Excision of Head and Neck Basal Cell Carcinoma With a Rapid, Cross-sectional, Frozen-Section Technique

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Objectives: To compare a rapid, cross-sectional frozen-section technique with Mohs micrographic surgery, using recurrence rate and cost of treatment for excision of basal cell carcinoma as indicators to validate our indications for Mohs surgery.

Design: Retrospective study of 557 head and neck basal cell carcinomas excised over 10 years.

Main Outcome Measures: Recurrence rates; tumor comparisons by size, location, and subtype; a life table, and a patient satisfaction survey.

Results: Recurrence rate for the cross-sectional technique was 2.1% at 5 years. Recurrent tumors had an average diameter of 1.56 cm (vs 1.04 cm for nonrecurrent tumors). Recurrences were in the cheek (30%), nose (20%), temple (20%), forehead/brow (10%), conchal bowl (10%), and postauricular crease (10%). Recurrences were nodular cystic (40%), micronodular (20%), multifocal (10%), and infiltrating (30%). A total of 86.6% of patients surveyed rated the aesthetic outcome of their surgery favorably. The cost compared with the cost of Mohs excision varied depending on the Current Procedural Terminology coding technique.

Conclusions: Cross-sectional frozen-section recurrence rates can compare favorably with Mohs micrographic surgery. The cross-sectional frozen-section technique generated a cost savings over Mohs surgery that may not hold true for all practice settings. Margin size did not adversely affect aesthetic results. Loupe magnification ×2.5 is important in our technique. We also offer a useful definition for recurrence.

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The appropriate utilization of expensive resources is a pervasive goal in health care throughout the United States. We believe that defining what is "appropriate" in this environment is best done through objective examination of treatment outcomes.

This is a study of basal cell carcinomas excised from patients of the Fallon Clinic, a multispecialty group practice with about 250 physicians. Through a capitated arrangement, it is the primary provider of health care for the Fallon Community Health Plan, a federally qualified health maintenance organization in Massachusetts with more than 200000 members. The Fallon Clinic does not have a full-time Mohs micrographic surgeon. Mohs surgery is performed on a fee-for-service basis by a contracted Mohs surgeon either at the Fallon Clinic’s New England Center for Facial Plastic Surgery or in the private office of the contracted surgeon. With limited access to Mohs services and payment coming out of the Fallon Clinic capitation, it is imperative that only cases that absolutely need Mohs micrographic surgery be referred for this service. Between 1979 and 1985, one of us (S.H.B.) developed the following set of in-house indications for Mohs micrographic surgery for basal cell carcinoma (BCC) of the head and neck:

- Indistinct visual margins of the tumor examined under ×2.5 loupe magnification
- Visual margins within 3 mm of the conjunctival margin of the eyelid
- Recurrence after an excision with any frozen-section–controlled technique
- Recurrence of a tumor excised more than once without frozen-section control or treated more than once with cryotherapy or electrodesiccation and curettage (if a patient is referred with a first recurrence after having undergone a non-margin-controlled technique, the tumor is excised with our
PATIENTS AND METHODS

All tumors were evaluated in the office under loupe magnification ×2.5. A total of 536 tumors were excised under loupe magnification ×2.5 and examined using our rapid, cross-sectional, frozen-section technique. The closest visual margin at the time of excision was routinely 2 to 3 mm. Specimens were sent immediately to a pathologist for frozen-section inspection of the margins using a cross-sectional technique that examines 4 opposite points created by cutting 2 strips across the entire specimen at 90° to each other (Figure 1A). Reconstruction began immediately after sending the specimen to the pathologist. If a margin was positive, the defect was reopened and an additional margin was taken along that entire edge of the defect. The entire outer surface of this margin was examined horizontally (Figure 1B). If necessary, additional margins were examined in this manner until all margins were judged to be free of tumor. Each frozen-section examination generally took 15 minutes or less; most cases took less than 1 hour. Twenty-one tumors were excised with Mohs micrographic surgery.

The study period was January 1, 1985, through December 31, 1995. To find all BCCs excised during this 10-year period, we searched office and hospital operating room logs and patient records by diagnosis (International Classification of Diseases, Ninth Revision) and procedure code (Current Procedural Terminology). We found 557 tumors in 318 patients. We reviewed consultations, progress notes, operative notes, and pathology reports to determine the size, location, BCC subtype, and success of surgery for a special examination. If patients were unable to be examined or declined examination during this time, a special examination was performed immediately after sending the specimen to the pathologist.

Of the 318 patients studied, 176 were male (335 tumors) and 142 were female (222 tumors). The mean age of the subjects was 66.3 years (66.6 years for the men, 66.0 years for the women).

Of the 557 tumors excised, 536 (96.2%) were excised using a cross-sectional frozen-section technique, and 21 (3.8%) were excised with a Mohs micrographic technique. However, only 19 tumors (3.4%) met our criteria for Mohs micrographic surgery. The 2 additional tumors excised by our Mohs surgeon were done for patient convenience at the time of another indicated Mohs micrographic excision.

We located 10 recurrences among the 536 tumors removed with the cross-sectional frozen-section technique during the 10-year period studied (1.9% raw calculation, 2.1% at 5 years, with SE <1%). There were no recurrences in the Mohs group. Initial tumor diameter was recorded preoperatively for 441 (82.3%) of the 536 tumors. Those tumors that recurred were larger than those that did not. The average initial overall diameter was 1.05 cm (1.56 cm for the tumors that recurred using the cross-sectional frozen-section technique, and 1.04 cm for the tumors that did not recur using this technique). Recurrences were distributed as follows: cheek, 3 tumors (30%); nose, 1 tip and 1 ala (20%); temple, 2 (20%); brow, 1 (10%); conchal bowl, 1 (10%); and postauricular crease, 1 (10%).

RESULTS

The distribution of BCC subtypes for the 383 tumors subclassified was 292 nodular cystic (76.2%); 2 micronodular (0.52%); 22 multifocal (5.7%); 57 infiltrating (14.9%); 9 morphea-type (2.3%); and 1 specimen too small to subtype (0.26%). There were 4 nodular cystic recurrences (40%); 2 micronodular (20%); 1 multifocal (10%); and 3 infiltrating (30%). The shortest and longest follow-up duration were 0 days and 14.5 years, respectively. Mean follow-up duration was 4.5 years; median, 3.8 years. The soonest a tumor recurred was at 9.6 months (1.5 years).

BCC SUBTYPES, RECURRENCE RATES, AND FOLLOW-UP

- Tumors of the conchal bowl, external auditory meatus, or ear canal
- Tumors larger than 2 cm in diameter
- Recurrence after radiation therapy
- Tumors that will require a major staged reconstruction such as a paramedian forehead flap to the nose, a cross-lip flap or cross-eyelid flap

Important goals of this study were to determine our recurrence rate for BCC excised using a rapid, cross-sectional, frozen-section technique and to validate our indications for Mohs micrographic surgery. We calculated a 5-year recurrence rate for our technique from a life table and examined tumor size, location, and BCC subtype. We compared our recurrence rate with published recurrence rates for Mohs micrographic surgery. We also compared cost with the cost of Mohs surgery and conducted a patient satisfaction survey.
months, and the latest was 8.4 years. Mean time to recurrence was 4.3 years; median, 4.0 years.

**Figure 2** is a life table that demonstrates the percentage of tumor-free sites for the 536 cross-sectional excisions yearly for each year of follow-up in this study. A total of 97.9% of original tumor sites were tumor free up to 5 years after surgery (SE <1% up to that time). In addition, Kaplan-Meier analyses were performed using the Stata statistical package. The Kaplan-Meier-estimated 5-year recurrence rate was 2.1% (95% confidence interval, 1.0%-4.5%). **Figure 3** depicts the recurrence rates by year up to 5 years after surgery. Because the number of tumors observed after 5 years was not large enough to yield an SE less than 1%, we cannot make a definitive statement about recurrence rates after 5 years.

**COSTS OF TREATMENT**

**Procedure Categories**

For the following reasons, in our system, comparing the cost of an excision with our rapid, cross-sectional, frozen-section technique with the cost of Mohs micrographic surgery involved comparing only the combined professional and institutional costs for our pathologist’s services with the cost for the Mohs micrographic excision:

1. The type of frozen-tissue examination was not related to where the surgery was performed. Frozen-section examinations by a pathologist and Mohs micrographic surgeon were available in our office or in the hospital. Generally, cases were done in the hospital only if the reconstruction required more than local anesthesia or if our office schedule was booked so far in advance.

**Figure 1.** A roughly elliptical excision is represented with the tumor (gray area) in the center. Initial margins are 2 to 3 mm. The specimen is sectioned by removing 2 cross-sectional strips at right angles to each other (black horizontal bars and white vertical bars), the second strip (black horizontal bars) being therefore halved. A, Current Procedural Terminology (CPT) code 88331 represents the frozen-section examination of the ends of the first strip (top and bottom arrows); CPT code 88332 represents the frozen-section examination of the ends of each half of the second strip (left and right arrows). B, If a frozen-section margin is positive, an additional frozen section is taken (CPT 88331 again) of the entire edge of the defect where the tumor persists (arc-shaped enclosure with shaded area representing residual tumor). This is sectioned horizontally and the entire outside edge (arrows) is examined microscopically. The “bow tie” marks at the top of each diagram represent the marking sutures placed to help the pathologist orient the specimen.

**Figure 2.** This life table demonstrates the percentage of tumor-free sites for the 536 cross-sectional excisions yearly for each year of follow-up in this study. The error bars indicate SE. A total of 97.9% of original tumor sites were tumor free up to 5 years after surgery (SE <1%).

**Figure 3.** Recurrence rates by year up to 5 years after surgery (SE <1%). The number of tumors observed after 5 years was not large enough to yield an SE of less than 1%.
that it was unreasonable to have the patient wait for an office appointment.

2. Since most of our patients came from the same health maintenance organization, all other costs were already capitlated.

3. Even had all other costs not been covered under a global capitation, laboratory, operating room facility, and other ancillary costs in our system still were not related to the type of tissue excision. Also, since most of these cases were performed in the office under local anesthesia, there were generally no other laboratory or ancillary fees. Operating room facility costs were significantly lower in the office than in the hospital; but again, where the surgery was performed did not depend on the choice of frozen-tissue examination. Cases requiring an extensive preoperative physical examination were only those that required intravenous sedation or general anesthesia, again not related to the choice of type of frozen-tissue examination.

4. The primary author (S.H.B.) was a salaried physician, and he routinely performed all the reconstructions. Hence, in either scenario, the cost for the reconstruction was constant and did not figure into any cost-comparison calculations.

Even though pathological services in our system were capitlated at less than Medicare prevailing rates, comparing Medicare rates for the cross-sectional technique and Mohs surgery is probably still the fairest way to establish a useful comparison. The application of Current Procedural Terminology codes for Mohs micrographic surgery (17304-17307) is clear and seems to be universally accepted. However, when coding for a pathologist’s services (88305, 88331, 88332), exactly how many frozen-section examinations are included in the cross-sectioning of a specimen seems open to interpretation. For each frozen-section examination (88331, first tissue block with frozen section[s]; or 88332, each additional tissue block with frozen section[s]), there is also a permanent-section examination (88305). Our pathologists consider the initial frozen-section cross-sectional examination of all 4 points at the periphery of the specimen to be from 1 tissue block and code for 1 frozen-section examination (88331+88305). Subsequent frozen-section examinations for positive margins also are coded 88331+88305. However, according to the 2001 Current Procedural Terminology code book, the way we section the specimen could also be considered to generate 3 tissue blocks and be coded 88331+88305, 88332+88305, and 88332+88305 (see Figure 1). Subsequent frozen-section examinations for positive margins would also be coded 88331+88305. Hence, the comparison of cost for our technique with the cost for a Mohs excision will differ depending on how the pathologist codes.

**Calculating Costs**

Our average rate of frozen sections per tumor was 1.1. **Table 1** and **Table 2** compare the costs of our technique with those of Mohs micrographic surgery using the 2002 local Medicare rates in our region† for specimen processing and interpretation. Table 1 summarizes the costs as billed by our pathologists. Table 2 summarizes a more expensive but still correct way of billing for pathological services. The cost of the initial frozen section and all subsequent frozen sections as actually billed was $286.98 less than it would have been under the 3-block billing method, and the cost per 1.1 frozen sections as actually billed was $315.67 less than it would have been billed as 3 blocks.

Assuming a reasonable scenario of the same average number of Mohs stages per tumor (1.1), our technique costs $470.50 less per tumor than Mohs micrographic surgery (“non-facility” fee) as billed by

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**Table 1. Cost Comparison as Actually Billed for Rapid, Cross-sectional, Frozen-Section Technique With Mohs Surgery**

<table>
<thead>
<tr>
<th>Frozen-section examination</th>
<th>Professional Fee</th>
<th>Technical Fee</th>
<th>Total Medicare Fee</th>
<th>Cumulative Medicare Fee</th>
<th>Total for No. of Examinations Performed</th>
<th>Cost Difference From Other Technique†</th>
<th>Cost for 1.1 Sections or Stages per Tumor</th>
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<tr>
<td>88331</td>
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<td>13.93</td>
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<td>689.66</td>
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</tbody>
</table>

†Numbers in parentheses are negative numbers and indicate lower cost in the comparison.

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our pathologists and $154.83 less if billed to the maximum. If all 557 of the tumors had been removed with a Mohs micrographic technique at 1.1 stages per tumor, the total cost would have been $384140.62. Adhering to our criteria for Mohs surgery, there would have been only 19 tumors done by the Mohs surgeon, at a cost of $13103.54. The cost for the other 538 tumors, as billed by our pathologists would be $117908.08. It would be $287738.54 if billed to the maximum. Therefore, the total cost for all 557 tumors following our criteria for Mohs surgery would be $131011.62 as billed by our pathologists and Mohs surgeon or $300842.08 if billed to the maximum. Compared with Mohs surgery only, this represents a savings of $253129.00 as actually billed by our pathologists or $83298.54 if billed to the maximum, a gain of $454.45 per tumor or at least $149.55 per tumor.

Of the 174 patients who agreed to participate in a satisfaction survey between October 14, 1997, and January 12, 1998, 86.6% rated the aesthetic outcome of their surgery favorably. A total of 81.5% rated their overall treatment experience (preoperative, intraoperative, and postoperative care) favorably.

Outcome is arguably the most important element to consider when establishing or verifying a standard of care. However, in a predominantly capitated, managed care system, we must also be aware of the cost of maintaining a given standard. We have had an active working relationship with a Mohs surgeon for over 15 years; but he is a contracted nongroup physician paid from the group capitation on a fee-for-service basis. In 1985, with the group's capitated population growing rapidly, the dilemma we faced was to determine whether we were sending an appropriate number of patients for Mohs surgery. Because of its associated low recurrence rate and tissue-sparing effect, Mohs micrographic surgery is considered by many surgeons the standard of care for excision of BCC of the head and neck. The primary objectives of this study were to compare the recurrence rate and cost of a rapid, cross-sectional, frozen-section technique with the recurrence rate and cost of Mohs micrographic surgery and to validate our indications for Mohs surgery.

To evaluate our recurrence rate, we first had to define recurrence. Many Mohs surgeons report 5-year recurrence rates for excision of primary BCCs ranging from 0.7% to 1.8%. Our Mohs surgeon (D.M.G.) reports a personal recurrence rate of about 1.5%. But what exactly is a recurrence? At the time of a Mohs excision, if the tumor is found growing directly in a scar microscopically, it is safe to assume that the lesion is a recurrence. However, we found no reports in the literature that defined an acceptable distance from the scar of a previous excision past which a tumor could be considered a new primary tumor and not a recurrence. Our initial resection margin was generally 2 to 3 mm from the visual edge of the tumor under magnification ×2.5. By defining a recurrence as any tumor growing within 5 mm of the original scar, we are saying that any tumor growing within 8 mm of the original tumor edge could be a recurrence. One could argue that this is a very wide radius, but as a starting point for a definition it seemed reasonable.

In our setting, the only real difference in cost between our rapid, cross-sectional, frozen-section technique and Mohs micrographic surgery was the difference in third-party reimbursement for pathology services and

Table 2. Cost Comparison Using 3-Block Billing Method of Rapid, Cross-sectional, Frozen-Section Technique With Mohs Surgery

<table>
<thead>
<tr>
<th>Mohs stage</th>
<th>Medicare Fee</th>
<th>Technical Fee</th>
<th>Medicare Total</th>
<th>Total Medicare Fee</th>
<th>Cost Difference From Other Technique</th>
<th>Cost for 1.1 Sections or Stages per Tumor</th>
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<td>0.00</td>
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<td>352.96</td>
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</table>

*Unless otherwise indicated, all data are US dollars. CPT indicates Current Procedural Terminology; ellipses, not applicable.
†Numbers in parentheses are negative numbers and indicate lower cost in the comparison.
Mohs surgery. With our frozen-section sampling rate of 1.1 examinations per specimen, the cost of this service at current prevailing Medicare rates in 2002 would be $219.16 per tumor as billed by our pathologists or $534.83 if billed to the maximum. The cost for Mohs surgery in an office setting with 1.1 stages per tumor would be $689.66 per tumor. To remove all the tumors in our study with Mohs surgery, the total cost at 2002 reimbursement rates would be $384 140.62. Following our indications for Mohs surgery, the cost for all tumors studied (19 Mohs; 538 cross-sectional frozen sections) would be $131 011.62 as billed by our pathologists and Mohs surgeon, or $300 842.08 if billed to maximum.

We had 10 recurrences of the 536 tumors excised with the cross-sectional technique. (Only 19 tumors met criteria for Mohs surgery, but 2 additional Mohs procedures were performed for patient convenience.) Had we used Mohs micrographic surgery for all the tumors, we reasonably could have expected our recurrence rate to have decreased from 2.1% at 5 years to a theoretical 1.5% or so. Thus, using Mohs micrographic surgery exclusively to eliminate perhaps 2 or 3 more recurrences of 557 excisions could have cost an additional $253 129.00 compared with actual cross-sectional billing by our pathologists or $83 298.54 compared with maximum Medicare allowable billing for cross-sectional pathological services. Also, with a patient satisfaction score of 86.6% for the aesthetic results, we think we can probably also assume most patients were reasonably satisfied.

In our opinion, our recurrence rate is close enough to published Mohs recurrence rates to validate our current indications for Mohs micrographic surgery for a practice situation like ours where there is limited access to a Mohs surgeon. Over the 10 years of cases studied, we have demonstrated considerable potential cost savings over exclusive use of Mohs surgery. The magnitude of the savings, however, is related not only to our technique but also to how pathologists interpret the coding rules for frozen sections laid out by the Centers for Medicare & Medicaid Services (formerly the Health Care Financing Administration). Furthermore, all fee calculations are subject to the yearly changes in Centers for Medicare & Medicaid Services financing.

Our current volume of BCC excised yearly is much higher than during the period of this study. A legitimate question, therefore, is whether we should employ a full-time Mohs surgeon. This question can only be answered by looking at the total expense of salary, benefits, equipment, and support staff for a high-quality, highly experienced Mohs surgeon. Also, since our actual pathology costs are really capitated below Medicare prevailing rates, the calculation becomes even more complex. These calculations are worth considering in a future budgetary process but are beyond the intent and scope of this study.

We believe our patient satisfaction score indicates that the 2- to 3-mm width of our margin is not a disadvantage of our technique. We also believe we have established a reasonable definition of recurrence that can be used in future publications and the importance of ×2.5 loupe magnification in examining and removing BCC without Mohs micrographic surgery.