MOHS MICROGRAPHIC SURGERY FOR BASAL CELL CARCINOMA: A REVIEW OF TREATMENT RESULTS

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ABSTRACT

Objectives: To evaluate the results of Mohs Micrography Surgery (MMS) in the treatment of basal cell carcinoma (BCC).

Materials and methods: We used the database of PUBMED and EMBASE to evaluate the results of MMS in treatment of BCC.

Results: Nine studies with the total number of 5845 BCC cases were included in this review, the follow-up time varied from 12 to 42 months. The overall cumulative probabilities of recurrence after MMS were 2.4%. The cumulative probability of recurrence for the primary BCC group and the recurrent BCC group was 2.9% and 7.2%, respectively. In the recurrent BCC group, the cumulative probability of recurrence after MMS was lower than after standard surgical excision (SSE) (3.9% vs 13.5%, $p < 0.05$). In MMS group, 52% of patients required one round of excision to achieve complete removal of BCC, 34% needed two rounds and 14% needed three rounds. The size of final skin defect after MMS was 1.34 times larger than that of the primary tumor ($p < 0.05$).

Conclusions: MMS is superior to SSE in BCC treatment, with lower recurrence rate and better normal skin-sparing. Therefore, MMS is strongly recommended for surgical treatment of BCC, especially in high-risk BCC.

Keywords: *Basal cell carcinoma, Mohs micrography surgery*.

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1. INTRODUCTION

Skin cancer can be classified into separate types, which arise from different types of skin cells. Basal cell carcinoma (BCC) is the most common skin malignancy. In Vietnam, BCC accounts for 52.6% of all skin cancers. Currently, BCC is the most common form of malignant neoplasm among Caucasians. Risk factors for BCC are: UV exposure, genetics, skin type I or II according to the Fitzpatrick classification, old age, male gender, arsenic exposure, and high-fat diet.[1,2]

Currently, surgery therapy remains the mainstay of treatment for BCC. Among various techniques, Mohs micrographic surgery (MMS), which involves the immediate microscopic examination of the entire (100%) margin of the excised tissue for residual tumor, is considered the most effective[3]. MMS is well-established in the United States and Europe4. However, in Vietnam, MMS has only been implemented at the National Hospital of Dermatology and Venereology. Furthermore, there has been no comprehensive overview of the outcomes of MMS in BCC treatment. Therefore, we conducted a literature review to assess the recurrence rate and normal skin-sparing ability among BCC patients who underwent MMS worldwide.

2. MATERIALS AND METHODS

2.1. Research tools

Our review was based on the 2009 PRISMA-P protocols according to the PRISMA statement. (Preferred Reporting Items for Systematic Reviews and Meta - Analyzes). This is a standardized checklist for review studies to help researchers conduct the most complete and reliable research design.

2.2. Database sources and searching strategies

We systematically searched from May 11, 2023 to May 20, 2023 in the PubMed, Embase databases and used the MESH search keyword "Mohs surgery" AND "Basal cell carcinoma".

2.3. Selection process

All original research articles on MMS outcomes for BCC were reviewed. Research title, research abstracts, and full text were evaluated by 3 independent researchers, namely Nguyen Hong Son, Le Van Duc, and Pham Ngan Giang, Vu Nguyen Binh et al.

Diagram 1 shows details of the study selection process for the systematic review.

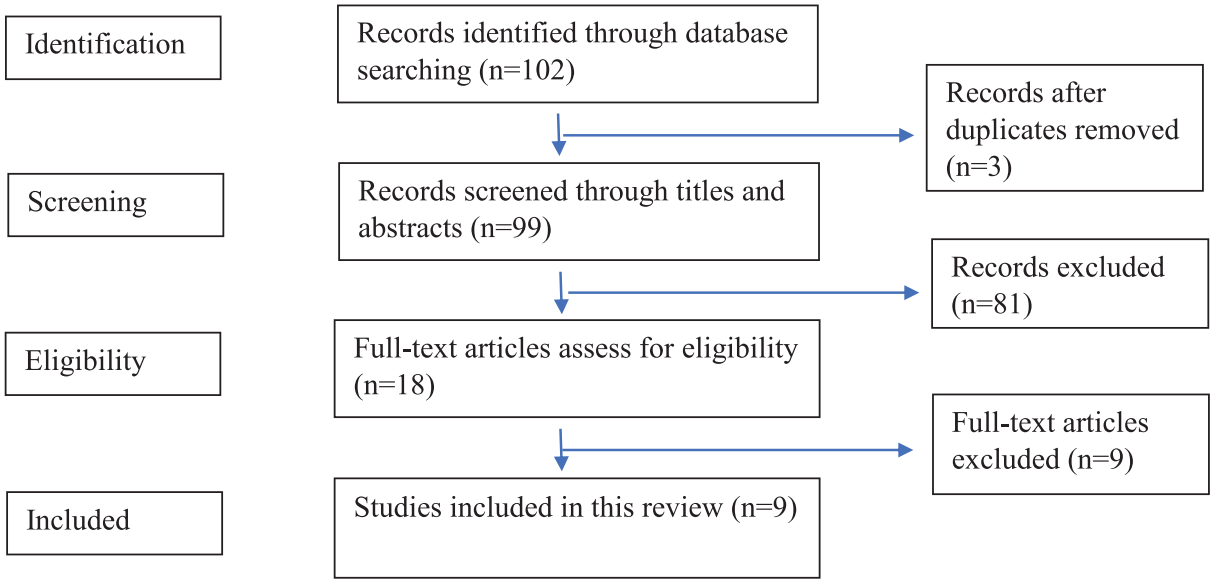

Diagram 1. Study selection process for the systematic review.

3. RESULTS

3.1. Features of selected articles

9 articles published between 2004 and 2019 were included in this review (7 in English, 1 in French, 1 in Spanish), with a total of 5962 BCC cases which underwent MMS and got followed-up.

Among them, seven clinical studies monitored the recurrence rate of BCC patients after MMS, 2 randomized clinical trials compared the efficacy between MMS and SSE in patients with BCC. The mean follow-up time ranged from 12 to 42 months.

3.2. Recurrence rate and cumulative probability of recurrence

3.2.1. The recurrence rate of BCC after MMS

The recurrence rate of BCC after MMS ranges from 0% to 8.3% (as shown in Table 1).

Table 1. The recurrence rate of BCC after MMS

Author	MMS rounds	Group	Cases	Recurrent cases	Recurrence rate (%)
Robert Gniadecki[5]	231	pBCC	125	0	0
		rBCC	106	0	
N W J Smeets[4]	720	pBCC	365	11	3.8
		rBCC	355	16	

Author	MMS rounds	Group	Cases	Recurrent cases	Recurrence rate (%)
F Veronese[6]	350	pBCC	169	12	8.3
		rBCC	156	17	
		NA	25	0	
John Paoli[7]	486	pBCC	306	6	3.3
		rBCC	179	10	
		NA	1	0	
G Galimberti[8]	2412	NA	2412	9	0.4
Salim Gallouj[9]	29	NA	29	0	0
Elsa M Kuiper[10]	1021	pBCC	586	16	4.1
		rBCC	174	8	
		NA	261	18	
Klara Mosterd[11]	306	pBCC	198	4	2.0
		rBCC	100	2	
Eva van Loo[12]	306	pBCC	198	6	3.0
		rBCC	100	3	

rBCC: recurrent BCC, pBCC: primary BCC

The recurrence rate after Mohs surgery of primary BCC is lower than that of recurrent BCC in 4 of 6 studies (Figure 1).

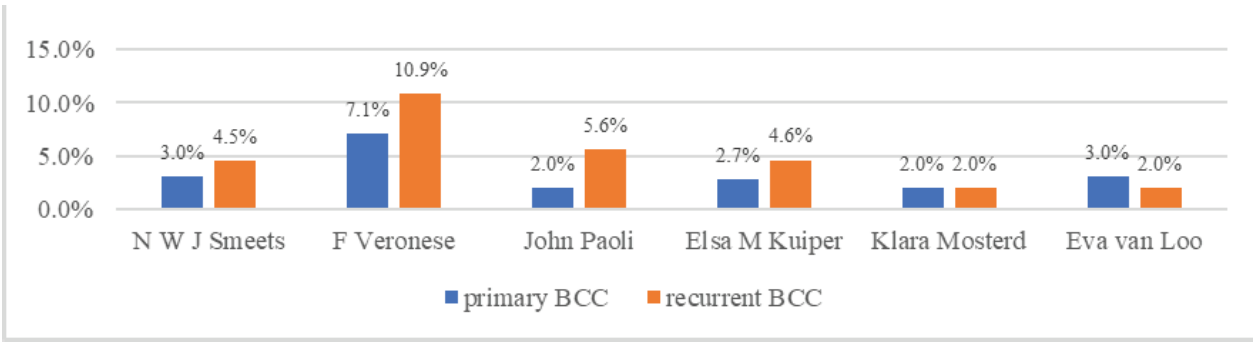

Figure 1. Recurrence rate after MMS of primary and recurrent BCC

3.2.2. Cumulative probability of recurrence

Table 2. Cumulative probability of BCC recurrence after surgery

Author	Group	Technique	Size	Recurrent cases	Recurrence rate (%)	Cumulative probability of recurrence
Klara Mosterd[11]	pBCC	MMS	198	4	2.0	2.5
		SSE	199	7	3.5	4.1
	rBCC	MMS	100	2	2.0	2.4
		SSE	102	10	9.8	12.1
Eva Van Loo[13]	pBCC	MMS	198	6	3.0	4.4
		SSE	199	15	7.5	12.2
	rBCC	MMS	100	3	3.0	3.9
		SSE	102	11	10.8	13.5

There were 2 studies on the same sample with study duration of 5 years and 10 years. After SSE: the 5-year and 10-year cumulative probability of recurrence in pBCC group was 4.1% and 12.2%, respectively; while in rBCC group the observed percentage was 12.1% and 13.5% (as shown in Table 2).

3.3. Number of MMS excision round

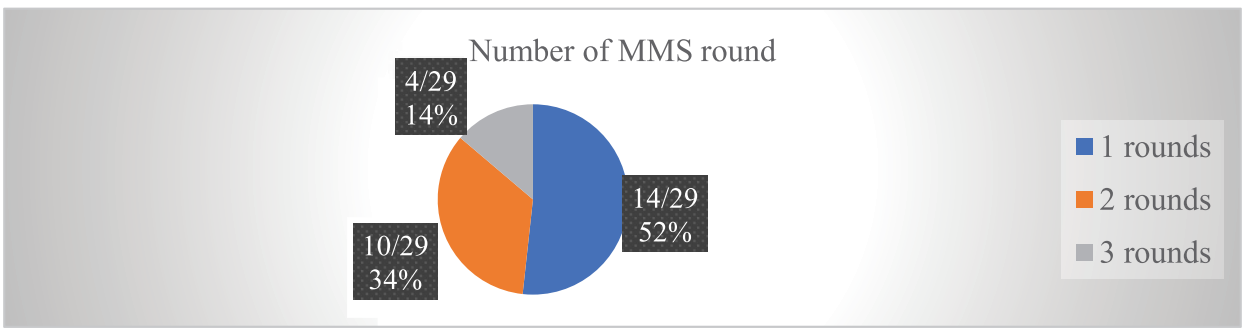

Figure 2. Number of MMS excision round

Among 29 BCC cases that underwent MMS, 52% required one MMS excision round, the percent of 2 rounds and 3 rounds MMS was 34%, and 14%, respectively (as shown in Figure 2).

4. DISCUSSION

There were 9 studies included in this review, with sample size ranged from 29 to 2412 cases. The mean follow-up time of patients in the studies ranged from 1 year to 10 years. The mean age of BCC patients varied from 45.8 to 67.7 years old.

The studies followed-up patients post-surgery to assess the recurrence rate and cumulative probability of recurrence in BCC patients, including primary BCC and recurrent BCC treated with either MMS or SSE. The studies evaluated the number of rounds required to achieve complete removal of tumor and the skin-sparing benefit of MMS.

MMS is the first choice for BCC treatment, with high-level evidence, especially in high-risk BCC, according to the latest guidelines of the American Academy of Dermatology.8 However, in Vietnam, there have been no studies to assess the recurrence rate in BCC patients underwent surgical intervention in overall, or MMS, or different methods such as cryosurgery, radiation therapy, etc.

Recurrence rates of BCC in the 9 studies included in this review were presented in Table 1.

Post MMS, the overall recurrence rate of BCC (including primary BCC, recurrent BCC, and other BCC) was 2.4% (142/5962 cases). The primary BCC group had a recurrence rate of 2.9% (142/5962 cases). The recurrent BCC group had a recurrence rate of 7.2% (142/5962 cases).

These results were similar to previous studies on the recurrence rate of BCC post MMS. In the US, the relapse rate of recurrent BCC group varied as patients underwent different surgical techniques. The relapse rate after MMS, SSE, cryosurgery, curettage and electrodessication, radiation therapy was 5.6%; 17.4%; 13.0%; 40.0%; and 9.8%, respectively.[14] Meanwhile, the recurrence rate after 5 years for primary BCC group post MMS was 1.0%, the percent for post SSE, cryosurgery, curettage and electrodessication, radiation therapy was 10.1%; 7.5%; 7.7% and 8.7%, respectively.[9]

There were 2 in 9 studies comparing the cumulative probability of recurrence, both studies were analyzed by the Kaplein-Meier method. The study of Klara Mosterd et al., which had a 5-year follow-up period, showed no statistically significant difference between the two treatments, namely MMS and SSE, in both patients groups with either primary BCC or recurrent BCC.[11]

However, a 10-year randomized clinical trial by Eva van Loo et al., showed a lower cumulative probability of recurrence post MMS in comparison to SSE.[3] Primary BCC cumulative probability recurrence after MMS and SSE were 4.4% and 12.2%, respectively ($p = 0.1$).[3] In recurrent BCC group, cumulative probability of relapse post MMS was lower than that of SSE (3.9% versus 13.5%, $p = 0.023$).[12]

SSE margin is based on risk classifications of BCC. Surgical excision with 4-mm clinical margin for low-risk BCC and over 6mm for high-risk BCC is recommended.[15] SSE sacrifices surrounding healthy-appearing tissue to ensure complete tumor removal. Standard excision margins are recommended based on research and statistics instead of being specific to each individual case. In MMS, the entire margin of the excised tissue got examined microscopically immediately for residual tumor, the resected lesion margin would not exceed 2mm, for each MMS round. Therefore, MMS optimizes the preservation of surrounding normal skin while ensuring complete tumor removal.

Each MMS round excised 1 to 2mm from the lesion margin, which would preserve 2 to 3mm normal-looking skin on each side, or in total, 4 to 6mm healthy tissue in diameter. In case it was necessary to remove the lesion with 2 rounds

of MMS, 1 to 2mm of normal skin could still be preserved. When 3 MMS sessions were required, the excised surrounding skin became larger than in SSE. However, this excision was necessary, as it helped completely remove the tumor with certainty. Furthermore, for high-risk BBC, resection should be at least 6mm from the lesion margin. Thus, for high-risk BCC, even when 3 MMS sessions were needed, the excision margin was not wider than SSE.

According to the study by Salim Gallouj et al., out of 29 BCC cases treated with MMS, 15 cases only needed one excision round, accounting for 51.7%. 2-round MMS was necessary in 10 patients, accounting for 34.5% and 3-round MMS was performed on 4 patients, accounting for 13.8%.[6] This study showed that at least 52% of BCC cases underwent MMS got optimal surrounding normal skin preservation, 35% of cases could spare some of the healthy skin.

Skin preservation ability of MMS may be less important for BCC lesions in sites with little traction or unexposed area, with little need for high esthetics. In areas prone to traction such as the eye, nose, mouth area, sometimes only a few millimeters of skin preservation will also avoid complicated reconstructive methods or removal of important parts, such as eyelid margins, nose wings, etc. In exposed areas, especially the face, skin defects after MMS are smaller to SSE, which will provide ideal condition for reconstructive surgery to cover skin defects after removal of tumor, facilitating the healing process, stabilize scars and create fewer scarring complications, with better aesthetics.

According to the study of Robert Gniadecki et al., the size of the final skin defect was 1.34 times the size of the primary tumor ($p < 0.05$).[5] For comparison, resection with a margin of 4mm from the tumor, which is the accepted value for excision of primary BCC according to the American Academy of Dermatology Guideline, will increase the size of skin defects by 3.0-fold ($p < 0.0001$). MMS reduced skin defect size by 43% (95% CI: 38 - 47%) in primary BCC compared with SSE with a 4mm resection margin.

5. CONCLUSION

MMS was superior to SSE in the treatment of both primary and recurrent BCC. MMS had a lower cumulative probability of recurrence and preserved more surrounding healthy skin than SSE. Therefore, MMS is highly recommended for surgical treatment of BCC, especially high-risk BCC.

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