Mohs Micrographic Surgery Comes to Dermatology Practice in India: Lessons Learnt Over 2 Years

Mohs micrographic surgery (MMS) is a specialized form of skin cancer surgery which has the potential to offer highest cure rates and negligible recurrence rates for a plethora of cutaneous tumors owing to complete histopathologic analysis of resected peripheral and deep margins offered by the procedure.[1] MMS also allows the operating surgeon to be the pathologist, which allows precise examination of the resected specimen by surgeon and reconstruction of defect on the same day. Currently, MMS has become the gold standard for treatment of non-melanoma skin cancers (NMSCs), with 5-year recurrence rates as low as 1% for basal cell carcinoma (BCC) and 3%–5% for squamous cell carcinoma (SCC).[2,3] There is also growing popularity of MMS for melanoma *in situ*, invasive melanoma, and less-common cutaneous neoplasms.[1]

Despite its inception and widespread practice since the 1990s in various parts of the world, the introduction of this technique and practice in India has been significantly delayed and sparse. Although many dermatologists perform standard excision for skin cancers in India, MMS is seldom offered. Our center has been performing MMS for skin cancers, especially BCC and well-differentiated SCC, for the past 2 years. MMS offers several advantages over standard excision, such as detection of microscopic extension of tumor, precise examination of peripheral and deep margins, and better preservation of uninvolved tissue. With increasing life expectancy and rise in patient population with immunosuppression and organ transplants, the incidence of skin cancers, especially NMSC, has been increasing in India, with BCC accounting for about 70% of all skin cancers. This underlines the scope of expert workforce in dermatology to cater to this patient load in India.

Knowledge regarding the local anatomy, technique of MMS, and reconstruction including grafts and flaps is also a prerequisite for performing MMS. As highlighted in a review article,[4] there is an unmet need for procedural dermatology and trained dermatosurgeons in India, which would also be a limiting factor for implementation of MMS. Certified training and mentorship programs are provided by the American College of Mohs Surgery, American Society of Dermatologic Surgery, Brazilian Society of Dermatology, and European Society for Mohs Surgery, which could be utilized to obtain formal training and expertise in MMS.[1] To begin with, small tumors like BCCs less than 2 cm, which do not involve free margins like the eyelids, nose, or lips, could be treated with MMS. Good rapport needs to be established with colleagues from plastic surgery, anesthesiology, ENT, and oculoplasty before operating larger tumors or tumors over high-risk areas. The use of MMS for treatment of locally aggressive tumors like SCCs entailing more complex reconstruction procedures would require multidisciplinary care from the departments mentioned above.

A significant deterrent in widespread practice of MMS is the availability of cryostat and trained histopathology technicians for processing samples in resource-limited settings like India. Although it is recommended that tissue processing should be performed preferably in the operation theater where MMS is undertaken, this is always not essential. In our practice, we have been working in liaison with pathology department, which is located in close vicinity to our operating room, thereby providing prompt processing and reporting of the samples. This could potentially be implemented in other institutes of the country, as infrastructure required is available in most pathology departments where staff can be trained in appropriate sample processing. The reporting of samples could be initially performed with the support from pathologists, who are trained in reporting skin cancers.

Although cost can be a limiting factor, especially in resource-limited settings, the benefits in terms of reduced recurrence rates, patient survival, and improved cosmetic outcomes would justify the economic considerations in health-care policy.

There are certain differences in behavior of skin cancers in skin of color, leading to subtle modifications in the technique of MMS in darker Fitzpatrick skin types. By virtue of BCCs being pigmented and nodular in morphology in skin of color, the peripheral extent of tumor could be well delineated by pigment, which could be appreciated both clinically and dermoscopically. The tissue preserving advantage offered by MMS could, therefore, be completely utilized by taking an initial excision margin of 1–2 mm, which contrasts with 3–4 mm recommended for the first stage of MMS by certain groups.[5,6] This principle would, however, not be applicable for high-risk histologic types, especially morpheaform BCC, where microscopic extension is more common and which requires multiple stages of MMS to ensure margin-free status. In the authors' experience of treating over 25 patients with MMS in the first 2 years, majority of the patients with pigmented nodular BCC would require one or two stages, whereas micronodular, morpheaform, or nonpigmented BCC may require higher number of stages, even a maximum of five. A case of nodular BCC treated with two stages of MMS and

free flap repair has been demonstrated as an example [Figure 1]. The margins were involved from 12'O clock to 3'O clock position in stage 1, followed by clearance of margins in stage 2 [Figure 2]. The area healed with minimal scarring, and there has been no recurrence for 2 years thus far. Another case of nodular BCC over the left infraorbital region required just one stage of MMS, and the defect was reconstructed using advancement flap [Figure 3]. In contrast, a case of morpheaform BCC required three stages of MMS to attain clear margins, and the defect was subsequently reconstructed using free flap from the inner arm [Figure 4]. Recurrent BCC is also an important indication for performing MMS [Figure 5].

The traditional indications of MMS for BCC need not be strictly adhered to in patients with pigmented BCC, especially in low-risk phenotypes. Well-defined pigmented BCC over the H-area of the face or >2 cm size could still be treated with standard excision using 3–4 mm margins, as the pigment seen clinically and dermoscopically aids in accurate delineation of tumor margins.[7] This is unlike the Western guidelines that recommend use of MMS for such situations.[8]

Preoperative and perioperative dermoscopy has been utilized to precisely map the margins for standard excision of BCC.[9] However, this technique has fallacies as pointed out by the authors in a previous report.[10] Combining dermoscopy to mark the tumor margin preoperatively in cases of morpheaform BCC where the margins are ill-defined could potentially reduce the number of MMS stages required to achieve clear margins.

The lighter Fitzpatrick skin types are also more prone for field cancerization and have higher rates of *in situ* lesions like actinic keratosis in the vicinity of the tumor, which could potentially interfere with accurate reading of margins and reconstruction process. This problem is fortunately less encountered in skin of color, where other than features of solar elastosis, the risk of *in situ* lesions is lesser.

At our center, all cases posted for MMS are administered amoxycillin clavulanic acid 1 g about an hour before the surgery. Dressing is done in three layers comprising antibiotic ointment, nonadherent gauze material, and gauze pad with cotton, followed by adhesive tape to maintain pressure. Postoperative care includes change of dressing after 48 h to assess the wound site, followed by regular dressing until suture removal. Routine postoperative antibiotics are not prescribed. The complications of MMS are similar to those encountered during standard excision, including intra- and postoperative bleeding, hematoma formation, secondary infection, wound necrosis, and dehiscence.

Despite the advantages mentioned, challenges remain in the widespread adoption of MMS in India, including limited access to specialized centers offering Mohs surgery, cost considerations for patients, and the need for continued training and education among health-care professionals.

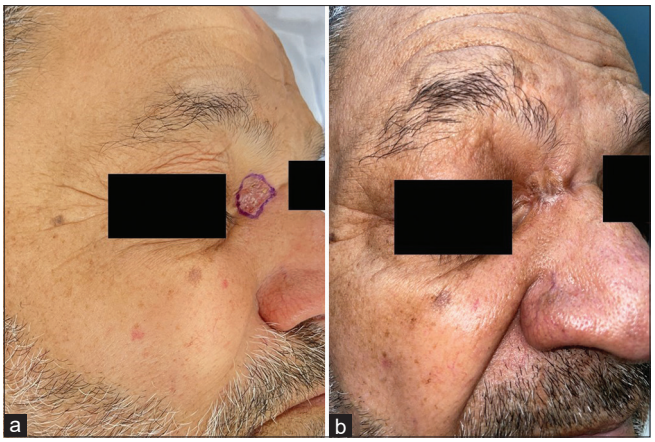

Figure 1: (a) Preoperative image showing nodular BCC measuring 1.3 × 1.3 cm present over medial to the medial canthal area treated with MMS (two stages) and free flap repair. (b) Follow-up image showing complete healing with minimal scarring at 3 months. BCC = basal cell carcinoma, MMS = Mohs micrographic surgery

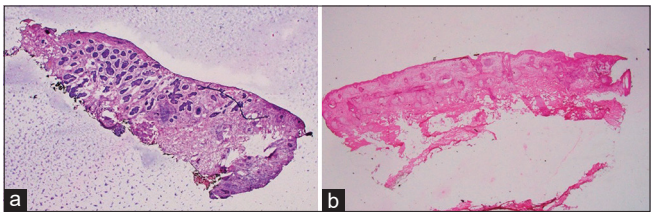

Figure 2: (a) Frozen section of stage 1 MMS done for nodular basal cell carcinoma. Section from 12'O clock to 3'O position shows multiple nests of basaloid cells indicative of margin positivity (hematoxylin and eosin, 100× magnification). (b) Frozen section of stage 2 MMS of the same case. Section from 12'O clock to 3'O position free of any tumor islands or stromal changes indicative of a clear margin (H & E, 100x). MMS = Mohs micrographic surgery

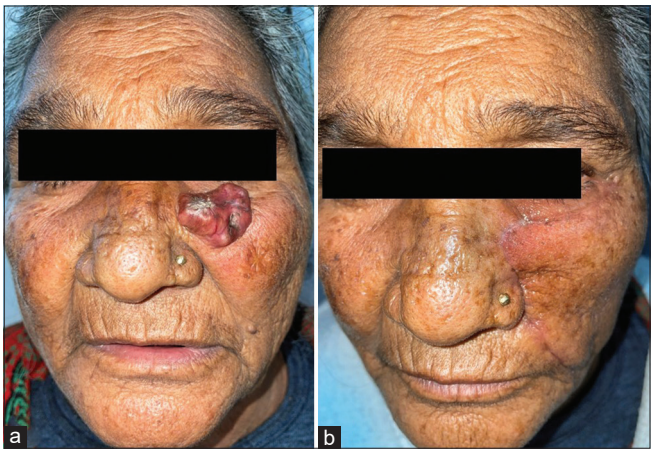

Figure 3: (a) Preoperative image showing nodular BCC measuring 3 × 2.7 cm present over the left infraorbital region treated with MMS (one stage) and the defect reconstructed using advancement flap. (b) Follow-up image showing complete healing with a thin, linear scar along the nasolabial and infraorbital skin folds at 3 months. BCC = basal cell carcinoma, MMS = Mohs micrographic surgery

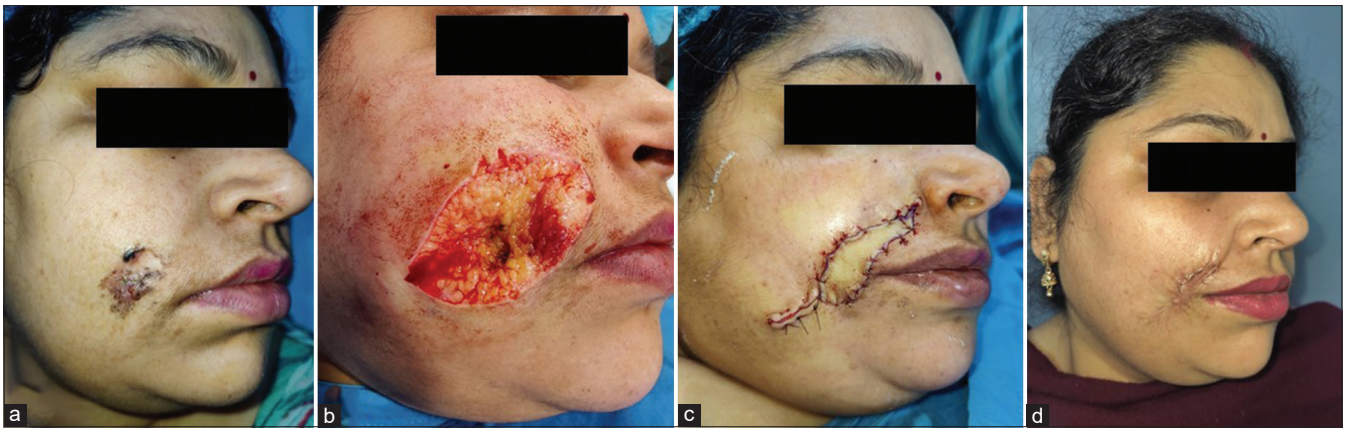

Figure 4: (a) Preoperative image showing ill-defined morpheaform BCC measuring 2.6 × 2.1 cm over the right cheek treated with MMS (three stages). (b) Intraoperative image showing the defect with clear margins after three stages of MMS. Note the scoring marks placed at 12'O clock, 3'O clock, 6'O clock, and 9'O clock positions to correlate with histopathologic margin status. (c) The defect reconstructed using a free flap from the right inner arm. (d) Follow-up image showing complete healing with minimal scarring along the nasolabial fold at 3 months. BCC = basal cell carcinoma, MMS = Mohs micrographic surgery

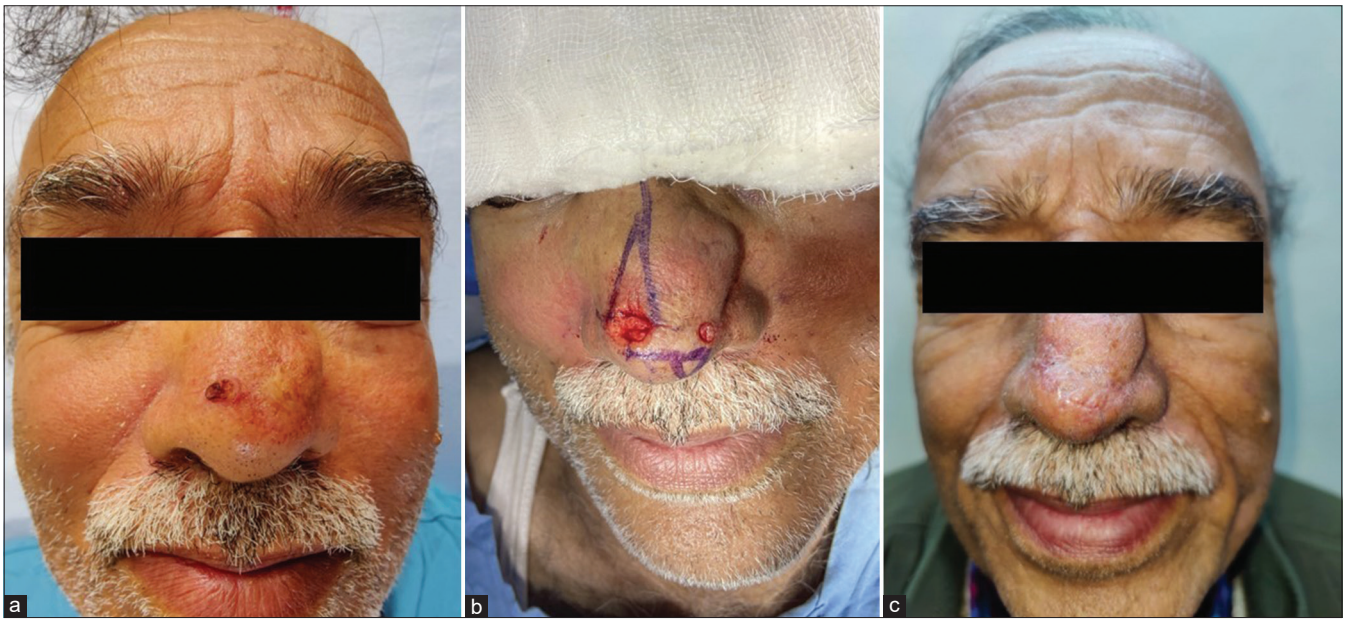

Figure 5: (a) Preoperative image showing recurrent BCC measuring 0.7 × 0.6 cm present over the dorsum of the nose treated with MMS (one stage). Note that the bulk over the left side of the dorsum of the nose is a result of previous surgery and repair done from a different institute. (b) Intraoperative image showing the defect with clear margins after one stage of MMS. The defect was closed using East–West advancement flap. (c) Follow-up image showing complete healing with a thin, linear scar at 3 months. BCC = basal cell carcinoma, MMS = Mohs micrographic surgery

In summary, while MMS is gaining attraction in India as an effective treatment option for certain types of skin cancer, its widespread adoption depends on addressing infrastructure challenges, improving accessibility, and continuing education and training for health-care professionals including dermatologists. As the health-care landscape evolves and awareness increases, Mohs surgery is likely to become more widely available and accepted as a standard of care for appropriate cases of skin cancer in India.

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