CLINICAL REPORT

Munich Method of Micrographic Surgery for Basal Cell Carcinomas: 5-year Recurrence Rates with Life-table Analysis

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The aim of this study was to find the recurrence rates of basal cell carcinomas treated with micrographic surgery in the Department of Dermatology, University of Regensburg. From 1992 to 1997, 261 basal cell carcinomas (178 primary and 83 recurrent) have been treated. The mean duration of follow-up was 5 years (range 1–9). Data were analysed by life-table analysis. Eleven basal cell carcinomas (6 primary and 5 recurrent) recurred. The 5-year recurrence rates were 3.3% for primary and 7.3% for recurrent basal cell carcinomas. Our results are comparable with previously published data from Europe but seem higher than those reported in the USA. Use of different statistical methods to report the recurrence rates mainly accounts for the discrepancy among studies. For a better comparison among studies on recurrence rates, a standard statistical method should be used, and we support the idea that life-table analysis provides the best approximation of the true recurrence rates. *Key words: micrographic surgery; basal cell carcinoma; Munich method; recurrence rate; life-table analysis.*

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Basal cell carcinoma (BCC) is the most common non-melanoma skin cancer worldwide. In Germany almost 150 000 new cases of BCC (100 per 100 000) are diagnosed per year (1, 2). Although rarely metastatic (3, 4), the tumour has a potential for local recurrence which is closely related to tumour localization, histological type, history of previous treatment and tumour size (5, 6). To minimize the recurrence rates, BCCs with a high risk of recurrence should be treated by micrographic surgery (MS), allowing the complete examination of all tissue margins (7, 8). MS was first described by Frederic E. Mohs in the 1930s as a chemosurgical technique for skin cancer removal (9). Later, Mohs himself and Tromovitch established a modified 'fresh-tissue technique', which has become the standard procedure in BCC surgery throughout the USA (10). The use of MS in European countries is still somewhat limited. In Germany, apart from the so-called 'Tübinger Torte' (cake method) (11), the 'Munich method' is accepted as a variant of MS (12).

The aim of this study was to evaluate the recurrence rates of high risk BCCs treated with the Munich method of MS at the Department of Dermatology of the University of Regensburg.

MATERIALS AND METHODS

Munich method of micrographic surgery

The Munich method differs in two points from the original description of fresh tissue MS technique. First, saucerization does not take place; the lateral and deep margins are not flattened into one plane before sectioning. Instead, serial horizontal cryostat sections are cut from the bottom up to the skin surface. Second, excision margins, therefore, are not cut at an angle of 45° but perpendicular to the skin surface.

The clinically apparent tumour is excised with 1–3 mm narrow margins and placed on a wet gauze, where the upper, lower, left and right margins are clearly marked. A schematic drawing on a laboratory sheet shows the tumour related to its topographic localization.

The margins of the specimens are painted with different coloured dyes to maintain proper orientation. Before freezing, the specimens are inverted, the tumour is cut in horizontal cryostat sections which are stained with haematoxylin and eosin. If residual cancer is seen in the basal section or at the lateral margins of any specimen, additional surgery is carried out at the precise localization of residual cancer using the surgical and processing techniques described above. The stepwise procedure is continued until the tumour is totally removed. The defect is either left for second intention healing or reconstructed by primary wound closure, flaps or grafts.

Patients

From May 1992 to December 1997, a total of 1121 BCCs were treated with excision. This number does not include the huge number of small or superficial BCCs treated with cryotherapy, curettage and electrodesiccation, or photodynamic therapy. Of these 1121 BCCs, MS was performed on 261 (178 primary and 83 recurrent) high risk tumours in 247 patients (122 women, 125 men) with a mean age of 62 years (range 30–88). The histological subtypes were solid in 133 (94 primary, 39 recurrent), aggressive (including the infiltrative, morpheaform, micronodular and mixed types) in 114 (72 primary, 42 recurrent) and superficial in 14 (12 primary, 2 recurrent) cases.

All tumours were located in the head and neck area. In

Table I. *Follow-up information for patients with primary (n=163) and recurrent (n=80) basal cell carcinomas (n=163), treated from 1992 to 1997*

Time interval (years)	Number censored (during time interval)	Number of recurrences (during time interval)	Cumulative rate of recurrences (at beginning of time interval)	Cumulative rate of no recurrences (at beginning of time interval)	SDF lower 95% confidence limit	SDF upper 95% confidence limit	Annual recurrence rate
Primary							
0–1	0	0	0	100	100	100	0
1–2	9	1	0	100	100	100	0.63
2–3	6	4	0.63	99.37	98.13	100	2.7
3–4	6	0	3.28	96.72	93.89	99.54	0
4–5	41	0	3.28	96.72	93.89	99.54	0
5–6	31	1	3.28	96.72	93.89	99.54	1.25
6–7	29	0	4.48	95.52	91.87	99.16	0
7–8	15	0	4.48	95.52	91.87	99.16	0
8–9	11	0	4.48	95.52	91.87	99.16	0
9–10	9	0	4.48	95.52	91.87	99.16	0
Recurrent							
0–1	0	0	0	100	100	100	0
1–2	5	2	0	100	100	100	2.61
2–3	4	1	2.58	97.42	93.88	100	1.42
3–4	4	0	3.95	96.05	91.66	100	0
4–5	12	2	3.95	96.05	91.66	100	3.51
5–6	20	0	7.26	92.74	86.54	98.92	0
6–7	9	0	7.26	92.74	86.54	98.92	0
7–8	14	0	7.26	92.74	86.54	98.92	0
8–9	6	0	7.26	92.74	86.54	98.92	0
9–10	1	0	7.26	92.74	86.54	98.92	0

SDF, survival distribution function.

primary BCCs, the most common localization was the nose ($n=96$) followed by the periorbital area ($n=22$), forehead and temple ($n=17$), ear ($n=15$), cheek ($n=13$), perioral area ($n=13$), scalp, ($n=1$) and neck ($n=1$). In recurrent tumours, the most common localization was the nose ($n=37$), followed by cheek ($n=14$), ear ($n=8$), periorbital area ($n=6$), perioral area ($n=5$) and scalp ($n=1$).

Defects were managed with primary closure in 56 of the tumours (21.4%), in 64 with flaps (24.5%) and in 111 with grafts (42.4%). The wound was left for secondary intention healing in 30 cases (11.4%).

Only high risk tumors have been treated by MS. Indications to use MS were as follows. (1) Tumours with ill-defined clinical borders and/or aggressive histological patterns (as described above) that did not warrant wide excision with an appropriate safety margin due to size and/or localization. (2) Most recurrent BCCs (excluding recurrent BCCs of small size and with well-defined borders). (3) Localization in high-risk anatomic areas such as the paranasal fold, retroauricular fold and columella.

Follow-up data

The recurrence data were collected primarily from the patients' files. Missing data were acquired by questioning the patients' physician (dermatologist or family doctor). For patients whose data could not be acquired this way, the patients themselves were contacted by mail.

We were unable to acquire any follow-up information for 18 patients (7 of these 18 patients died of unrelated causes). Mean duration of follow-up was 5 years (range 1–9).

Statistics

Recurrence rates were calculated by the life-table method using the program SAS (Statistical Analysis Software) 8.2. Recurrence rate curves were compared by the log-rank test and Wilcoxon test. The Cochran-Armitage trend test was used to establish the correlation of tumour type and number of MS sessions.

RESULTS

As demonstrated in Table I, primary BCCs had a 5-year recurrence rate of 3.3% (standard error [SE] 1.4%) while the recurrent BCCs had a 5-year recurrence rate of 7.3% (SE 3.2%). The 95% confidence interval for the cure rate after 5 years was 93.9–99.5% for primary and 86.5–98.9% for recurrent BCCs.

Fig. 1 illustrates the cumulative disease-free status of primary versus recurrent BCCs. No statistically significant difference was found between the survival curves of these two groups with either the log-rank test ($p=0.35$) or the Wilcoxon test ($p=0.33$).

All recurrences were observed between the first and fifth postoperative year. No recurrences were observed after the fifth year.

Detailed information about the recurrences of primary and recurrent BCCs are shown in Table II. In patient no. 2, a primary BCC with an aggressive histological subtype on the nose was treated with MS in
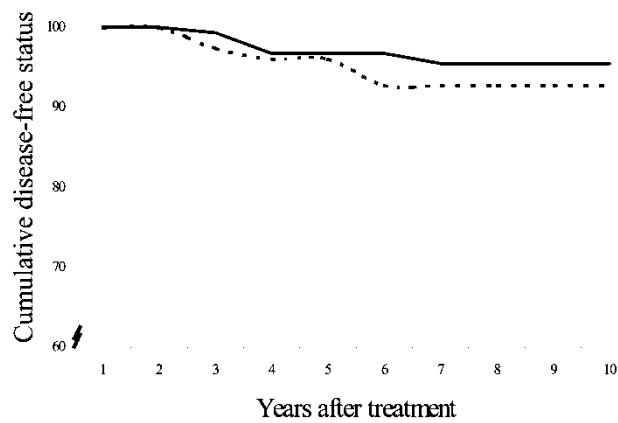
Fig. 1. Cumulative disease-free status of primary (—) versus recurrent (···) BCCs.

1995 and recurred 2 years later. The same patient was treated again with MS in 1997 and had a recurrence 1 year later.

There was a statistically significant trend for recurrent BCCs to need more MS sessions than primary BCCs to achieve eradication ($p = 0.008$). However, the histological subtype had no significant influence upon the number of MS sessions.

DISCUSSION

Although the 'Munich method' does not use saucerization, the main characteristics of the original fresh-tissue MS technique still remain intact: colour coding of tissue margins, accurate orientation of excised tissue by tissue maps, and microscopic examination of horizontal frozen sections.

Recurrence rates may be reported in different ways. The raw 5-year recurrence rate (all recurrences reported/all tumours treated) suggests that all patients that are lost to follow-up would still be recurrence-free after 5 years, which may lead to a recurrence rate that is lower than the true rate (11–14). In contrast, with the strict 5-year recurrence rate (all recurrences reported/number of tumours with complete 5-year follow-up) patients with a follow-up period of <5 years are neglected, even if some of these patients would possibly be recurrence-free after 5 years. This may lead to a recurrence rate that is higher than the true rate (5, 11, 13, 14). According to the literature on this topic, we decided to use the life-table method, which allows the calculation of an annual recurrence rate based on the number of patients still under observation at a given time. Disease-free credit is given in recurrence calculations until exactly the time that the patient is lost to follow-up. Thus, this method provides the best approximation of the true recurrence rate if 100% follow-up information were available. It is based on the assumption that the recurrence characteristics of the patients lost to follow-up are identical to those patients with known follow-up. As a rule the recurrence rate calculated with the life-table method is slightly higher than the value with the raw method and slightly lower than the value with the strict method.

The 5-year recurrence rate in this study was 3.3% for primary and 7.3% for recurrent BCCs. Although permanent sections were not available, 75% of the cryostat sections of the patients that suffered recurrences were still re-evaluable at the time of our analysis. Re-evaluation revealed one non-disease-free margin in one of these sections, which had obviously been misdiagnosed at the time of surgery.

Corresponding figures from the USA were 1% for primary and 5.6% for recurrent BCCs (15, 16). In the USA, however, MS is a standard procedure for the treatment of all kinds of BCC, even for uncomplicated solid and clearly demarcated tumours. In contrast, in

Table II. *Recurrences in primary (previously untreated) and recurrent (previously treated) basal cell carcinomas*

Patient no.	Age	Operation date	Localization	Histological subtype	MMS sessions	Time to recurrence (years)
Primary						
1	69	1994	Nose	Superficial	2	5
2	69	1995	Nose	Aggressive	1	2
3	76	1996	Temple	Aggressive	2	2
4	54	1996	Nose	Aggressive	2	1
5	51	1997	Temple	Superficial	1	2
6	40	1997	Nose	Solid	1	2
Recurrent						
7	52	1992	Cheek	Solid	1	4
8	67	1993	Nose	Solid	1	2
9	53	1996	Periorbital	Aggressive	2	1
10	69	1997	Nose	Aggressive	1	1
11	70	1997	Periorbital	Solid	2	4

MMS: Mohs micrographic surgery.

Table III. *Recurrence rates (RR) of basal cell carcinomas (BCC) after micrographic surgery: previously reported European studies*

Reference	Total number of patients	RR for primary BCCs	RR for recurrent BCCs	RR calculation method	Time interval
Neumann et al. (17)	208	2%*		Raw	1984–1988
Julian et al. (18)	228	1.7%	4.8%	Raw	1981–1983
					1985–1995
Wennberg et al. (19)	228	6.5%	10%	Strict	1983–1992

*Value not differentiated between primary and recurrent BCCs.

Germany, only challenging tumours with a high risk of recurrence are regularly treated with MS. Because of these differences it is no surprise that our recurrence rate is higher than those reported from the USA, as our data for 261 high risk tumours do not include the vast number of uncomplicated BCCs treated with primary excision or superficial methods of removal.

As demonstrated in Table III, not only the recurrence rates but also the total number of patients who underwent MS in these European centres are very similar to ours, representing the limited use of this approach in Europe, where it is still frequently restricted to complicated and/or recurrent tumours. Owing to methodical differences, however, the comparison between these studies remains difficult. Without categorizing primary and recurrent tumours and without indicating the range of follow-up periods, Neumann et al. (17) reported a 2% raw recurrence rate with a mean follow-up period of 6.4 years for the Netherlands. Julian and Bowers (18) reported a raw recurrence rate of 1.7% for primary and 4.8% for recurrent BCCs for the UK. However, they neglected three recurrences beyond 5 years of follow-up, although they had observed three more recurrences during this time. If these had been taken into consideration, the rate for recurrent tumours would have been nearly twice as much. Wennberg et al. (19) reported strict recurrence rates of 6.5% for primary and 10% for recurrent BCCs for Sweden. As could be expected, our results with life-table analysis are slightly higher than the raw recurrence rates and slightly lower than the report with the strict recurrence rate.

In conclusion, we believe that MS will remain the gold standard for challenging non-melanoma skin cancers, unless more accurate *in vivo* imaging techniques become available to determine the extent and growth pattern of locally aggressive malignancies. To allow an adequate comparison among studies on recurrence rates we strongly support the use of life-table analysis as a standard method for the calculation of recurrence rates, as in our opinion it allows the best approximation of the true recurrences.

REFERENCES

1. Köhler D, Stadler R. Klinik und Histologie des Basalioms. In: Garbe C, Dummer R, Kaufmann R, Tilgen W, eds. Dermatologische Onkologie. Berlin: Springer-Verlag, 1997: 135–149.
2. Korting HC, Callies R, Reusch M, Schlaeger M, Schöpf E, Sterry W. Basalzellkarzinom. In: Korting HC, Callies R, Reusch M, Schlaeger M, Schöpf E, Sterry W, eds. Dermatologische Qualitätssicherung Augsburg: Presse-Druck, 2000: 55–66.
3. Lo JS, Snow SN, Reizner GT, Mohs FE, Larson PO, Hruza GJ. Metastatic basal cell carcinoma: report of twelve cases with a review of the literature. J Am Acad Dermatol 1991; 24: 715–719.
4. Tavin E, Persky MS, Jacobs J. Metastatic basal cell carcinoma of the head and neck. Laryngoscope 1995; 105: 814–817.
5. Roenigk RK, Ratz JL, Bailin PL, Wheeland RG. Trends in the presentation and treatment of basal cell carcinomas. J Dermatol Surg Oncol 1986; 12: 860–865.
6. Silverman MK, Kopf AW, Grin CM, Bart RS, Levenstein MJ. Recurrence rates of treated basal cell carcinomas. Part 2: Curretage-electrodesiccation. J Dermatol Surg Oncol 1991; 17: 720–726.
7. Shriner DL, McCoy DK, Goldberg DJ, Wagner RF Jr. Mohs micrographic surgery. J Am Acad Dermatol 1998; 39: 79–97.
8. Drake LA, Dinehart SM, Goltz RW, Graham GF, Hordinsky MK, Lewis CW, et al. Guidelines of care for Mohs micrographic surgery. J Am Acad Dermatol 1995; 33: 271–278.
9. Cottel WI, Bailin PL, Albom MJ, Bernstein G, Braun M, Hanke W, et al. Essentials of Mohs micrographic surgery. J Dermatol Surg Oncol 1988; 14: 11–13.
10. Breuninger H. Histologic control of excised tissue edges in the operative treatment of basal-cell carcinomas. J Dermatol Surg Oncol 1984; 10: 724–728.
11. Thissen RTMM, Neumann HAM, Schouten LJ. A systematic review of treatment modalities for primary basal cell carcinomas. Arch Dermatol 1999; 135: 1177–1183.
12. Burg G, Hirsch RD, Konz B, Braun Falco O. Histographic margins of basal-cell epithelioma. J Dermatol Surg Oncol 1975; 1: 21–24.
13. McGovern TW, Leffel DJ. Mohs surgery, the informed view. Arch Dermatol 1999; 135: 1255–1259.
14. Silverman MK, Kopf AW, Grin CM, Bart RS, Lewenstein MJ. Recurrence rates of treated basal cell carcinomas. Part 1: Overview. J Dermatol Surg Oncol 1991; 17: 713–718.
15. Rowe DE, Carroll RJ, Day CL. Long-term recurrence rates in previously untreated (primary) basal cell carcinoma: implications for patient follow-up. J Dermatol Surg Oncol 1989; 15: 315–328.
16. Rowe DE, Carroll RJ, Day CL. Mohs surgery is the

treatment of choice for recurrent (previously treated) basal cell carcinoma. J Dermatol Surg Oncol 1989; 15: 424–431.

17. Neumann HAM, Krekels GAM, Verhaegh MEJM. Treatment of 208 extensive basal cell carcinomas with Mohs micrographic surgery. J Eur Acad Dermatol 1996; 6: 217–225.

18. Julian CG, Bowers PW. A prospective study of Mohs' micrographic surgery in two English centres. Br J Dermatol 1997; 136: 515–518.

19. Wennberg AM, Larkö O, Stenquist B. Five-year results of Mohs' surgery for aggressive facial basal cell carcinoma in Sweden. Acta Derm Venereol 1999; 79: 370–372.