Original Investigation

Cervicofacial Rhytidectomy After Radiotherapy for Head and Neck Tumors

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IMPORTANCE Whether undergoing cervicofacial rhytidectomy after radiotherapy for tumors of the head and neck is associated with increased complication rates and therefore should be avoided remains unknown.

OBJECTIVE To evaluate complication rates in patients who have undergone cervicofacial rhytidectomy after radiotherapy for head and neck tumors and compare these rates with those of patients who have not undergone radiotherapy.

DESIGN, SETTING, AND PARTICIPANTS Retrospective review of the medical records of 16 patients who underwent cervicofacial rhytidectomy after completing radiotherapy for head and neck tumors and those of 16 age-matched control participants who did not undergo radiotherapy. Patients underwent treatment from July 1, 2006, through February 28, 2014, with final follow-up on February 28, 2014. Complications after surgery were reviewed and data for surgery type, technique, radiation dose and delivery method, and time to surgery after radiotherapy were analyzed. Data were collected from June 1 through December 31, 2013, and analyzed from January 1, 2014, through June 1, 2015.

MAIN OUTCOMES AND MEASURES Rate of complications after surgery.

RESULTS The radiotherapy and control group patients were a mean of 62 years old. In the radiotherapy group, 8 of 16 were women; 14 of 16 were women in the control group. Two major complications, 1 hematoma and 1 perioperative stroke, occurred in the 16 patients who composed the study cohort. In the control group, there was 1 case of transient facial nerve weakness and 1 case of cellulitis that was successfully treated with antibiotics. Two patients experienced wound dehiscence, and no incidents of motor or sensory nerve injury occurred. Subcutaneous face-lift (3 of 3 patients [100%] vs 1 of 13 patients [8%] who underwent superficial musculoaponeurotic system and deep-plane face-lifts; $P = .02$) and the addition of chemotherapy (4 of 9 patients [44%] vs 0 of 7 patients who did not receive chemotherapy; $P = .04$) were associated with increased complications. Being older and the time from completion of radiotherapy and surgery did not show any correlation to complications.

CONCLUSIONS AND RELEVANCE Aesthetic facial surgery after radiotherapy has an increased risk for complication compared with facial surgery without radiotherapy. The incidence of wound dehiscence is elevated in the population undergoing radiotherapy but can be managed conservatively in most cases. Patients who undergo radiotherapy must be counseled on the increased risk for complications before proceeding with cervicofacial rhytidectomy.

LEVEL OF EVIDENCE 3.

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Head and neck squamous cell carcinomas (HNSCCs), which include cancers of the oral cavity, larynx, pharynx, salivary glands, and nose or nasal passages, account for approximately 3% of all malignant neoplasms in the United States. The overall incidence began decreasing 30 years ago and stabilized in 2003, whereas overall mortality rates have steadily declined.[1] Tobacco and alcohol use remain the most important risk factors for most HNSCCs. In addition, infection with certain types of human papillomavirus causes more than half of all cases of oropharyngeal cancer, and these patients frequently do not have the typical risk factors for HNSCC.

Standard treatments for HNSCC, which depend on tumor type, location, and stage, include radiotherapy, surgery, chemotherapy, or a combination of these modalities. Complications after radiotherapy occur in as many as 60% of patients undergoing surgery, and the early and late sequelae include skin atrophy, soft-tissue fibrosis, desquamation, epithelial ulceration, fistula formation, and major-vessel rupture.[2-4] The posttreatment effects of radiotherapy make decisions regarding elective facial cosmetic surgery challenging when one considers the lack of clear data as to the safety of the procedures in this patient population. How many patients have had previous radiotherapy and undergo elective rhytidectomy each year remains unclear; however, an increasing patient population being cured of their disease desire subsequent aesthetic improvements after cancer treatment. Furthermore, this population has a lower prevalence of alcohol and tobacco abuse, given the higher incidence of human papillomavirus disease, which makes them better surgical candidates.

Studies have shown that patients are often dissatisfied with their facial appearance after treatment for HNSCC.[5] The increasing demand for facial cosmetic surgery in this patient population has led us to examine the safety of elective surgery after radiotherapy for HNSCC.

Methods

We enrolled a cohort of patients who received radiotherapy for HNSCC before undergoing cervicofacial rhytidectomy. All operative procedures performed in the Department of Otolaryngology–Head and Neck Surgery, University of Michigan, from July 1, 2006, through February 28, 2014, were included for review. This study was approved by the University of Michigan institutional review board, who also determined that, owing to the retrospective nature of the review, informed consent was waived. The patient data were deidentified.

Patients who underwent a major resection for HNSCC and cervicofacial rhytidectomy were selected for further review. We reviewed the electronic medical records, and patients were included if they had received radiotherapy to the surgical field before undergoing rhytidectomy. Patients were excluded if the radiotherapy was outside the operative field or if radiotherapy was performed on the contralateral side in patients undergoing a unilateral face-lift. A total of 16 patients met the inclusion criteria. From June 1 through December 31, 2013, we reviewed clinical documentation and operative reports in the electronic medical records to collect demographic information, the date of completion of radiotherapy, and whether the patient received concurrent chemotherapy. The type of cervicofacial rhytidectomy was determined based on the description in the operative report. We reviewed clinical documentation for at least 6 postoperative months to evaluate for evidence of complications. Complications were categorized as major or minor to correspond with previous reports in the literature.[6] In our series, *major complications* were defined as hematoma requiring a return to the operating room, skin flap necrosis, wound dehiscence (≥1.5 cm), permanent motor or sensory nerve damage, or other major medical events requiring prolonged hospitalization. *Minor complications* were defined as infection, partial wound dehiscence (<1.5 cm), transient motor or sensory nerve damage, and alopecia. Patients were determined to have immunosuppression if they received an antirejection or an immunomodulation medication at the time of their face-lift (including 3 patients undergoing organ transplant and 1 patient with autoimmune disease, respectively). Patient follow-up was completed on February 28, 2014.

We examined all operative reports performed at the Department of Otolaryngology–Head and Neck Surgery at the University of Michigan from July 1, 2006, to February 28, 2014. All patients who underwent a rhytidectomy and did not receive radiotherapy were isolated, and all identifying information, with the exception of age, was removed. Medical records were then selected to match controls with the radiotherapy group by age.

Data analysis was performed from January 1, 2014, through June 1, 2015. Statistical analysis, including χ^2 tests and 2-tailed *t* tests where appropriate, was performed using STATA software (version 13; StataCorp).

Results

We included 8 men (50%) and 8 women (50%) in the study cohort (**Table 1**). The mean age at the time of surgery was 62.0 (range, 35.1-75.9) years. The median time between the completion of radiotherapy and surgery was 31.0 (range, 1.3-311.6) months. All operations were performed by three of us (S.R.B., J.C.K., and J.S.M.). A total of 16 face-lifts were performed. The face-lift technique varied among subcutaneous face-lifts (3 patients [19%] vs 0 patients in the control group), superficial musculoaponeurotic system (SMAS) plication (8 patients [50%] vs 13 participants in the control group [81%]), and deep-plane face-lift (5 patients [32%] vs 3 participants in the control group [19%]) (**Table 2**). Two major complications occurred in the study cohort and no major complications occurred in the control group. One patient had a hematoma that required a return to the operating room for evacuation, and 1 patient had a stroke during the operation that required a prolonged hospitalization (**Table 3**). Two minor wound breakdowns occurred: one as the result of dermal tumor recurrence and another that healed with conservative measures. No incidents of nerve damage or skin flap necrosis were found in the study cohort.

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Table 1. Patient Characteristics

Characteristic	Patient Group[a] Radiotherapy (n = 16)	Control (n = 16)	*P* Value
Demographic			
Male	8 (50)	2 (12)	.03
Female	8 (50)	14 (88)	
Age at surgery, mean (range), y	62.0 (35.1-75.9)	62.1 (40.3-72.7)	.98
Time from radiotherapy to surgery, median (range), mo	31.0 (1.3-311.6)	NA	NA
Received chemotherapy	9 (56)	NA	NA
Immunocompromised	4 (25)	NA	NA
Complication[b]			
Minor	3 (19)	2 (12)	NA
Major	1 (6)	0	

Abbreviation: NA, not applicable.

[a] Unless otherwise indicated, data are expressed as number (percentage) of patients.

[b] Defined in the Methods section.

In the control group, 1 case had transient facial nerve weakness and 1 case of cellulitis was successfully treated with antibiotics.

Subgroup analysis evaluates for associations among the data with an increased risk for postoperative complications using the Pearson χ^2 test. Patients who received chemotherapy in addition to radiotherapy were more likely to have complications (4 of 9 patients [44%]) than were those who did not receive adjuvant chemotherapy (0 of 7 patients) ($P = .04$). The 3 patients who underwent rhytidectomy using a subcutaneous technique after radiotherapy (3 of 3 patients [100%]) were more likely to have complications than those who had a different technique (1 of 13 patients [8%] who underwent SMAS and deep-plane face-lifts) ($P = .02$). Despite the inherent risks for immunosuppression, our cohort did not show a significant increased risk for complications if patients were receiving immunomodulating medication at the time of their surgery (1 of 4 patients [25%] vs 3 of 12 patients [25%]; $P > .99$). We used a 2-tailed *t* test to evaluate the time from completion of radiotherapy to surgery and age as they related to complication rate. A longer time from the completion of radiotherapy to elective facial surgery did not decrease the risk for complication significantly ($P = .62$). Furthermore, being older (>65 years) at the time of facial plastic surgery was not a risk factor for complications. Older patients had significantly fewer complications than younger patients in this study ($P = .02$). The mean American Society of Anesthesiologists physical status classification of patients in the cohort[14] was 2.6 compared with 2.0 in the control group ($P = .009$). However, the incidence of complications did not vary significantly between different physical status classifications ($P = .40$). Smoking history was also reviewed because it related to complication rates in this patient cohort. The rate of tobacco use among patients who did not develop a complication was the same or greater than the rate among those who developed a complication. Therefore, the complications are not attributed to smoking alone.

Table 2. Surgical Technique

Technique	Patient Group, No. (%) Radiotherapy	Control
SMAS plication	8 (50)	13 (81)
Deep-plane face-lift	5 (32)	3 (19)
Subcutaneous face-lift	3 (19)	0

Abbreviation: SMAS, superficial musculoaponeurotic system.

Discussion

The incidence of HNSCC has declined steadily during the past 30 years; however, the incidence of tumors positive for human papillomavirus is rising rapidly.[15,16] The presence of human papillomavirus within tumor specimens has been shown to be an independent predictor of improved survival by treatment with concurrent chemotherapy and radiotherapy.[17,18] This improved survival has created a relatively new subgroup of patients who have undergone radiotherapy, who do not abuse alcohol or tobacco, and who desire aesthetic improvements after treatment for HNSCC. In previous studies,[2-4] radiotherapy was thought to be a contraindication for elective surgery given the risk for subcutaneous fibrosis, diminished blood supply, and wound breakdown. However, with the increased use of intensity-modulated radiotherapy techniques, the radiation dose to normal surrounding structures is reduced compared with external beam techniques.[19]

Given these findings, we set out to examine the complication rates among patients who received radiotherapy to the head and neck and underwent cervicofacial rhytidectomy. Fortunately, the rates of life-threatening complications (eg, stroke, myocardial infarction, and anesthetic reaction) in elective facial surgery are exceedingly rare. However, a number of postoperative complications after cervicofacial rhytidectomy have been well documented. In the patient population that does not undergo radiotherapy, the rates of these complications have remained relatively stable during the past 3 decades.[11] Published rates of major complications among these patients range from 0.3% to 3.6%, whereas minor complication rates have been reported to be 8.4% to 15.1%.[11,20] To our knowledge, no review of the complication rates in aesthetic surgery as it relates to radiotherapy has been undertaken. For the purposes of discussion, we divided the complications into major and minor categories and compared our series with a control group in the literature (Table 3).[6]

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Table 3. Complications After Cervicofacial Rhytidectomy

Complication	Incidence in Patients With Radiotherapy, No. (%) (n = 16)[a]	Incidence in Patients Without Radiotherapy, % in Literature	Source
Major			
Hematoma	1 (6)	1.9-3.6	Baker,[7] 1983; Rees et al,[8] 1994
Postoperative stroke	1 (6)	Rare	Adamson and Moran,[9] 1993
Motor nerve damage	0	0.3-2.6	Baker and Conley,[10] 1979
Sensory nerve damage	0	1-7	Moyer and Baker,[11] 2005
Wound dehiscence >1.5 cm	0	Rare	Adamson and Moran,[9] 1993
Minor			
Wound dehiscence <1.5 cm	2 (12)	Rare	Adamson and Moran,[9] 1993
Infection	0	<1	LeRoy et al,[12] 1994
Alopecia	0	1-3	Baker et al,[13] 1977

[a] Present study.

Figure. Photographs of a Patient Who Underwent Radiotherapy and Superficial Musculoaponeurotic System Plication

The most common perioperative complication in rhytidectomy is hematoma, with rates ranging from 1% to 15%.[7,8,13,21,22] Hematomas can range from small collections of blood beneath the flap that can undergo needle aspiration in the clinic to large expanding collections, which require operative intervention. The reported rates of hematoma requiring a return to the operating room for drainage have been reported to be 1.9% to 3.6%.[7,8] In our series, 1 patient had a hematoma, for a rate of 6%, which is slightly higher than previous rates reported in the literature; however, this difference is probably owing to the small number of patients in our study and unlikely related to previous radiotherapy.

One major complication in our population was perioperative stroke, which has been reported to be exceedingly rare in the general medical literature. However, the patient who experienced this complication was a woman in her 30s who had a temporal fossa rhabdomyosarcoma treated with radiotherapy in early childhood. As illustrated by the Childhood Cancer Survivor Study (CCSS),[23] a longitudinal cohort of childhood cancer survivors, approximately 60% of the almost 10 400 adult participants reported at least 1 chronic health condition, and almost 30% have a severe condition by a mean age of 26.6 years. This population also had a hospitalization rate 1.6 times higher years after the primary cancer treatment, especially those patients with a history of radiotherapy.[24] In adult patients with cancer, previous radiotherapy is a risk factor for the development of cerebrovascular disease and is becoming recognized in survivors of childhood cancer.[24-26] When the CCSS cohort was surveyed for stroke events, the relative risk was almost 10-fold higher than its sibling control group.[23] Stroke is a substantial risk factor in this patient population that all surgeons should be aware of, especially as it relates to elective surgery.

Two incidents of minor wound breakdown occurred, which is quite rare in patients who do not undergo radiotherapy. The first patient with wound breakdown was a woman in her 50s with a history of high-grade salivary ductal carcinoma who underwent subcutaneous rhytidectomy and a midface-lift in conjunction with facial reanimation. The patient developed a small (<1.5-cm) area of wound dehiscence along the postauricular incision line. This area was treated conservatively with daily dressing changes and allowed to heal by secondary intention without further inter-

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vention. The second patient with wound breakdown was a man in his 60s with a history of cutaneous squamous cell carcinoma metastatic to the parotid gland who underwent a subcutaneous face-lift and subperiosteal midface-lift in conjunction with facial reanimation procedures. After surgery, he developed an area of dehiscence approximately 1 cm in length along the preauricular incision. This area was treated conservatively but did not heal after several weeks. A biopsy specimen from the area was taken and noted to be positive for squamous cell carcinoma. This area then underwent a second resection and was closed without further complication. Small tumor recurrences can be difficult to detect clinically and radiographically; however, all patients in our study were followed up at regular intervals by head and neck cancer surgeons and received tumor surveillance scans according to the latest National Comprehensive Cancer Network clinical practice guidelines,[27] making this recurrence somewhat surprising. This type of complication points out the importance of close clinical and radiographic observations of these areas before any elective surgery. Both patients in our population who had wound breakdown underwent rhytidectomy with a subcutaneous technique.

Patients who undergo radiotherapy have an increased risk for wound breakdown and delayed healing,[4] which our study also demonstrated. Residual tumor in the area of the incision will cause dehiscence, but both episodes of dehiscence occurred during a subcutaneous dissection. One can hypothesize that a deeper plane of dissection helps to maintain the remaining blood supply to the overlying skin and reduces this risk. Subcutaneous face-lift in these cases was performed as an adjunct to the patients' facial nerve reanimation but is not routinely performed at our institution and has been discontinued entirely in favor of a sub-SMAS plication or a deep-plane face-lift (**Figure**). However, these cases illustrate the risk for wound dehiscence associated with subcutaneous face-lift, especially as it relates to this patient population.

Conclusions

The treatment of HNSCC continues to evolve, but today we increasingly rely on the use of radiotherapy in the treatment of these tumors. The increased role of radiotherapy in this patient population has led to a subgroup of people who desire aesthetic improvement after cancer treatment. Radiotherapy was once thought to be a contraindication for elective surgery; however, we questioned whether the complication rate is higher in these individuals compared with the population who did not undergo radiotherapy. When compared with the published data, our study demonstrates a slightly higher incidence of complications in patients who undergo radiotherapy. Although the small number of patients in this study makes conclusions difficult to draw, several factors showed statistical significance within the data set. First, subcutaneous face-lift is associated with a higher incidence of complications and should be avoided in favor of a deep-plane or a composite face-lift. Although this technique is no longer in common use, the proper plane of dissection is paramount in reducing the risk for postoperative wound complications. Furthermore, the addition of chemotherapy was associated with increased complications after surgery. Patients who have undergone treatment with induction or concurrent chemotherapy should be counseled that their risk for complication after cervicofacial rhytidectomy is higher than if they had received radiotherapy alone. Being older and the time from completion of radiotherapy to facial surgery did not seem to affect complications, although most of the patients in our series had received radiotherapy more than 1 year before their cosmetic procedure. Our series mirrors previous reports of increased risk for wound dehiscence in the population undergoing radiotherapy.[6] Patients should understand that their healing time may be prolonged and that they are at greater risk for wound dehiscence, which may require revision surgery.

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Study concept and design: Wudel.
Acquisition, analysis, or interpretation of data: All authors.
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