New techniques

Technical variations in Micrographic Surgery

Variações técnicas em Cirurgia Micrográfica

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ABSTRACT

Introduction: Mohs Micrographic Surgery is a well-known and established method in the United States, and is currently considered the gold standard treatment in many cases involving cutaneous neoplasias. Since it was first described by Dr. Frederic E. Mohs, the micrographic surgery technique has been continuously changed and adapted to better suit the daily life needs of dermatologic surgeons. This article examines different and innovative Mohs Micrographic Surgery techniques.

Keywords: mohs surgery; carcinoma, basal cell; carcinoma, squamous cell.

RESUMO

Introdução: *A cirurgia micrográfica de Mohs é método amplamente difundido e consagrado nos Estados Unidos, sendo hoje considerado tratamento padrão ouro para diversas situações envolvendo neoplasias cutâneas. Desde a sua primeira descrição pelo Dr. Frederic E. Mohs, a cirurgia micrográfica vem passando por constante processo de modificações e adaptações com o objetivo de desenvolver variações técnicas que melhor se adaptem à rotina diária dos cirurgiões dermatológicos. O presente artigo tem o objetivo de demonstrar as diferentes e inovadoras técnicas em cirurgião micrográfico de Mohs.*

Palavras-chave: *cirurgia de Mohs; carcinoma basocelular; carcinoma; carcinoma de células escamosas.*

INTRODUCTION

Mohs Micrographic Surgery (MMS) was originally described by Dr. Frédéric E. Mohs 1 as an *in vivo* tissue fixation technique (using zinc chloride paste), evolving to a freezing technique, after Dr. Theodore Tromovitch and Samuel Stegman's publications in 1974. The MMS technique has evolved over the years, and although some of the basic stages of the procedure remain indispensable (Table 1), there is considerable room for surgeons' personal preferences. Although there are no right or wrong technical variations, knowing and mastering diverse ways of reaching the final objective certainly helps obtain the best results for the physician and the patient. The objective of this paper is to present diverse new techniques, described by a micrographic surgeon, which can be especially useful in the different stages of MMS.

Chart 1: MMS' basic stages

1. Tumor exeresis
2. Mapping of the surgical area
3. Microscopic analysis with total control of the margins
4. Selective exeresis of areas with residual tumor

MMS TECHNIQUES

Pre-operative evaluation

The first step of a dermatologic surgery must be the careful pre-operative evaluation of the patient's general health. The patient's complete medical history must be evaluated, with special attention given to comorbidities and medication use. Deciding on whether anticoagulants and platelet antiaggregants should be discontinued is a controversial subject, since consequences and resulting complications can be severe. The authors suggest that medications are maintained whenever possible and, in cases in which interrupting the use or decreasing the dose of those substances is extremely necessary, the evaluation and orientation of a specialist are required. Monitoring vital signs before and during surgery is also a straightforward way of foreseeing and preventing possible intercurrences and complications (such as anxiety, tachycardia, hyper or hypotension, etc.) that can directly interfere in the surgical results.

Local anaesthesia

The infiltration of local tumescent anesthesia (Figure 1) helps to decrease bleeding.[3] The use of 0.5% lidocaine with epinephrine 1:200,000 allows greater volumes of anesthetics to be used without weakening their analgesic effect. The addition of sodium bicarbonate (8.4% solution, at a 1:10 proportion, e.g., 5 ml for each 50 ml of anesthetic solution) helps to reduce the discomfort during infiltration.

Hemostasis

When using tumescent local anesthesia, bleeding is minimal. Therefore, the use of electrocautery can be avoided i most cases, saving time and minimizing thermal tissular damage. Patient application of manual pressure for five minutes on the dressing bandage between MMS stages, also helps control bleeding.[4]

Debulking

Most MMS surgeons carry out the enucleation (also known as debulking) of the lesions before the tumor exeresis. There are different ways to perform the debulking. One is through curettage, which helps to better delimit the tumorous margins, but can also lead to removing more tissue than absolutely necessary. Another debulking technique is the excision of the visible part of the lesion with the use of a surgical scalpel; the excised portion can be sent for histological analysis, thus facilitating the identification of the tumor and its histological type. Debulking can also be conducted using flexible razor blades, especially in small and superficial tumors. The authors of this study carry out debulking only in cases where the tumors are large and exophytic.

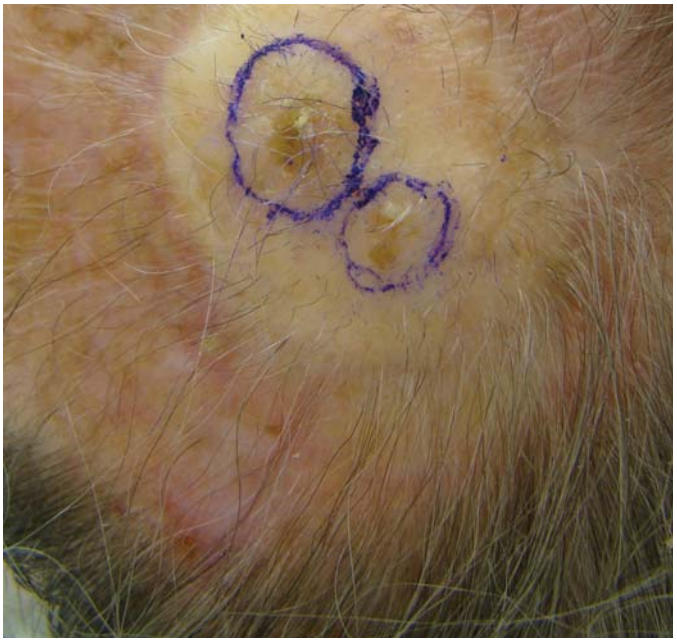

Figure 1 - Local tumescent anesthesia helps control bleeding

SURGICAL TECHNIQUES FOR OBTAINING SPECIMENS FOR MICROGRAPHIC SURGERY

Elliptical Mohs [5]

With the aid of a surgical marking pen, the tumor is delimited in the shape of an ellipse with margins of 1-2 mm comprising the lesion. A vertical incision perpendicular to the skin's surface is made through the epidermis and dermis. Next, the correct dissection plane is found and, with the aid of scissors, the exeresis of the surgical area is completed. The excised ellipse is then placed on non-stick gauze longitudinally bisectioned, allowing the lateral and deep margins to keep full contact with the gauze's surface (Figure 2). In this manner, the specimen is ready for marking, mapping and preparation of the slides. If the presence of additional tumorous tissue is detected in the histological analysis of the margins, an additional excision of 1-2 mm is performed in the positive area, with efforts to maintain the elliptical shape of the surgical defect.

90° technique

When dealing with tumors that are more aggressive, larger, recurrent and poorly delimited, and located in areas where performing primary linear sutures would be difficult, a different approach must be used. An appropriate method is performing excisions with 2 mm margins and a 90° angle to the cutaneous surface. Then, the lateral margins are separated from the tumoral block and placed laterally on non-stick gauze (so that all peripheral margins are visible during the microscopic

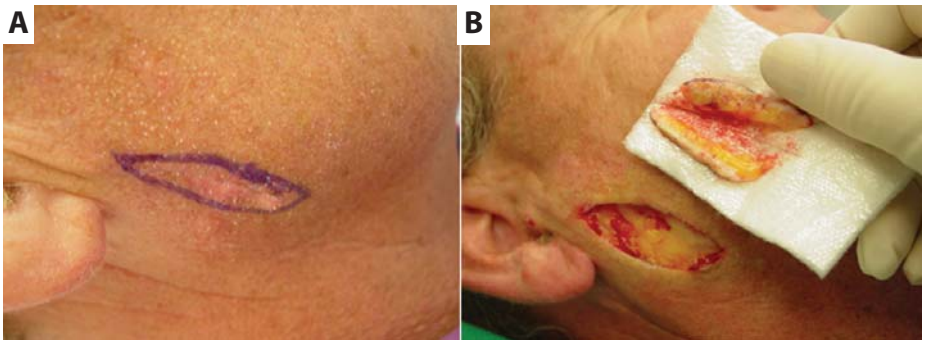

Figure 2 - A: Recurrent basal cell carcinoma scar marked for exeresis using elliptical Mohs technique **B:** Bisectioned surgical area ready for histological evaluation of lateral and deep margins

evaluation). The remainder of the excised surgical area is then used in the analysis of the deep margin (Figure 3). This technique has been described by Breuninger [6]; however, while he used paraffin, we have used the freezing technique for the histological evaluation.

Shaving technique

This new MMS technique has been successfully used to treat superficial lesions.[7] A flexible razor blade is held between two fingers and used to perform the tangential exeresis of the tumor, with 2-3 mm margins (Figure 4). The excision's depth is controlled by the surgeon according to the curvature resulting from the amount of pressure exerted on the blade. Tumescent anaesthesia is mandatory in this technique, for the cutaneous turgor and resulting edema allow the blade to slide through the tissue and excise thin skin layers. While the margins' histological analysis yields positive outcomes, the procedure must be repeated.

Histological evaluation

Although most MMS surgeons use hematoxylin-eosin staining in their procedures, toluidine blue has some particular characteristics that can be useful in the histological evaluation; for instance, it metachromatically stains mucopolysaccharides and hyaluronic acid, dying the stroma around basocellular carcinogenic cells pink/magenta. That helps in the differentiation of basocellular carcinomas from hair follicles, benign follicular tumors and squamous cell carcinomas, and also helps to identify small groups of basaloid carcinogenic cells.[8] Toluidine blue also stains keratin turquoise, facilitating its identification. It is important to highlight that the latter should not be used in melanocytic lesions. In those cases, staining with hematoxylin-eosin and, if possible, Mart-1 based immunohistochemistry must be chosen.

Reconstruction

The reconstruction of MMS' surgical defects must take all aspects of the case into consideration (location, size, patient's age, etc.). Whenever it is possible and aesthetically acceptable, the primary suture must be performed along the skin's minimum tension lines. The use of a surgical hook in one of the lesion's apexes (or even in both extremities of the wound) helps ensure the sutures are symmetrical, because the hook's extension allows the alignment of the incision's margins, preventing the mispositioning of the healing wound and the formation of "dog ears" [9] at the extremities of the incision. In the next step, horizontal subcutaneous sutures are performed using Poliglecaprone 25 threads (Monocryl®, Ethicon Inc., USA) while simple or continuous cutaneous sutures are carried out with nylon threads.

In the repair of defects resulting from excision with flexible blades, excellent aesthetic results can be achieved with healing by secondary intention or thin partial grafts since only superficial tissue was removed and most of the dermis is still present. In cases where the defect reaches more deeply, yet not as far as the dermis, thick partial grafts can be the best option.

Partial thickness skin grafts are also removed from the

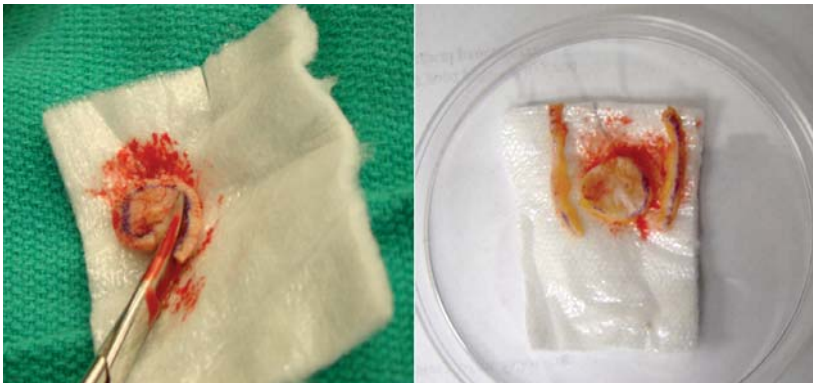

Figure 3 - Separation of the lateral margins from the tumorous block; each of the resulting fragments will be individually evaluated

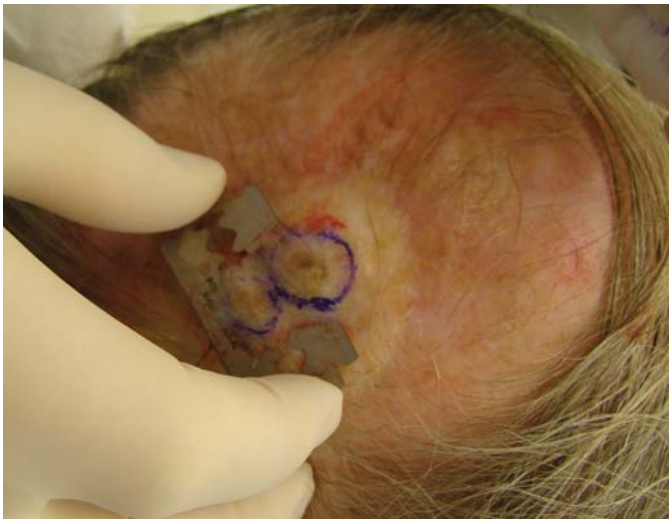

Figure 4 - *Tumor shaving with flexible razor blades*

donor area with flexible blades, applying the same technique used in the exeresis of the tumor. The graft's thickness is determined by the degree of curvature of the flexible blade. The graft is then sutured in the receptor area (Figure 5), with the donor area left to heal by secondary intention. However, if the defect resulting from the tangential exeresis reaches the subcutaneous tissue, it should be handled as a total thickness defect.

Discussion

MMS is the treatment of choice for (non-melanoma) high-risk skin cancers. It is preferred to conventional surgery because it allows the full histological evaluation of margins and the maximum protection of healthy tissue. The daily challenges for MMS surgeons serve as stimuli for the development of technical variations aimed at obtaining the best results for individual patients. Therefore, the techniques described in this article are useful tools for the honing of surgical skills, providing alternatives for different possible scenarios.

Figure 5 - Partial thickness grafts for wounds resulting from excision with flexible blades

In traditional MMS, incisions in the skin must be at an angle of 30 to 45° to allow full contact of the lateral and deep margins with the cryostat and total visualization. Vertical incisions (at a 90° angle), used in some of the techniques described in this paper, increase tissular preservation since the lateral margin becomes narrower even in cases with significant dermal invasion. By contrast, inclined incisions (30 to 45°) require larger lateral margins – especially for invasive tumors – otherwise the incision will run into the tumoral mass [5] (Figure 6). Most importantly, when using vertical incisions it is necessary to ensure that the epidermal, dermal and subcutaneous margins are being visualized in the microscope. That can be achieved by bisecting the elliptical surgical areas removed (or by separating the lateral from the deep margins in larger tumors, as already mentioned). In addition, the correct mapping of the specimen is crucial for the total control of the margins.

The elliptical excision of tumors with full histological evaluation of the margins is an appropriate choice for relatively small (< 15 mm), well-delimited and non-sclerodermiform tumors. The surgical wound can be closed with a simple linear suture, thus facilitating and accelerating the reconstruction process. This method is also useful in cases of incompletely excised tumors, for the remaining healed surgical wound resulting from the previous surgery can be excised in an elliptical shape.

Micrographic surgery excisions with flexible razor blades constitute an efficient way to treat small and superficial cutaneous neoplasias (Figure 7). The inclined margins formed by tangential exeresis allow the correct evaluation of the lateral and deep margins (in a process similar to that used in the conventional Mohs technique). Nevertheless, in larger lesions it is sometimes necessary to perform relief incisions (hatch marks) in the center of the surgical area or even to divide the specimen into smaller areas. Performing histological cuts of those thin and delicate specimens is a challenging process that requires skill and technical precision.

CONCLUSIONS

Several possible surgical technique variations regarding conventional MMS were described. The knowledge of such techniques can help dermatologic surgeons – in diverse clinical situations – to refine the practicality and efficacy of their surgeries. ●

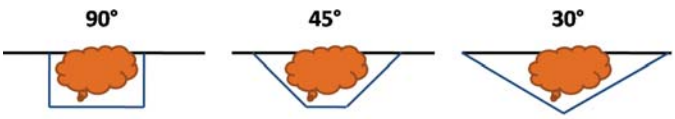

Figure 6 - Required lateral margins according to the angle of incision used

Figure 7 - Examples of cutaneous neoplasias excised through shaving

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