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Surgical versus Medical Treatment of Ocular Surface Squamous Neoplasia

A Cost Comparison

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Purpose: The objective of this study was to compare the cost associated with surgical versus interferon-alpha 2b (IFNα2b) treatment for ocular surface squamous neoplasia (OSSN).

Design: A matched, case-control study.

Participants: A total of 98 patients with OSSN, 49 of whom were treated surgically and 49 of whom were treated medically.

Methods: Patients with OSSN treated with IFNα2b were matched to patients treated with surgery on the basis of age and date of treatment initiation. Financial cost to the patient was calculated using 2 different methods (hospital billing and Medicare allowable charges) and compared between the 2 groups. These fees included physician fees (clinic, pathology, anesthesia, and surgery), facility fees (clinic, pathology, and operating room), and medication costs. Time invested by patients was calculated in terms of number of visits to the hospital and compared between the 2 groups. Parking costs, transportation, caregiver wages, and lost wages were not considered in our analysis.

Main Outcome Measures: Number of clinic visits and cost of therapy as represented by both hospital charges and Medicare allowable charges.

Results: When considering cost in terms of time, the medical group had an average of 2 more visits over 1 year compared with the surgical group. Cost as represented by hospital charges was higher in the surgical group (mean, $17 598; standard deviation [SD], $7624) when compared with the IFNα2b group (mean, $4986; SD, $2040). However, cost between the 2 groups was comparable when calculated on the basis of Medicare allowable charges (surgical group: mean, $3528; SD, $1610; medical group: mean, $2831; SD, $1082; $P = 1.00$). The highest cost in the surgical group was the excisional biopsy (hospital billing $17 598; Medicare allowable $3528), and the highest cost in the medical group was interferon ($1172 for drops, average 8.0 bottles; $370 for injections, average 5.4 injections).

Conclusions: Our data in this group of patients previously demonstrated equal efficacy of surgical versus medical treatment. In this article, we consider costs of therapy and found that medical treatment involved two more office visits, whereas surgical treatment could be more or equally costly depending on insurance coverage. *Ophthalmology 2015;■:1–8 © 2015 American Academy of Ophthalmology.*

Ocular surface squamous neoplasia (OSSN) is an umbrella term for a spectrum of epithelial dysplasia of the conjunctiva and cornea ranging from epithelial dysplasia to carcinoma in situ to invasive squamous cell carcinoma.[1] The current mainstay of therapy is surgical excision with a "no-touch technique"[2] and with cryotherapy to conjunctival margins.[3] However, surgical therapy can be associated with significant limbal stem cell deficiency, infection, induced astigmatism, diplopia, and symblepharon.

As such, given the potential side effects of surgical treatment and increasing evidence that topical therapies are effective in the treatment of OSSN, more providers[4] are opting for the use of topical therapies. Advantages of topical therapy include the ability to treat the whole ocular surface and to avoid morbidity associated with large excisions. The most commonly used agents are interferon-alpha 2b (IFNα2b),[5–12] 5-fluorouracil,[13–16] and mitomycin-C.[17–22] Our practice favors IFNα2b eye drops because the side effect profile is the mildest.[14]

Although there is increasing evidence that IFNα2b is an effective treatment for OSSN,[5,7,23] there is a knowledge gap regarding the time and financial cost of a surgical approach compared with medical treatment. Our group recently published that a cohort of patients receiving surgical treatment and a cohort of patients receiving medical treatment had no significant differences in side effects, complications, or recurrences.[23] We now take the analysis a step further in the same cohort of patients with OSSN (Table 1) to compare the cost associated with these 2 modalities.

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Table 1. Demographic and Clinical Features in Ocular Surface Squamous Neoplasia Treated Surgically versus Medically

	Surgical	Medical	*P* Value
No. of eyes/patients	49	49	
Age (yrs), mean [SD]	64 [14]	58 [24]	0.12
Gender, male n [%]	26 [53]	27 [55]	0.84
Race			
white n [%]	41 [84]	33 [82.5]	0.33
black n [%]	5 [10]	2 [5]	
other n [%]	3 [6]	5 [12.5]	
Ethnicity, Hispanic n [%]	26 [54]	16 [33]	0.03
Area (mm^2), mean (SD)	24 (30)	34 (36)	0.14
Clinical AJCC stage, n [%]			
T1	13 [27]	5 [10]	0.07
T2	6 [12]	4 [8]	
T3	30 [61]	40 [82]	
Appearance, n [%]			
Leukoplakia	21 [51]	14 [29]	0.03
Papillomatous	9 [18]	10 [22]	0.64
Nodular	28 [57]	15 [31]	0.008
Gelatinous	22 [58]	16 [33]	0.02

AJCC = American Joint Committee on Cancer; SD = standard deviation.

Methods

Study Population

This study was approved by the institutional review board of the University of Miami. The design was a retrospective, matched, case-control study.

For the medical arm of the study, patients treated with IFNα2b were selected by a screening of the Bascom Palmer Eye Institute (BPEI) pharmacy database. Patients with OSSN were included if they were successfully treated with IFNα2b as the primary treatment. Exclusion criteria for the medical arm of the study included patients treated with IFNα2b adjuvantly for positive margins after surgery or if they failed primary treatment. Of the 61 patients identified, 49 met the criteria for inclusion. Of the 12 excluded patients, 6 failed treatment with interferon or were lost to follow-up before resolution, 3 used interferon for treatment of positive surgical margins, 2 were unable to tolerate interferon and preferred excision, and 1 was prescribed interferon by a referring ophthalmologist but with an unclear diagnosis. To select the matched cases for the surgical arm of the study, the Florida Lions Eye Bank pathology database, which contains more than 500 patients with excisional surgery as the primary treatment for OSSN, was screened. Matches were created on the basis of patient age (within 10 years) and date of surgical excision (within 10 years). Surgically matched patients were treated successfully with surgery only; patients treated with adjuvant medical therapy after their surgeries were not eligible for matching.

Surgically Treated Group

Excisional biopsy was performed in the setting of the operating room at BPEI in Miami (n = 43), the ambulatory surgical center at BPEI in Palm Beach Gardens (n = 2), the Minor Procedure Room at BPEI in Miami (n = 2), or the clinic at BPEI in Miami (n = 2). Eleven providers performed the excisional biopsies. Surgical treatment consisted of lesion excision with up to 4 mm of tumor-free conjunctival margins excluding the limbal margin (mean, 2.7 mm for those with known margin width, n = 34). Cryotherapy was applied to the limbus and conjunctival edges in a double freeze-thaw method in 41 of the excisions, intraoperative mitomycin C was applied in 1 case, and sclerectomy was performed in 6 cases. Amniotic membrane was used to cover the area of excision in 14 cases, conjunctival autograft was used in 1 case, primary closure was used in 10 cases, and the rest were left open with bare sclera. Pathology to identify the lesion as an OSSN was performed by 1 of 2 experienced ocular pathologists at the BPEI.

Medically Treated Group

Patients were treated with IFNα2b in the form of drops (n = 40), subconjunctival/perilesional injections (n = 1), or combination drop and injection therapy (n = 8). A dose of 1 million IU/ml (n = 35) or 3 million IU/ml (n = 11; n = 2 for combination of doses) was used for topical therapy. A dose of 3 million IU (in 0.5 ml) was used for subconjunctival injections. Eye drops were administered with an initial dose of 4 times daily (with 1 exception of 3 times daily) until clinical resolution. Patients were initially seen on a monthly basis to assess treatment response, with a gradual lengthening of follow-up time to every 2 to 3 months. Duration of interferon therapy was based on treatment response.

Main Outcome Measures

Our 2 main outcome measures were time considerations and financial cost incurred with each treatment modality. With regard to time, the number of visits was tallied from the initiation of interferon or surgery for 1 year thereafter. With respect to the financial cost, costs were calculated using 2 different methods (Table 1). The first cost estimation was of hospital billing charges (at 2013 prices), and the second estimation was of the reimbursements based on Medicare allowables. Medicare allowables were calculated using the 2013 Medicare fee schedules acquired from the Centers for Medicare and Medicaid Services specific to a hospital-based practice in the geographic area of Miami, Florida, and for an Ambulatory Surgical Center in the same geographic area. More detailed information about financial costs is described next.

Hospital Billing Information

Excisional Biopsy. To determine the financial billing charges of an excisional biopsy in the operating room, full billing records were obtained in 40 patients detailing the itemized facility fee, the surgeon fee, and the anesthesia/nurse anesthetist fee for the procedure. Billing records included 3 costs: physician charge, facility fee, and anesthesia costs. Of those, physician and anesthesia costs were stable over the years. The facility fee included several itemized fees, including all materials used during the procedure (including amniotic membrane, if used, and fees for the use of surgical and anesthesia equipment). Of those, the cost of most items remained stable over the study period with the exception of the charge for the use of the holding area, the charge for the hourly use of the operating room, the charge for the hourly use of anesthesia equipment, and the charge for the use of amniotic membrane. These prices were all adjusted to reflect 2013 itemized charges for these items at BPEI.

Two cases were performed in the minor operating room. In these cases, charges were calculated on the basis of 2013 charging schedules for use of the minor operating room facility and physician fees for biopsy. An additional 2 patients had lesions small enough to be excised in the clinic. For these patients, 2013 prices for in-office facility and physician fees were applied. In 5 patients, billing records were incomplete. In these cases, we did have complete surgical, nursing, and anesthesia notes from which we were able to calculate the surgical time, anesthesia time, and cost of materials. These records were used to impute the missing values