

Complications and solutions in Mohs micrographic surgery: a retrospective analysis

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RESUMEN

Introducción: la cirugía micrográfica de Mohs es el *gold standard* para el tratamiento del cáncer de piel no melanoma. Ocasionalmente puede presentar complicaciones. Nuestro objetivo fue describir las complicaciones que observamos en nuestra Unidad de Cirugía Dermatológica y comparar nuestros resultados con otros estudios.

Materiales y métodos: se realizó un estudio retrospectivo de todas las cirugías de Mohs realizadas en nuestro servicio entre noviembre 2013 y abril 2016. Los datos clínicos, tumorales y quirúrgicos representan aquellos disponibles en la historia clínica.

Resultados: se realizaron 100 cirugías individuales en 71 pacientes; 48 hombres y 23 mujeres. La edad promedio fue de 69.1 ± 1.7 años. El área del defecto promedio fue de 6.2 ± 0.9 cm². Sólo se observaron 3 complicaciones (3%): necrosis de colgajo, hematoma con abultamiento de colgajo, y hemorragia postoperatoria. Todas se presentaron en pacientes diferentes, todas en fumadores activos y en región de cabeza y cuello.

Discusión: las complicaciones son infrecuentes y suelen corresponder a infecciones del sitio quirúrgico, dehiscencia de suturas, hematoma/hemorragia o necrosis. Si bien el número de pacientes es limitado, nuestros resultados y la revisión de la literatura concuerda en su mayor parte. Destacamos que el tabaquismo activo representa un factor de riesgo para complicaciones.

Conclusiones: la cirugía de Mohs tiene una incidencia baja de complicaciones, y la mayoría de estas son menores. Un conocimiento de sus modos de prevención y tratamiento es necesario para llevar a cabo este procedimiento.

Palabras clave: Cirugía micrográfica de Mohs; Cáncer de piel; Cirugía dermatológica; Complicaciones.

SUMMARY

Introduction: Mohs micrographic surgery is the gold standard for non-melanoma skin cancer treatment. It may occasionally present complications. Our objective was to describe the complications we observed in our Dermatologic Surgery Unit and compare our results with other studies.

Materials and methods: we performed a retrospective analysis of all Mohs surgeries done in our service between November 2013 and April 2016. Clinical, tumoral and surgical data was gathered from the patients' medical history.

Results: 100 individual surgeries in 71 patients were registered; 48 males and 23 females. Mean age was 69.1 ± 1.7 years. Mean defect area was 6.2 ± 0.9 cm². Only 3 complications were seen (3%): flap necrosis, hematoma with flap bulging, and postoperative hemorrhage. All of these occurred in different patients, all of them in active smokers and in the head and neck region.

Discussion: complications are infrequent and are usually surgical site infections, suture dehiscence, bleeding/hematoma or necrosis. Although our number of patients is limited, our results are mostly compatible with the literature. We highlight that active smoking represents a risk factor for complications.

Conclusions: Mohs surgery has a low incidence of complications, and most of these are minor. A knowledge of prevention and treatment modalities is necessary to perform this procedure.

Key words: Mohs micrographic surgery; Skin cancer; Dermatologic surgery; Complications.

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Mohs micrographic surgery (MMS) is a technique for the excision of complex or ill-defined skin cancer, with histologic examination of 100% of the surgical margins, achieving the highest cure rate with the maximum preservation of surrounding healthy tissue.^{1,2} It can usually be performed with local anesthesia, and although complications are rare, every Mohs surgeon must have clear knowledge of their prevention strategies and treatment modalities.³

When evaluating a patient that is going to be treated with MMS, the surgeon has to bear in mind numerous factors, such as the anatomic location, size of the tumor as well as the size of the defect during surgery itself. Patient factors must also be considered, including age, skin qualities, comorbidities, habits (such as smoking) and response to previous interventions (if any).

The objective of this study was to describe the complications our patients had after MMS in our Dermatologic Surgery Unit, and compare these with other studies. Prevention and treatment of these complications are briefly described and reviewed.

MATERIALS AND METHODS

We performed a retrospective cohort descriptive analysis of all the patients that underwent MMS by a single Mohs surgeon in our Dermatologic Surgery Unit since the beginning of this procedure in November 2013 up to April 2016.

Epidemiological and clinical data was obtained (sex, age, comorbidities and smoking habit), tumor characteristics (anatomical location and size), as well as management criteria (defect size, method of closure, timing of reconstruction). Complications were evaluated during surgery, in the immediate post-operative evaluation and in every follow-up consultation by a dermatologist. Physical examination and symptoms described by the patient were considered.

Smoking habit was labeled as: active smoker (any amount six months before and/or after surgery), discon-

tinued smoking (at least six months before surgery) or never smoked.

Photographs of the tumors were taken with a digital reflex camera as well as during surgery and at each follow-up consultation. All of them have ongoing follow-up for a possible recurrence, however, this was not the main focus of our study.

Aesthetic results were scored by a dermatologist using photographs taken during follow-up. He was unrelated to the patient's treatment and was also blinded to the objectives of this study. The score used was: excellent, very good, good, moderate, bad and very bad.

All patients were ambulatory and operated by a single Mohs surgeon with local anesthesia. Informed consent was read, given and signed.

RESULTS

During this timespan we had a total amount of 71 patients and 100 individual surgeries. 48 males and 23 females were studied (Table 1).

If we group all flap subtypes, we see that they comprise 48% of all closure techniques, followed by primary closure (36%), secondary intention (11%) and skin graft (3%).

Complications were observed in 3.0% (3) cases, all of them in different patients (Table 1). All complications presented in the head and neck region (Figure 1 and 2).

DISCUSSION

Most of the information regarding MMS complications come from retrospective, single center studies.^{4,5} Few studies have described complications thoroughly. A large multicenter prospective cohort of 20,821 cases at 23 centers by Murad Alam et al. studied intraoperative and postoperative minor and serious adverse events. These amounted to 0.72% (149 / 20,821), including 4 serious events (0.02%), and no deaths were reported. The most common reported complications were infections (61.1%), dehiscence and partial or full necrosis (20.1%), and bleeding/hematoma (15.4%). Most bleeding and

CAPSULE SUMMARY

Mohs micrographic surgery is a safe procedure, however, it may occasionally present complications.

This work describes our cases, which were similar to those reported in other studies.

Our study intends to help other physicians in the prevention and management of these complications.

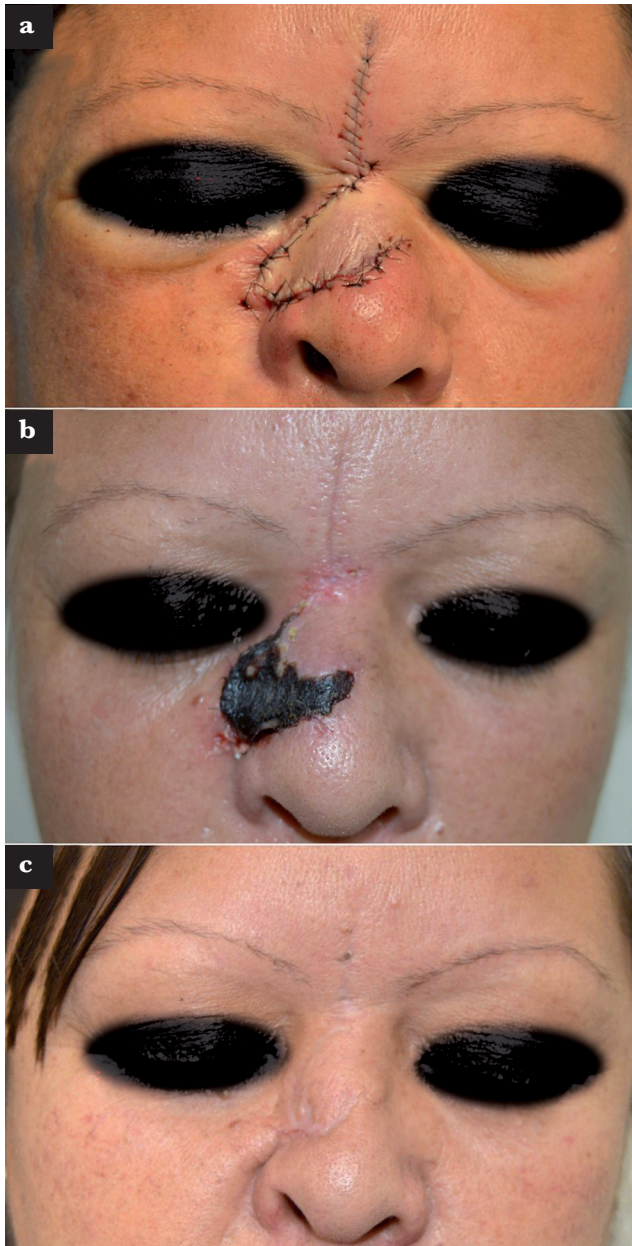


Figure 1: patient 1

- a.** the day of the surgery with notorious eyelid edema and a glabellar flap.
- b.** two weeks after MMS flap necrosis was at its most prominent.
- c.** eight months after MMS she showed a moderate aesthetic result, considering she rejected treatment.

wound-healing complications were seen in patients receiving anticoagulation therapy. Use of antiseptics, antibiotics and sterile gloves during MMS were associated with a modest reduction of adverse events, which probably wouldn't prove statistically significant given the rarity of complications and simple management. We saw no



Figure 2: patient 2

- a.** during surgery with a Tripier flap. A hematoma rapidly developed,
- b.** quite notorious at his 96-hour follow-up.
- c.** flap bulging is evident six weeks after MMS.
- d.** surgical removal of excess tissue under his flap was performed,
- e.** and primary linear closure was achieved.
- f.** three months after his correction surgery, we can see an excellent aesthetic result, with no ectropion.

cases of infection in our patients, which might be explained, in part, by the fact that our MMS were performed entirely using sterile gloves. The most frequent topography for complications in their study was the head and neck region, which is compatible with our findings. Flaps and grafts were more commonly associated with complications, also similar to our results. A common risk factor associated with all adverse events included current and past smoking habit and, therefore, Mohs surgeons should expect wound-healing issues in active and past smokers. Our findings support this statement as well. Although we only had three patients with complications, we highlight the fact all of them were active smokers, which is over the expected frequency.³

Surgical registries are useful tools to monitor patient safety.⁶ Given that only three patients had complications, there is no way of determining statistical significance

Table 1. summarized description of our MMS patients.

Patients	Sex	Age (years)	Comorbidities	Active smoking	Topography	Lesion area (cm ²)	Defect area (cm ²)
Overall results of 100 surgeries	M/F ratio: 2.1/1	Mean: 69.1 ± 1.7 (range: 22 - 89)	Most frequent: hypertension in 47.9% (34) and DM [†] 12.7% (9)	12.7%*	75.0% (75) on head and neck	Mean: 2.3 ± 0.4 (range: 0.1 - 25.5)	Mean: 6.2 ± 0.9 (range: 0.3 - 63.6)
Patient 1	Female	46	(-)	Yes	Right lateral nose	9,46	19,35
Patient 2	Male	54	(-)	Yes	Lower left eyelid	5,66	14,07
Patient 3	Male	87	CAF [‡] with anticoagulation therapy, hypertension, prediabetes	Yes	Left lateral neck	49,48	175,93

Table 1 (continued). summarized description of our MMS patients.

Patients	Reconstruction	Complications	Complication management	Aesthetic result
Overall results of 100 surgeries	(see text)	3 cases (3.0%)	(described below)	80% (56): good, very good or excellent
Patient 1	Glabellar flap	Flap necrosis	Patient rejected further treatment	Moderate
Patient 2	Tripiier flap	Flap hematoma and bulging	Surgical removal of excess tissue and primary linear closure	Excellent
Patient 3	Secondary intention	Postoperative hemorrhage	Prevention: suspension of anticoagulant therapy, LMWH before MMS. Treatment: calcium alginate dressings	Moderate

† = type 2 diabetes mellitus

* = we had no record of smoking habit for 16 patients

‡ = chronic atrial fibrillation

with such a low number. In these situations, it is convenient to describe what was seen case-by-case. Patients that presented complications had lesion and defect areas well over the mean for the total sample. Hussain et al. reported an incidence of 7.78% of minor complications in their MMS, which were of similar characteristics to those seen in our patients.⁷

The main limitation of our study was its retrospective design and the limited number of cases we have so far. The former limits the amount of information to what is registered in the patients' medical history and the photographs taken during follow-up.

MAIN COMPLICATIONS IN MMS AND THEIR PREVENTION/TREATMENT STRATEGIES

• **Hemorrhage and hematoma:** Patients subjected to MMS are commonly on anticoagulant or antiplatelet medication, therefore the Mohs surgeon must balance the bleeding complications against the risk of thromboembolic events. Although the common approach in the past was to stop these medications several days be-

fore surgery, recent data suggest the relatively low risk of bleeding does not justify a possible life threatening thrombotic event. Patients taking warfarin should avoid surgery if international normalized ratio (INR) is over 3.5, meanwhile aspirin should not to be discontinued. In case of doubt, consultation with the prescribing physician is advisable.^{8,9} Appropriate measures to ensure adequate hemostasis should be taken intraoperatively, which includes the use of electrocautery methods, as well as pressure over bleeding sites. Partial evacuation of hematoma (if present) and suture ligation are also suitable options depending on the context.¹⁰ Appropriate postoperative pressure dressings can be used for 24-48 hours to promote continued hemostasis.¹¹ Minor bleeding in patients taking warfarin can be managed with intravenous vitamin K.⁸

• **Infection:** Some studies have found no significant reduction in surgical site infection in MMS with the use of antibiotics prophylaxis or sterile techniques.^{12,13} In cases where signs of infections are present, the antibiotic of choice must be selected based on the local resistance patterns, the patient's risk factors for methicillin-resistant *Staphylococcus aureus* (MRSA) infection, and drug allergies.

Wounds than fluctuate should be incised and drained. Microbial culture of the content is advisable to guide antibiotic choice, but should not delay treatment.¹²

• **Flap bulging and necrosis:** Most flap failures can be traced to errors in flap design. Successful flaps are the ones that find a correct balance between flap liberation and vascular preservation. Excessive tension can result in ischemic necrosis and favor secondary infection. If bulging is present, particularly in the nose, dermabrasion (either manually or with ablative laser) 6 to 8 weeks postoperatively may be particularly helpful. Corrective surgery of the scar has shown favorable results, as seen in patient ^{2,4}

• **Pain:** MMS is usually performed with local anesthesia, however pain after the procedure is common during the first couple of days. In a prospective study by Limthongkul et al., on day 0 of MMS mean pain score was 1.97 +/- 1.46 on a scale of 0-10. On day 1 mean pain score was 1.15 +/- 1.20. The following days pain diminished steadily, and by day 7 only 16% (25/158) had any pain at all. Only 16% (26/158) required prescription of analgesics on day 0. Scalp procedures were associated with greater pain, and most cases are effectively managed with oral acetaminophen.¹⁴

CONCLUSIONS:

The small number of cases doesn't allow for statistical significance to be determined, however, a descriptive analysis of each complication is helpful and lead to interesting conclusions.

Besides the known deleterious effects of smoking in general health, patients that are candidates for MMS should be strictly instructed to discontinue smoking, since preliminary results seem to show that they are in significant risk of presenting more complications than non-smokers.

This is the first center in Uruguay with a Mohs surgeon, and our results are compatible with the frequency and characteristics of MMS complications in other centers and larger studies.^{3,4,7,15} Our work, as well as larger studies, show that MMS has a low incidence of complications, and most of these are minor, predictable, and/or preventable.

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