ Ablative surgery for cancer in the sinonasal cavity and paranasal sinuses often involves removal of all or part of the lacrimal drainage apparatus. High-dose radiation therapy after ablative surgery causes inflammation and fibrosis and further increases the risk of nasolacrimal duct obstruction and particularly canalicular scarring.

In addition, some chemotherapeutic agents, such as taxanes, are known to cause canalicular and nasolacrimal duct stenosis.⁷⁻⁹ Surgical intervention in the form of DCR or conjunctival DCR may be required to alleviate the symptoms of cancer treatment-induced nasolacrimal duct obstruction in patients with head and neck cancer.^{10,11}

To our knowledge, our early preliminary observations published in 2003 are the only published observations to date on the outcomes of patients undergoing DCR following high-dose radiation therapy for head and neck tumors.¹² The purpose of the current study was to expand on our previous study by reviewing outcomes in a larger series of patients with head and neck cancer treated with DCR after high-dose radiation therapy at our comprehensive cancer center. In contrast with our previous study, the current study was limited to patients who received high-dose radiation therapy to the head and neck. The current study also included patients treated over a longer period of time (a decade) and with longer follow-up time. Herein, we report our more mature clinical observations from this new and larger study.

METHODS

After institutional review board approval was obtained, the clinical records of 43 consecutive patients with a primary head and neck cancer who underwent lacrimal bypass surgery (DCR) after high-dose external-beam radiation therapy in combination with ablative surgery, chemotherapy, or both between December 2001 and April 2011 were retrospectively reviewed. All patients underwent an external DCR or conjunctivo-DCR with placement of a silicone or Pyrex glass tube as dictated by the patient's degree of canalicular stenosis. Incisions were closed with three layers to help prevent the formation of fistulas. The follow-up time was measured from the date of DCR to the date of last contact.

Parameters recorded from each patient's chart included age at diagnosis, gender, primary tumor diagnosis, ethnicity, type of primary surgery for the head and neck cancer (e.g., debulking surgery, maxillectomy, details of radiation therapy and chemotherapy, whether lacrimal bypass surgery was performed at the time of primary cancer surgery or later, time interval between completion of radiation therapy and lacrimal bypass surgery, findings during in-office probing and irrigation before and after DCR, symptoms before and after DCR, type and outcome of DCR, length of time silicone tubing was left in place, complications of DCR, and whether additional lacrimal procedures were required.

RESULTS

Patient and Tumor Characteristics

Of the 43 patients in this study, 23 were male and 20 were female. The age at diagnosis of primary head and neck cancer ranged from 2 years to 92 years (median, 56 years). In this series, 31 patients were Caucasian, 6 were Hispanic, 4 were Asian, and 2 were African American. The presenting symptoms were epiphora in 30 patients (70%), dacryocystitis in 3 patients (7%), and both in 10 patients (23%). Symptoms were unilateral in 34 patients (79%) and bilateral in 9 patients (21%).

The primary cancer diagnoses included squamous cell carcinoma in 14 patients (32.5%), sarcoma in 8 patients (18.6%), adenoid cystic carcinoma in 4 patients (9.3%), basal cell carcinoma in 4 patients (9.3%), esthesioblastoma in 2 patients (4.6%), pleomorphic adenoma in 2 patients (4.6%), undifferentiated carcinoma in 2 patients (4.6%), and adenocarcinoma, melanoma, neuroendocrine carcinoma, adnexal carcinoma, mucoid epidermoid carcinoma, chordoma, and ameloblastoma in 1 patient (2.3%) each. The most common primary tumor locations were the sinonasal cavity (16 patients; 37.2%), maxillary sinus (9 patients; 20.9%), palate (3 patients; 6.9%), and ethmoid sinus (3 patients; 6.9%). The most common primary surgical resections included maxillectomy in 22 patients, ethmoidectomy in 12 patients, palatectomy in 4 patients, and rhinectomy in 3 patients: some patients may be counted more than once depending on the tumor location.

Radiation Therapy and DCR

The median dose of radiation was 60 Gy (range, 40-70 Gy), and the median number of fractions was 30 (range, 16-33). Thirty-nine patients (90.7%) received either extended mantle radiation therapy with photons or intensity-modulated radiation therapy with photons; 1 patient received proton therapy; 1 patient received fast neutron radiation therapy; and 2 patients received radiation therapy at another institution and had incomplete records.

Thirty-seven patients (86%) (43 eyes) had DCR with silicone tube placement, and 6 patients (14%) (7 eyes) had DCR with Pyrex glass tube placement. Following DCR, 31 patients (72%) (36 eyes) had resolution of their symptoms, and 12 patients (28%) (13 eyes), 9 with silicone tubes and 3 with Pyrex glass tubes had persistent or recurrent epiphora. Of these 12 patients, 8 underwent additional surgery (8 eyes), most commonly with the placement or repositioning of a Pyrex glass tube in 7 patients. The other 4 patients either declined additional treatment, treatment is pending or failed to return for follow-up appointments.

Four patients had DCR performed by a head and neck surgeon at the time of initial surgical resection of their primary tumor. Three of these patients were referred to our ophthalmology service for persistent epiphora, and 1 patient was referred for both persistent epiphora and dacryocystitis. Two of the patients (2 eyes) went on to repeat DCR with Pyrex glass tube placement, and 2 patients declined additional lacrimal surgery.

Outcomes of DCR by Pre-DCR Status of the Canaliculi and Nasolacrimal Duct

Probing and irrigation was performed in all patients at the time of presentation and revealed complete nasolacrimal duct blockage in 40 patients (93%), partial blockage in 2 patients (4.6%), and complete absence of the nasolacrimal duct in 1 patient (2.3%) (this patient had undergone total rhinectomy). The pre-DCR probing and irrigation revealed canaliculi open to probing to 8 mm in 27 patients (63%) (30 eyes), complete or partial stenosis in 13 patients (30%) (14 eyes), and complete absence of canaliculi in 1 patient (2.3%) (the patient who had undergone total rhinectomy). The status of the canaliculi before DCR was unclear from the records in 2 patients (4.6%).

The 27 patients with open canaliculi on probing and irrigation as well as the 2 patients with incomplete documentation were treated with DCR and silicone tube placement (32 eyes). Of these 29 patients, 5 patients (17.2%) (6 eyes) had only temporary improvement in epiphora or immediate return of epiphora following surgery. Two of these 5 patients went on to have repeat DCR with Pyrex glass tube placement (2 eyes), and the other 3 patients declined additional surgery because symptoms were minimal. One additional patient required additional extensive surgery within 6 weeks for local recurrence of a sinus adenoid cystic carcinoma, and thus evaluation of the outcomes of DCR was not possible.

Of the 13 patients with either partial or complete stenosis of the canaliculi (15 eyes), 5 had DCR with Pyrex glass tube placement (6 eyes), and 8 had DCR with silicone tube placement (9 eyes). In the Pyrex glass tube group, 3 of the 5 patients required additional surgery for recurrent or persistent symptoms. In the silicone tube group, 2 of the 8 patients required additional surgery for recurrent or persistent symptoms.

The patient who had complete absence of the canaliculi and nasolacrimal duct due to a previous total rhinectomy responded well to DCR with Pyrex glass tube placement but has required several tube-repositioning surgeries to maintain their function.

Interestingly, among the 9 patients who had failure of primary DCR with silicone tube placement, probing and irrigation of the nasolacrimal duct after DCR demonstrated stenosis of the canaliculi in 3 patients (3 eyes) and blockage distally in 3 additional patients (3 eyes). The remaining 3 patients had no findings on probing and irrigation to correlate with the reported symptoms. The most common reason for failure of DCR was significant residual canalicular and nasal mucosal scar tissue.

Outcomes of DCR by Interval between Radiation Therapy and DCR

The median interval from completion of radiation therapy to DCR was 12 months (range, 0-324 months). Of the 20 patients who underwent DCR less than 12 months after radiation therapy, 7 patients (7 eyes) (35%) had persistent or recurrent symptoms (failed DCR). Of the 23 patients who underwent DCR at least 12 months after radiation therapy, 5 patients (22%) had persistent or recurrent symptoms.

When the analysis was restricted to the 37 patients (43 eyes) who underwent DCR with silicone tube placement, 6 (37.5%) (8 eyes) of the 16 patients who underwent DCR less than 12 months after radiation therapy had recurrent symptoms, versus 4 (19%) (4 eyes) of the 21 patients who underwent DCR at least 12 months after radiation therapy ($p=0.27$). While this difference did not reach statistical significance, there was a trend toward better outcomes when surgery was delayed until at least 12 months after completion of radiation therapy.

Outcomes of DCR by Duration of Canalicular Stenting

Of the 37 patients (43 eyes) treated with DCR and silicone tube placement, 26 patients (31 eyes) had the tubes removed during the study period, and 11 still had the tubes in place at the end of the study period. The average time before silicone tube removal following DCR was 10 months (median, 6 months). Following tube removal, 23 patients remained asymptomatic until the end of the study period (mean and median times free of symptoms were 10.3 months and 6 months, respectively). However, 3 patients (8%) (3 eyes) experienced recurrent symptoms following tube removal. The mean and median times from tube removal to development of recurrent symptoms were both 4 months. None of the 14 patients who had silicone tubes removed 6 months or more after DCR but 3 of the 12 patients who had silicone tubes removed less than 6 months after DCR experienced recurrent symptoms. The 11 patients who still had the silicone tubes in place at the end of the study were without complications and without recurrent symptoms.

Complications of DCR

Complications of DCR occurred in 12 patients. The most common complication in patients who underwent DCR with silicone tube placement was mild cellulitis overlying the incision, which occurred in 3 patients. Other complications in this group of patients were punctal erosion in 2 patients, and postoperative pain in 2 patients, lower lid ectropion in 1 patient, and fistula formation at the DCR wound in 1 patient. In the 6 patients who underwent DCR with Pyrex glass tube placement, tube migration or expulsion occurred in 3 patients.

DISCUSSION

Our findings suggest that DCR in head and neck cancer patients who have been treated with high-dose radiation therapy is successful in more than 70% of patients despite the anatomic changes and radiation-induced tissue changes. Our findings also suggest that DCR is more successful when delayed until at least 12 months following the completion of radiation therapy. A common reason for failure of DCR after high-dose radiation therapy was severe canalicular and nasal mucosal scarring. Thus, in some patients with severe canalicular stenosis, it may be prudent to offer placement of a Pyrex glass tube at the time of initial DCR.

In our series, 37 patients underwent DCR with silicone intubation, and 12 of these patients (28%) had recurrent or persistent symptoms following uncomplicated surgery. This rate of 28% is higher than the 2-5% failure rate reported for DCR with silicone tube placement in patients with idiopathic nasolacrimal duct obstruction.¹³ The obvious cause of the higher failure rate in our series is the anatomic abnormalities encountered in head and neck cancer patients due to extensive surgical ablation, which sometimes includes total removal of significant portions of the lacrimal drainage apparatus, and high-dose postoperative radiation therapy, which causes extensive tissue changes. Additionally, many of the patients in our report had extensive facial reconstructions including large free tissue grafts (free flaps) and metal hardware that complicated attempts at creating a direct conduit between the lacrimal sac and the nasal cavity. The only other report we could find in the literature that addresses the DCR failure or success rate in head and neck cancer patients was our report published in 2005, in which we reported a failure rate of 17%.¹² It is important to point out that the previous report from our institution included fewer patients and did not limit the study population to patients who had received high-dose radiation therapy—the report included all patients with head and neck cancer who needed a DCR even if their treatment did not include high-dose radiation therapy. Interestingly, in our previously published report, the 3 patients with failure of primary DCR with silicone tube placement were the patients who had received high-dose postoperative radiation therapy, which supports the hypothesis that high-dose radiation therapy increases the risk of failure of lacrimal bypass surgery.

During the latter part of the current study period, lacrimal bypass surgery was delayed by the principal investigator for at least 12 months after completion of radiation therapy because of preliminary observations that there was a higher risk of failure of DCR when the surgery was performed within the first few months after completion of radiation therapy. The data presented in this report confirm our clinical impression that a higher proportion of patients who had DCR within the first year after completion of high-dose radiation therapy experienced persistent epiphora (failed DCR): 45% of patients who had DCR within the first year had recurrent or persistent epiphora, while 21% of patients who had DCR more than 12 months after completion of radiation therapy had recurrent or persistent epiphora. Although this difference in failure rate between the two groups did not reach statistical significance ($p=0.19$), the trend for better outcomes when DCR was delayed for at least 12 months supported our clinical impression. Another clinical impression by the principal investigator is that patients with canalicular stenosis caused by radiation therapy would benefit from placement of a Pyrex glass tube at the time of first DCR attempt rather than placement of a silicone tube in hopes of avoiding a Pyrex glass tube, which may only increase the chance of having to repeat the DCR in the future. Another variable of interest was the relationship between the duration that the silicone tubes were left in place after DCR and outcomes. Our data suggest that when the tubes are not causing complications such as punctal erosion or discomfort, it may be desirable to keep the silicone tubes in place beyond 6 months and closer to 10 months as doing so resulted in long-term function following DCR in this series of patients.

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PRÉCIS

DCR in head and neck cancer patients previously treated with high-dose radiotherapy is more successful when delayed until at least 12 months after the completion of radiotherapy.