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ORIGINAL ARTICLE

Cost Analysis of Mohs Micrographic Surgery in High-Risk Facial Basal Cell Carcinoma

N. Blázquez-Sánchez,[a,b,*] M. de Troya-Martín,[a,b] M. Frieyro-Elicegui,[a] R. Fúnez-Liébana,[c] L. Martín-Márquez,[d] and F. Rivas-Ruiz[e]

[a]*Servicio de Dermatología, Empresa Pública Hospital Costa del Sol, Marbella, Málaga, Spain*
[b]*CIBER Epidemiología y Salud Pública (CIBERESP), Empresa Pública Hospital Costa del Sol, Marbella, Málaga, Spain*
[c]*Laboratorio de Anatomía Patológica, Empresa Pública Hospital Costa del Sol, Marbella, Málaga, Spain*
[d]*Departamento de Económico, Empresa Pública Hospital Costa del Sol, Marbella, Málaga, Spain*
[e]*Unidad de Investigación, Empresa Pública Hospital Costa del Sol, Marbella, Málaga, Spain*

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KEYWORDS
Micrographic surgery;
Mohs;
Cost analysis;
Cost-effectiveness

Abstract

Introduction: Mohs micrographic surgery (MMS) is the treatment of choice for high-risk facial basal cell carcinoma (BCC) as it offers the greatest chance of cure with maximum preservation of healthy tissue. Its use in Spanish public health care hospitals is still limited, however, due to the controversy surrounding its cost.

Objectives: To determine the cost of MMS with fresh tissue to treat high-risk facial BCC and compare this to the estimated cost of conventional surgery in a Spanish public hospital. A secondary objective was to identify cost-optimization strategies for MMS.

Material and methods: Cross-sectional study of a consecutive series of patients with high-risk facial BCC who underwent MMS at the Department of Dermatology at Hospital Costa del Sol in Malaga, Spain between July 2006 and December 2007. We performed a descriptive analysis of the clinical characteristics of the patients and surgical factors. We calculated the total and mean cost of MMS and compared the results to the estimated costs of conventional surgery using patients as their own controls. Differences were analyzed according to tumor site and size, histologic subtype, and recurrence.

Results: Seventy-nine patients (mean age, 62 years) with 81 high-risk facial BCCs, 97.5% of which were primary tumors, underwent MMS. The most common tumor site was the nose (57%) followed by the orbital region (25%). Histology showed that 64% of the tumors were infiltrative or micronodular carcinomas. Tumor-free margins were achieved in all patients, with no more than 2 stages required in 88% of the cases. The most common surgical reconstruction techniques were direct closure (21%) and closure with a local skin flap or graft (71%); the corresponding estimates for conventional surgery were 2% and 89%,

*Corresponding author.
E-mail address: nuriaderm1@gmail.com (N. Blázquez-Sánchez).

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respectively. The total and mean cost of MMS was €106 129.07 and €1325.80, respectively (compared to €97700 and €1208.70 for conventional surgery). The difference in mean costs between MMS and conventional surgery was not significant (*P*=.534).
Conclusions: MMS is a viable, effective technique that does not generate significantly higher costs than conventional surgery in selected patients with high-risk facial BCC. Certain technical and organizational strategies could contribute to optimizing the cost of MMS.
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PALABRAS CLAVE
Cirugía micrográfica;
Mohs;
Análisis de costes;
Coste/beneficio

Análisis de costes de la cirugía micrográfica de Mohs en el carcinoma basocelular facial de alto riesgo

Resumen
Introducción: La cirugía micrográfica de Mohs constituye el tratamiento de elección del carcinoma basocelular de alto riesgo, pues ofrece la mayor garantía de curación con la máxima preservación de tejido sano. Sin embargo, su implementación en hospitales del ámbito sanitario público españoles es minoritaria hasta la fecha, debido a que el coste económico de esta técnica continúa siendo motivo de controversia.
Objetivo: Determinar los costes de la cirugía micrográfica de Mohs en fresco (CMF) en el tratamiento del carcinoma basocelular facial de alto riesgo (CBFR) frente al coste teórico mediante cirugía convencional (CC), en un centro hospitalario del ámbito sanitario público español. Identificar estrategias de optimización de costes en este tipo de cirugía.
Material y métodos: Estudio transversal de una serie consecutiva de pacientes con CBFR intervenidos mediante CMF en el Servicio de Dermatología del Hospital Costa del Sol desde julio 2006 a diciembre 2007. Se realizó un análisis descriptivo de las características clínicas de la serie y aspectos quirúrgicos. Se realizó un estudio de costes (coste total y coste medio) de la CMF y se compararon con los costes teóricos de la CC, utilizando cada paciente como su propio control. Se analizaron las diferencias por localización, tamaño del tumor, histología y recurrencia.
Resultados: Se intervinieron con CMF 79 pacientes con 81 CBFR (edad media = 62 años). El 97,5% fueron tumores primarios. La localización más frecuente fue la pirámide nasal (57%) seguida de la región orbitaria (25%). El 64% correspondieron a tipos histológicos infiltrativo y micronodular. La exéresis tumoral mediante CMF se concluyó en todos los casos con márgenes libres, requiriéndose en el 88% únicamente uno o dos estadios. Las técnicas de reconstrucción quirúrgica más empleadas fueron el cierre directo y colgajo local (21 y 71% de los casos respectivamente en la CMF, frente al 2 y 89% en la CC). El coste total y coste medio de la CMF fue de 106.129,07 y 1.325,8 euros respectivamente (frente a 97.770 y 1.208,7 euros de la CC). La diferencia de costes entre ambos procedimientos no fue significativa (p = 0,534).
Conclusiones: LA CMF es una técnica factible, eficaz y que genera costes que no son significativamente superiores a los de la CC en pacientes seleccionados con CBFR. Algunas estrategias técnicas y organizativas pueden contribuir a la optimización de costes de esta cirugía.
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Introduction

Mohs micrographic surgery (MMS) is currently considered the treatment of choice for certain types of high-risk basal cell carcinoma (BCC),[1] despite the fact that its superiority over other treatments has not been demonstrated in long-term studies.[2] In addition to maximizing structural and functional preservation of the treated area, MMS provides the opportunity to analyze all the surgical margins and consequently results in much lower recurrence rates than those achieved with conventional surgery. For example, 5-year recurrence rates for primary BCCs and recurrent tumors are 1.4% and 4%, respectively, with MMS[3] but 3.2% to 10% and 17%, respectively, with conventional surgery.[4]

MMS, however, is a laborious procedure that requires considerable investment in terms of time and personnel, and its cost-benefit ratio remains a controversial issue. Consequently, and also in view of the lack of cost-analysis studies of MMS in Spain, the procedure is still uncommon in our setting. The aim of this study was to determine the cost of MMS with fresh tissue to treat high-risk facial BBC at Hospital Costa del Sol, a public health care hospital in Andalusia, Spain.

Patients and Methods

We performed a cross-sectional study of a consecutive series of patients with high-risk facial BCC who underwent

MMS with fresh tissue at the Department of Dermatology at Hospital Costa del Sol in Malaga, Spain between July 2006 and December 2007. Only patients with histologically confirmed BCCs meeting one of the following criteria were included: 1) Primary BCCs with histologic features predictive of increased risk (morpheaform, micronodular or infiltrating lesions) or located in the H zone of the face; or 2) recurrent carcinomas with aggressive histologic patterns. Patients at high surgical risk or with a short life expectancy were excluded. A preoperative confirmatory biopsy was performed in all cases.

Description of Procedure: At our hospital, MMS is performed by a team of 2 dermatologists and a pathologist. The tumors are excised under local anesthesia (mepivacaine 1%) with the aim of achieving surgical margins of 3 mm. The lesions are removed at a 45° angle to include lateral margins, with excision of deep margins with a cut horizontal to the skin surface. The tissue specimens are frozen, sliced horizontally, and stained with hematoxylin-eosin for the histology study (following division of the sample into quadrants and mapping). If residual cancer is detected in the surgical margins, the MMS process is repeated until the margins are completely tumor-free. In most cases, reconstruction of the surgical defect is performed in a single procedure under local anesthesia and sedation (Figure 1).

Cost Analysis: We performed a comparative cost analysis of MMS and conventional surgery in 2 treatment arms: a real-cost arm (MMS) and a hypothetical-cost arm reflecting what conventional surgery would have cost and in which patients were their own controls. The estimated costs of conventional surgery were based on an independent evaluation performed by 3 dermatologists before each of the surgical procedures. The evaluation was based on the patients' clinical histories and on the study of images of the lesions. The most suitable course of action (to achieve surgical margins of 5 mm[5]) was planned according to 3 parameters: type of anesthesia (local, local plus sedation, or general), type of surgical reconstruction (direct closure or closure with a local or distant skin flap or graft), and type of admission (major ambulatory surgery or hospitalization).

For the purpose of the cost analysis, the surgical procedure (MMS or conventional surgery) was defined as including all the activities required to remove the tumor and provide care up to the moment of discharge. These activities included surgery scheduling and management, surgery (tumor removal and surgical reconstruction), and recovery (in day hospital or inpatient facilities). The cost of surgery included personnel costs (by category), material costs (disposable materials and medication), and costs arising from the use of the operating room (time) and the day hospital or inpatient facilities. By analyzing the measurement units and real costs for each activity based on salaries and the real cost of material at our hospital, it was possible to calculate the direct cost of each surgical procedure. Indirect costs (infrastructure and personnel) were added later to obtain information on the total costs of both types of procedures (MMS and conventional surgery) (Table 1).

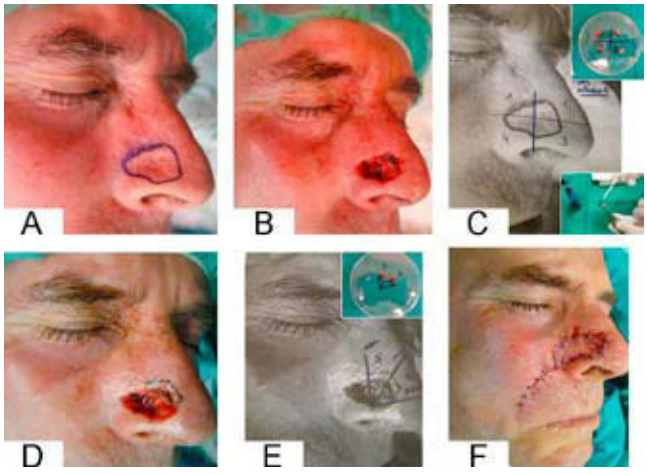

Figure 1 A, Excision of basal cell carcinoma from right nose by Mohs micrographic surgery with evaluation of fresh tissue (MMS). B, C, First tissue excision with mapping of tumor into 4 quadrants. The histology study showed neoplastic involvement in the superficial margin of quadrant 2. D, E, Additional tissue excision (extension of margins in quadrant 2). The subsequent histology study confirmed tumor-free margins. F, Surgical reconstruction.

Table 1 Unit Costs

	MMS With Fresh Tissue Evaluation	Conventional Surgery
Mean direct costs per patient: (28% of direct costs)	€388.27	€337.98
Direct costs		
1. Surgical staff		
Tumor removal team, cost per patient	€46.31	€68.30
Surgical reconstruction team, cost per patient	€123.08	€230.72
Total team cost per hour	€168.02	€209.73
2. Direct material costs per patient (disposable material and medication)	€497.35	€438.89
3. Direct costs for postoperative care per patient		
MAS unit	€19.49	
Day hospital/MAS unit		€41.15
4. Histology study costs		
Staff (pathology laboratory specialists and technical staff) per patient	€183.53	€20.14
Mean cost per pathology study	€243.61[a]	€21.40[b]
Mean cost per MMS stage	€144.18	
Direct cost per analysis of conventional surgery specimen		€21.40

Abbreviations: MAS, major ambulatory surgery; MMS, Mohs micrographic surgery.
[a]Per patient.
[b]Per specimen.

Statistical Analysis: We performed a descriptive analysis of patient variables (age and sex), clinical and pathologic features (tumor site, histology, recurrence, size), and surgical data (number of sessions, number of Mohs stages, surgical margins, size of surgical defect, and type of reconstruction and anesthesia). Data were presented as means (SD) and 95% confidence intervals (CIs) for continuous variables and as frequencies for qualitative variables. The cases were stratified by tumor size, location, recurrence, and aggressiveness to determine differences between the total and mean costs of MMS and conventional surgery in the treatment of different subtypes of BCC. We performed a sensitivity analysis of the 2 surgical techniques; in calculating the cost of conventional surgery, all the cost categories corresponded to major ambulatory surgery. The nonparametric Mann-Whitney U test was used to compare data, and statistical significance was set at a *P* value of less than .05.

Results

Patient and Clinical Characteristics

Seventy-nine patients with 81 BCCs (72 primary tumors and 9 recurrent tumors) were included in the study. The ratio of men to women was 1.2 to 1 and the mean (SD) age was 62 (13.8) years. The mean tumor size was 11.93 (4.26) mm. The most common tumor site was the nose (54.3%) followed by the orbital region (25.9%), and the most common histologic subtype was infiltrating BCC (53.1%) followed by micronodular BCC (11.1%) (Table 2).

Surgical Data

All the MMS procedures were conducted as major ambulatory surgery. When estimating costs for the hypothetical use of conventional surgery, it was assumed that 89% of the operations could be performed on an outpatient basis and that the remaining 11% would require hospitalization.

Tumor-free margins were achieved in all cases with no more than 2 stages required in 88% of the cases. The most common surgical reconstruction technique used was closure with a local skin flap or graft (71% of cases) followed by direct closure (21%). The corresponding estimates for conventional survey were 89% and 2%, respectively (Table 3).

Economic Data

The total cost of treatment for the 81 patients who underwent MMS was €106129.07; in contrast, the estimated cost of conventional surgery was €97770.63. The difference in costs for the total study period (18 months) was thus €8358.44. The mean cost of treatment was €1325.60 for MMS (95% CI, €795-€2322.20) and €1208.70 for conventional surgery (95% CI, €590.8-1658.50) (Table 4). With the exception of tumors located on the forehead, in which MMS was more costly than conventional surgery (€1465 vs €1179.80), the difference in costs between MMS and conventional surgery was not significant (*P*=.534) (Table 5).

The sensitivity analysis did not reveal any significant difference in mean cost between MMS (€1322.90, 95% CI,

Table 2 Patient Characteristics

	No. (%) of Patients	Mean (SD)
Sex		
Men	54	
Women	46	
Age, y		63.3 (13.8)
Size, mm		
≤10 mm	42 (51.9)	
>10 mm	36 (44.4)	16 (0.5)
Unknown	3 (3.7)	
Histologic subtype		
Aggressive (infiltrating, micronodular)	52 (64)	
Nonaggressive (superficial, nodular)	8 (10)	
Unknown	21 (26)	
Primary/recurrent tumor		
Primary	72 (89)	
Recurrent	9 (11)	
Anatomic location		
Forehead and/or temporal region	5 (6.1)	
Cheek	7 (8.6)	
Nose	46 (56.8)	
Orbital region	20 (24.7)	
Lips	3 (3.7)	
H zone of the face	69 (85.2)	
Non-H zone of the face	12 (14.8)	

Table 3 Characteristics of Surgical Procedure

	MMS, Fresh Tissue Evaluation No. (%) of Patients	Conventional Surgery No. (%) of Patients
Type of Admission		
Major ambulatory surgery	81 (100)	72 (89)
Hospitalization	–	9 (11%)
Tumor excision (No. of MMS stages)		
1	43 (53)	81 (100)
2	29 (36)	–
3	8 (10)	–
4	1 (1)	–
Type of surgical reconstruction		
Direct closure	16 (21)	2 (2)
Closure with local skin flap/graft	58 (71)	72 (89)
Closure with distant skin flap/graft	7 (8)	7 (9)

Abbreviation: MMS, Mohs micrographic surgery.

Table 4 Costs of Whole Surgical Procedure and Individual Steps or Components

	MMS, Fresh Tissue Evaluation	Conventional Surgery	
1. Scheduling of surgery			
Management and scheduling of surgery	€9.11	€9.11	
2. Preoperative preparatory phase			
Admission and preparation in MAS unit or day hospital	€13.88	€19.91	
3. Surgery			
Tumor removal	€435.98[a]	€255	
Surgical reconstruction	€649.27	€860.74	
4. Recovery			
Monitoring of patient in MSA or admission to day hospital	€19.49	€41	
5. Histology study			
Submission, processing, and evaluation of tumor specimen	€243.61	€21.14	
Total cost	€106 129.07	€9 7770.63	
Mean (SD) cost	€1325.60 (€364)	€1208.70 (157)	*P*=.534

Abbreviations: MAS, major ambulatory surgery; MMS, Mohs micrographic surgery.
[a]Includes stay in MAS unit after tumor removal.

Table 5 Costs by Tumor Characteristics: Anatomic Location, Size, Recurrence, and Histologic Features

Total Costs, €		Mohs Micrographic Surgery (MMS) Fresh Tissue Evaluation				Conventional Surgery (CS)				Mean Difference MMS-CS	*P*
	No. of Patients	Min.	Max.	Mean	SD	Min.	Max.	Mean	SD		
Facial H/non-H zone											
H zone	74	795.1	2322.30	1323.10	363.80	590.80	1658.50	1210.30	164.00	112.80	.436
Non-H zone	7	795.1	1887.90	1320.70	365.60	1179.80	1266.50	1192.20	32.80	128.60	.805
Anatomic Location											
Nose	44	795.10	1952.80	1299.10	299.20	590.80	1658.50	1224.70	172.70	74.40	.188
Orbital region	21	795.10	2322.30	1341.70	482.30	590.80	1571.80	1193.20	181.40	148.50	.764
Forehead	6	795.10	1887.90	1465.00	422.50	1179.80	1179.80	1179.80	0.0	285.20	.039
Cheek	6	795.10	1887.90	1352.30	390.00	1179.80	1266.50	1194.20	35.40	158.10	.406
Lips	3	1131.50	1518.50	1260.50	223.40	1179.80	1179.80	1179.80	0.0	80.70	.480
Scalp	1	1131.50	1131.50	1.131.50	0.00	1179.80	1179.80	1179.80	0.0	-48.30	.317
Tumor size											
≤1 cm	31	795.1	2322.30	1398.70	391.40	590.80	1658.50	1200.40	193.80	198.30	.448
>1 cm	40	795.1	2322.30	1296.50	307.30	590.80	1658.50	1204.90	158.60	91.70	.472
Tumor recurrence											
No	72	795.10	2322.30	1301.40	352.60	590.80	1658.50	1211.20	166.30	90.20	.262
Yes	9	795.10	1952.80	1494.90	408.30	1179.80	1266.50	1189.40	28.90	305.50	.258
Histology											
Aggressive	52	795.10	2322.30	1363.50	326.20	590.80	1658.50	1203.20	177.50	160.40	.797
Non-aggressive	8	795.10	2322.30	1317.90	481.90	1179.80	1658.50	1.299.50	198.50	18.40	.199

Abbreviations: Max., maximum; min, minimum.

€795.1-€2322.30) and conventional surgery conducted in an ambulatory setting (€1202.70, 95% CI, €590.80-€1604.20) (P=.518).

Discussion

We have presented the results of a cost-analysis of MMS performed at Hospital Costa del Sol, a public health care hospital in Andalusia, Spain. The hospital serves a population of approximately 400 000 inhabitants from 9 municipalities along the western Costa del Sol region of Malaga. Over 1000 cases of skin cancer are detected at the dermatology department of our hospital every year, and of these approximately 800 are BCC. Nonetheless, only 10% of these cancers are treated with MMS.

In the skin cancer unit, the selection of suitable candidates for the procedure is based on highly specific criteria (BCCs with histologic features predictive of increased risk, tumors occurring on embryonic fusion planes, a tumor size of over 1 cm, and tumor recurrence). Histologic confirmation is required in all cases and patients with a low life expectancy are excluded as it is considered that the benefits will be short-lived. Given the high prevalence of BCC, it is essential to carefully select candidates for MMS in order to control costs.

At our hospital, MMS is performed by a team of 2 dermatologists and a pathologist. The work is performed in 2 parallel operating rooms consisting of an ambulatory surgery unit (where the tumor is removed under local anesthesia) and a major ambulatory surgery unit (where surgical reconstruction is performed under sedation administered by an attending anesthesiologist). The characteristics of the patients that undergo MMS (carefully selected candidates with tumors that can mostly be removed under local anesthesia) led us to create this parallel operating room arrangement as it reduces the risks associated with sedation and increases the efficient tailoring of the procedure as a whole. The histology study is always performed by a pathologist; the awake patient remains in the day hospital while the fresh tissue sample is examined.

We cannot compare our findings to other data from Spain as our search of the literature revealed no published studies on the cost of MMS here. Based on our sample, the mean cost of MMS per patient was €1322.90. The average cost in the United States (between $937[6] and $1243[7]) has been similar to ours, considering the years in which the reports were published and the fall in the value of the dollar in recent years. A more recent European study with the same inclusion criteria as ours reported a lower cost per patient (€1146),[8] however. The difference might be attributable to differences in the procedure. For example, in the European study, only local anesthetic was used and the histology study was performed by the operating dermatologist. In our opinion, the use of sedation given by an attending anesthesiologist results in a considerable improvement in the quality of treatment as it reduces levels of pain and anxiety experienced by the patient during the procedure. In some centers, the operating dermatologist now performs the histology study. While this requires specialized training and experience, in the long term, it might result in lower costs.

Our comparative analysis showed that the total cost of MMS was higher than that of conventional surgery (€106 129.07 vs €97 770.63), but no significant differences were found between the mean costs of the 2 procedures (P=.534). Furthermore, no statistically significant differences were found in the sensitivity analysis comparing the 2 procedures. We assumed that all the conventional surgery procedures would be conducted in an ambulatory setting to remove possible bias due to the general tendency to overestimate the complexity of conventional survey. This was particularly important in our study as the analysis of our control group was based on hypothetical data. Our results are in agreement with findings reported by several studies[6,7] but there are also conflicting reports.[2]

The analysis of the costs associated with the different stages of the procedures revealed a number of interesting findings. Like other authors, we found that the main factor that increases the cost of MMS compared to conventional surgery is the histology study of fresh tissue (mean cost of €243.61 per patient vs €21.14). Using 3-dimensional histologic examination of paraffin-embedded tissue sections[9] might be a less costly alternative to examining fresh tissue, but it would represent an obstacle to reconstructing the surgical defect during the same procedure.

The second most important factor contributing to the cost of MMS is the mapping of tumor margins (€435.98 in MMS compared to €255 in conventional surgery). The main reason is the increased cost of staff. MMS is a laborious procedure whose main requirement is the time of highly skilled personnel. Consequently, organizational strategies designed to optimize surgery times (in our case the use of the parallel operating room arrangement to reduce time wastage is key to reducing costs arising at this stage). In the future, the incorporation of new preoperative mapping techniques such as skin ultrasound, surface microscopy, or the use of 5-aminolevulinic acid might contribute to reducing time and minimizing the cost of MMS in the treatment of high-risk facial BCC.[10-15]

We found that the cost of performing MMS was lower than the cost of conventional surgery for both the reconstruction stage (€646.27 vs €860) and the postoperative recovery stage (€19.49 vs €41). This is because of the greater preservation of healthy tissue and hence the need for less extensive surgical reconstruction with MMS.[16]

There are 4 known predictors of greater subclinical spread in BCC: a tumor size of over 1 cm, tumor recurrence, an aggressive histologic subtype, and involvement of embryonic fusion planes.[17-21] Combinations of these factors occur in high-risk facial BCC and it is therefore to be expected that more surgical stages will be required to completely remove the tumor, leading to higher costs. Nonetheless, the only significant difference between the mean cost of the 2 procedures in relation to these was that tumors located on the forehead were more costly to remove with MMS than with conventional surgery. This could be due to an underestimation of the true extension of morpheaform BBC in this anatomic location and consequently an underestimation of the margins that needed to be removed in conventional surgery.

The cost-benefit relationship in MMS treatment of BBC is still being debated. Mustard et al[1] found no significant

differences between recurrence rates for primary high-risk facial BCC between MMS and conventional surgery (2.5% vs 4.1%) but they did find a difference for recurrent BCCs (12.1% vs 2.4%). Based on these data, the authors concluded that while MMS was not cost-effective for primary BCCs, it was for recurrent BCCs as the risk of recurrence and the need for additional interventions was significantly higher than with conventional surgery. Esser et al[8] had previously reached a similar conclusion. The cost-effectiveness of these procedures should be further analyzed in future studies incorporating variables such as extent of healthy tissue preservation, scarring, and impact on quality of life.[22]

Limitations of Study: The results of our cost analysis of MMS in high-risk facial BCC are influenced by the patient selection criteria employed, by the organizational structure of our department, and by staff and material costs at Hospital de Sol. They should thus be modified accordingly before being extrapolated to other settings in order to ensure appropriate interpretation. Another possible limitation of our study is that the results for conventional surgery might vary with respect to true clinical situations as the control group data we analyzed were hypothetical. Such an approach, however, ensured that the data for both procedures were matched as each patient served as his/her own control. Furthermore, potential bias arising from subjective evaluation was minimized by using 3 independent dermatologists. This meant that the 2 samples used for the cost-comparison analysis were matched.

We have presented the results of the first cost-analysis study of MMS in Spain. MMS is a viable, effective technique that is comparable to conventional surgery in terms of cost in the treatment of high-risk facial BCC. Differences in technical and organizational strategies may considerably alter the cost of MMS but further studies are required to explore this aspect in more detail.

Conflict of Interest

The authors declare that they have no conflicts of interest.

References

1. Mosterd K, Krekels GA, Nieman FH, Ostertag JU, Essers BA, Dirksen CD, et al. Surgical excision versus Mohs' micrographic surgery for primary and recurrent basal cell-carcinoma of the face: a prospective randomised controlled trial with 5-years' follow-up. Lancet Oncol. 2008;9:1149-56.
2. Bath-Hextall FJ, Perkins W, Bong J,Williams HC. Interventions for basal cell carcinoma of the skin. Cochrane Database Syst Rev. 2007;1:CD003412.
3. Leibovitch I, Huilgol SC, Selva D, Richards S, Paver R. Basal cell carcinoma treated with Mohs surgery in Australia II. Outcome at 5-year follow-up. Journal of the American Academy of Dermatology. 2005;53:452-7.
4. 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;15:315-28.
5. Telfer NR, Colver GB, Morton CA. Guidelines for the management of basal cell carcinoma. Br J Dermatol. 2008;159:35-48.
6. Cook J, Zitelli JA. Mohs micrographic surgery: a cost analysis. J Am Acad Dermatol. 1998;39(5 Pt 1):698-703.
7. Bialy TL, Whalen J, Veledar E, Lafreniere D, Spiro J, Chartier T, et al. Mohs micrographic surgery vs traditional surgical excision. A cost comparison analysis. Arch Dermatol. 2004;140:736-42.
8. Essers BAB, Dirksen CD, Nieman FHM, Smeets NW, Krekels GA, Prins MH, et al. Cost-effectiveness of Mohs micrographic surgery vs surgical excision of basal cell carcinoma of the face. Arch Dermatol. 2006;142:187-94.
9. Then SY, Malhotra R, Barlow R, Kurwa H, Huilgol S, Joshi N, et al. Early cure rates with narrow-margin slow-Mohs surgery for periocular malignant melanoma. Dermatol Surg. 2009;35:17-23.
10. Stenquist B, Ericson MB, Strandeberg C, Mölne L, Rosén A, Larkö O, et al. Bispectral fluorescence imaging of aggressive basal cell carcinoma combined with histopathological mapping: a preliminary study indicating a possible adjunct to Mohs micrographic surgery. Br J Dermatol. 2006;154:305-9.
11. Redondo P, Marquina M, Pretel M, Aguado L, Iglesias ME. Methyl-ALA induced fluorescence in photodynamic diagnoses of basal cell carcinoma prior to Mohs micrographic surgery. Arch Dermatol. 2008;144:115-7.
12. Jambusaria-Pahlajani A, Schmults C, Miller C, Shin D, Williams J, Kurd SK, et al. Test characteristics of high-resolution ultrasound in the preoperative assessment of margins of basal cell squamous cell carcinoma in patients undergoing Mohs micrographic surgery. Dermatol Surg. 2009;35:9-16.
13. Karen JK, Gareu DS, Duzsa SW, Tudisco M, Rajadhyaksha M, Nehal KS. Detection of basal cell carcinomas in Mohs excisions with fluorescent confocal mosaicing microscopy. Br J Dermatol. 2009;160:240-5.
14. Alkalay R, Alkalay J, Maly A, Ingber A, Fritsch C, Ruzicka T, et al. Fluorescence imaging for demarcation of basal cell carcinoma tumor borders. J Drugs Dermatol. 2008;7:1033-7.
15. Chung VQ, Dwyer PJ, Nehal KS, Rajadhyaksha M, Menaker GM, Charles C, et al. Use of ex vivo confocal laser microscopy during Mohs surgery for non melanoma skin cancer. Dermatol Surg. 2004;30:1470-8.
16. Downes RN, Walker NP, Collin JR. Micrographic (Mohs') surgery in the management of periocular basal cell epitheliomas. Eye (Lond). 1990;4:160-8.
17. Leibovitch I, Huilgol SC, Selva D, Richards S, Paver R. Basal cell carcinoma treated with Mohs surgery in Australia. Outcome at 5-year follow-up. J Am Acad Dematol. 2004;151:141-7.
18. Leiter C, Gaiber U. Epidemiology of melanoma and nonmelanoma skin cancer-the role of sunlight. Adv Exp Med Biol. 2008;624: 89-103.
19. Batra RS, Kelley LC. Predictors of extensive subclinical spread in nonmelanoma skin cancer treated with Mohs micrographic surgery. Arch Dermatol. 2002;138:1043-51.
20. Orengo IF, Salasche SJ, Fewkes J, Khan J, Thornby J, Rubin F. Correlation of histologic subtypes of primary basal cell carcinoma and number of Mohs stages required to achieve a tumor-free plane. J Am Acad Dermatol. 1997;37(Pt 1):385-7.
21. Alonso T, Sánchez P, González , Ingelmo J, Ruiz I, Delgado S, et al. Cirugía de Mohs: nuestros primeros 100 pacientes. Actas Dermosifiliogr. 2008;99:275-80.
22. Rhee JS, Matthews BA, Neuburg M, Logan BR, Burzynski M, Nattinger AB. The skin cancer index: clinical responsiveness and predictors of quality of life. Laryngoscope. 2007;117:399-405.