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ORIGINAL RESEARCH

Geometric-Marking Quantification for First-Stage Excision of Large Congenital Melanocytic Nevi

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Background: Staged excision is often needed for large CMN. Accurately determining the first-stage excision volume is critical.

Objective: To introduce and evaluate a geometric-marking quantification method for precise preoperative planning of the first-stage excision volume in staged CMN removal.

Methods: A prospective study was conducted on 21 patients undergoing staged excision of large CMN between January and June 2023. Preoperatively, a novel geometric-marking quantification technique was employed to calculate the maximum feasible first-stage excision volume. Surgical execution, intraoperative conditions, and postoperative recovery were observed. Relevant surgical techniques and postoperative care were examined.

Results: All first-stage excisions resulted in successful tension-free primary closure. No instances of insufficient excision, suture dehiscence, or other immediate complications occurred. Postoperative recovery was favorable across all patients. All patients proceeded to successful second-stage excision for complete nevus removal.

Conclusion: The geometric-marking quantification method provides a reliable, reproducible, and objective approach for planning the first-stage excision in large CMN. It achieved 100% technical success in this cohort, eliminating complications related to inaccurate volume estimation. This standardized protocol warrants clinical adoption to replace subjective estimation methods, significantly enhancing surgical outcomes and reducing complication risks.

Keywords: congenital melanocytic nevi, staged excision, geometric marking, precise measurement, surgical planning

Introduction

Pigmented Nevus (Melanocytic Nevus) are common conditions in reconstructive surgery that can occur on any part of the body. When located on exposed areas such as the face, they can detract from aesthetic appearance, impacting the psychological well-being and quality of life of patients.[1] Additionally, pigmented nevi carry a certain risk of malignancy. While smaller nevi (less than 3 mm) can be treated with non-surgical methods such as laser therapy, cryotherapy, or chemical peeling, large congenital melanocytic nevi typically require surgical excision.[2] Common surgical approaches include direct excision, staged excision,[3] and subsequent skin grafting or flap reconstruction.

In managing large congenital melanocytic nevi (CMN), along with staged excision, reconstructive techniques such as tissue expansion and free flap reconstruction can be utilized. Tissue expansion involves placing a saline-filled expander beneath the skin to provide additional tissue for covering the defect, while free flaps transfer tissue along with its blood supply from another body area, ideal for large defects. Although both methods require advanced skills, and the trauma is greater, the postoperative appearance is not aesthetically pleasing.

For slightly large congenital melanocytic nevi, single excision may result in significant tension during suturing, leading to more noticeable scarring or potential deformation or displacement of adjacent tissues and organs. In such cases, staged excision can be utilized. This classic technique in reconstructive surgery involves several small excisions

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that gradually reduce the size of the nevus, ultimately resulting in only linear scarring. The surgical procedure is relatively straightforward, easy to master, and minimally invasive. Proper selection of surgical indications can yield excellent repair outcomes.[4]

The design of incisions for the excision of large congenital melanocytic nevi should adhere to the principles of reconstructive surgery incision design. The direction of the incision should follow the skin's natural lines, such as skin creases, contours, or along the long axis of the pigmented nevus.[5] Generally, elliptical incisions can be designed for round or oval-shaped nevi, while irregularly shaped nevi may be excised using "Y" or "W" shaped incisions or other irregular patterns.

Typically, the amount of tissue to be excised is estimated based on the degree of skin laxity, using techniques such as pinch or grasp methods. The principles include avoiding the formation of "dog ears", preventing significant deformation of surrounding structures, and maximizing the excision of the pigmented nevus. With the exception of the final operation, all incisions should remain within the margins of the pigmented nevus to avoid unnecessary removal of normal skin, which could lead to longer incisions.[6]

Currently, in the staged excision surgery of large congenital melanocytic nevi, the pinch method is commonly used to estimate the amount of tissue to be excised. Specifically, it estimates the tissue that can be excised in each surgical procedure by pinching the skin based on the degree of skin laxity. However, this method has significant limitations. On one hand, the pinch method highly depends on the doctor's experience. Doctors with different levels of experience, and even the same doctor during different operations, may obtain considerably different estimation results. On the other hand, it has a large margin of error and is difficult to accurately control the excision volume. Relevant studies have shown that in a retrospective analysis of 50 cases of staged excision surgery for pigmented nevi,[7] approximately 30% of the patients who had their excision volume estimated by the pinch method experienced insufficient excision. This not only increased the difficulty of the second - stage surgery and the patient's pain but also prolonged the treatment cycle. In addition, about 15% of the patients had excessive excision, resulting in excessive tension during wound suturing. This not only increased the risks of wound dehiscence and infection but also led to significant widening and hyperplasia of postoperative scars, severely affecting aesthetics and functional recovery.[8] These adverse consequences caused by errors fully illustrate the inadequacies of the traditional pinch method in the staged excision surgery of large congenital melanocytic nevi. There is an urgent need for a more accurate measurement method to guide the surgery, so as to improve the surgical effect and reduce the occurrence of complications.

Therefore, we propose a method that allows for precise preoperative measurement of excision volume during the initial excision in cases of staged excisions. This method is based on the classic geometric principles of elliptical excision. By marking the intersection points of the long and short axes, combined with the quantification of skin mobility, the tissue excision volume is transformed into measurable geometric parameters. This design ultimately reduces empirical dependence through mathematical quantification, which has demonstrated good clinical outcomes.

Patients and Methods

Patients

During the period from January 2023 to June 2023, patients undergoing excision of skin large congenital melanocytic nevi at the Department of Plastic Surgery were evaluated. Based on inclusion and exclusion criteria, a total of 21 patients with staged excision of skin pigmented nevi were included (Table 1). The methodology and treatment process of this study were approved by the Ethics Committee. Written informed consent was obtained from all individual participants included in the study. All procedures performed were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments.

Inclusion criteria: (1) Large skin pigmented nevi requiring staged excision; (2) No prior treatments such as laser therapy, cryotherapy, electrosurgery, surgery, or other invasive procedures; (3) Age between 16 and 50 years.

Exclusion criteria: (1) Presence of special diseases such as hematological disorders, coagulopathy, or diabetes; (2) Allergic reactions, inflammation, or infections in the surgical area within three months prior; (3) Active or passive smoking within three months before and after surgery; (4) Female patients during menstruation.

Table 1 General Situation Statistics of Patients

General Situation	Numbers (n)
Gender	
Male	11
Female	10
Age	
16~30 years old	14
31~50 years old	7
Location	
Face and neck	5
Four limbs	13
Body	3
Size (short axis diameter)	
<3cm	2
3~5cm	16
>5cm	3

Surgical Procedure

1) Preoperative Measurement Protocol (Figure 1)

1. Mark the longitudinal midline of the pigmented nevus, intersecting the edges of the nevus at points J and K. At the widest part of the short axis of the nevus, draw a perpendicular line to the longitudinal midline, intersecting the edges of the nevus at points M and N.

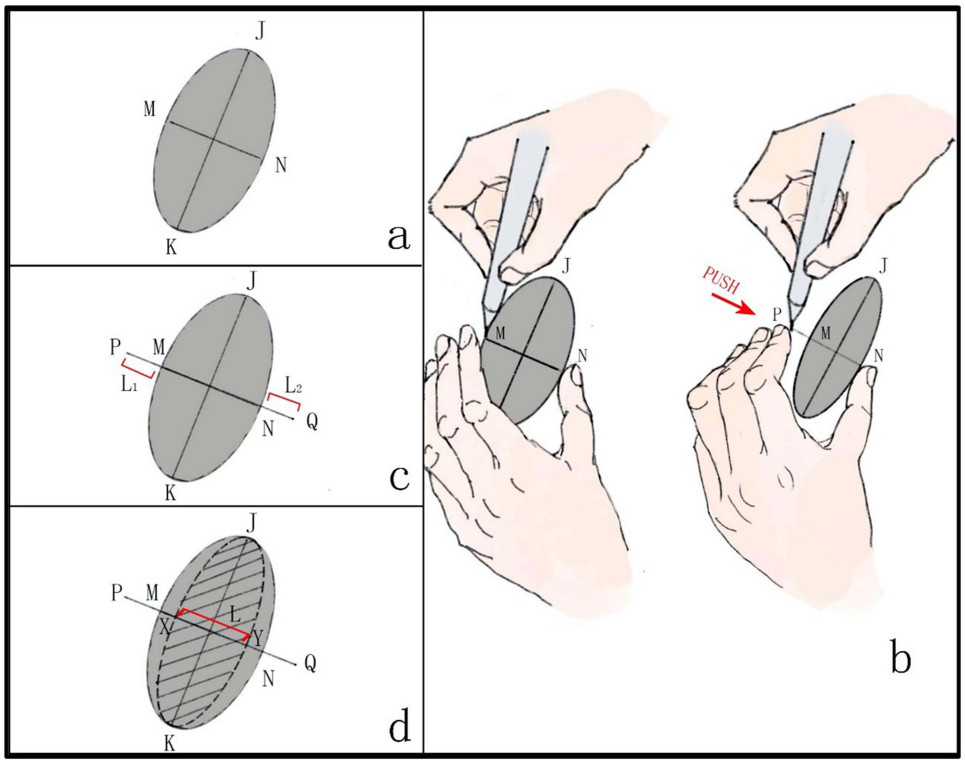

Figure 1 Preoperative Measurement Protocol. (**a**) Mark the long axis JK and short axis MN of the pigmented nevus. (**b**) Record the skin mobility on both sides of the pigmented nevus using a special pinching technique. (**c**) L1 + L2 = L indicates the maximum excisable width of the skin. (**d**) Use the long axis of the pigmented nevus as the perpendicular line, marking length Long MN to intersect PQ at XY, and connect JX and KY to define the initial excision area of the pigmented nevus.

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2. Hold the marking pen at point M with the right hand, while using the left thumb to press point N. The remaining four fingers of the left hand will pinch against the thumb. Draw a line from M to P along the direction NM, and similarly from N to Q along the direction MN.
3. Measure the lengths MP and NQ, denoted as L1 and L2, respectively. Calculate L as L1 + L2, which represents the maximum amount of skin excised along the short axis during the first resection of the pigmented nevus.
4. Using the longitudinal midline of the nevus as the midpoint, measure a distance of L along MN, marking the endpoints as X and Y. At this point, XY will represent the short axis, and JK the long axis, forming an ellipse that indicates the maximum excision for the first resection of the pigmented nevus.

2) Disinfect the marked area and a surrounding margin of 15 cm with iodine complex solution. Place a sterile drape and perform local infiltration anesthesia using an appropriate amount of 2% lidocaine solution combined with epinephrine injection. Proceed with the first excision of the pigmented nevus followed by tension-relieving sutures. Postoperatively, apply a small amount of erythromycin gel and cover with a sterile dressing, followed by applying pressure bandaging.

Postoperative Management

Postoperatively, the wound is subjected to routine disinfection and dressing changes every day. The timing for suture removal varies based on the specific site of the excision. Each patient is scheduled for follow-up visits at one month and three months post-surgery.

Results

All cases in this group achieved primary wound healing. During the follow-up period of 1 to 3 months, the incision was noticeably raised within the first month postoperatively. By the three-month mark, the skin in the incision area had healed well, with most of the elevation subsiding. There were linear scars observed locally, but no significant depression or hypertrophic scarring was noted. All patients opted for a second complete excision of the remaining pigmented nevus.

Typical Case

A 17-year-old female patient with a pigmented mole on the left upper limb, measuring 11cm in length and 5cm in width. The resection area was accurately measured and marked before surgery, and the first surgical resection was performed. The wound was immediately closed after surgery, and the incision tension was moderate (Figure 2).

A 32-year-old female patient presented with a giant facial pigmented nevus that showed poor response after multiple laser treatments, and she requested surgical excision. The nevus was measured to have a long diameter of 10 cm and a short diameter of 4.5 cm. The first surgery was performed based on preoperative precise measurements. Three months later, after the second excision and suture, the wound was immediately closed, and the pigmented nevus was completely resected (Figure 3).

Discussion

Staged excision is a traditional reconstructive surgery technique aimed at gradually removing large congenital melanocytic nevi while expanding and distending the surrounding tissue. This method involves multiple surgical procedures to incrementally excise portions of the nevus, ultimately achieving complete removal. By employing this technique, the characteristics of the surrounding normal skin can be utilized to close the wound, resulting in postoperative skin color and texture that closely resembles or minimally differs from the adjacent areas.[3]

In terms of surgical design, careful planning of the incision and the use of cosmetic suturing techniques can leave only subtle linear scars.[9] Furthermore, postoperative scar treatment can further reduce the prominence of scars, leading to favorable cosmetic outcomes.[10] Compared to single-stage excision, staged excision allows for the removal of larger areas of pigmented nevi and effectively avoids the “dog-ear” deformity or distortion of adjacent structures that can result from excessive excision in a single procedure.[4]

Figure 2 Typical Case 1. (**a**) A 17-year-old female patient presented with a pigmented nevus on the left upper limb, measuring 11 cm in length and 5 cm in width. (**b**) The marked excision area based on preoperative precise measurements, followed by the first surgical excision. (**c**) The patient's incision immediately after suturing, demonstrating proper wound closure with moderate tension at the incision site.

Compared to methods such as skin grafting, flap transfer, and tissue expansion, staged excision offers several advantages. It does not require specialized instruments or materials, making the procedure straightforward and easy to learn. Additionally, it leaves no scars in the donor area and involves minimal trauma. There are no strict age restrictions for patients undergoing this surgery, and the hospitalization duration is short, often allowing the procedure to be performed on an outpatient basis. Furthermore, it is relatively cost-effective, results in less time away from work, and is generally more acceptable to patients as a treatment option.[11]

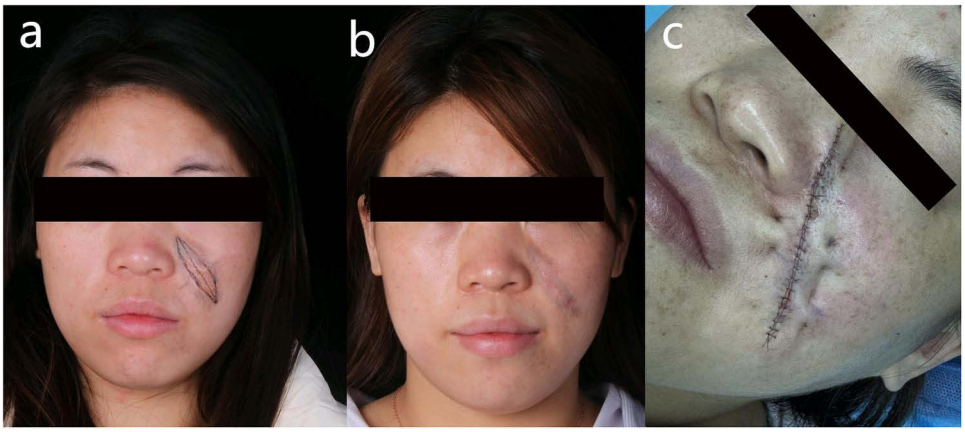

Figure 3 Typical Case 2. A 32-year-old female patient. (**a**) After laser treatment for facial pigmented nevus, the long diameter is 10 cm and the short diameter is 4.5 cm. (**b**) The excision range marked according to preoperative precise measurement and the condition 3 months after the first surgical excision. (**c**) Immediately after the second excision and suture 3 months later, the wound is closed and the pigmented nevus is completely excised.

Staged excision is particularly suitable for large congenital melanocytic nevi that cannot be completely removed in a single procedure, as well as those located in specialized areas such as the eyelids, perioral region, and nasal tip. However, for pigmented nevi suspected of having malignant potential—such as those that rapidly enlarge within a short period, exhibit irregular pigmentation, present with ulceration or erosion on the surface, and are associated with satellite lesions and localized itching—a strategy of complete excision in one stage should be adopted. In such cases, consideration should also be given to using skin grafting or flap transfer methods for wound reconstruction.[12]

In staged excision, each surgical procedure should adhere to the principles of cosmetic surgery, with careful attention paid to preventing hypertrophic scarring and widening throughout the treatment process, as each operation can affect the final aesthetic outcome.[7] Incision design should follow the lines of skin tension, with the final scar concealed along contour lines and natural folds. However, if the long axis of the pigmented nevus does not align with the skin tension lines, incisions may be made parallel to the long axis of the nevus to avoid insufficient excision, with "Z" plasty performed when necessary.[5]

The amount of tissue excised during each procedure should be maximized; typically, the surgeon estimates the excisable volume using a combination of forceps or finger pinch to gauge the tissue without causing significant deformation of the surrounding structures. This estimation method is not precise; therefore, we propose a more accurate approach for measuring the excised volume during the first procedure, which allows for maximal tissue removal while ensuring that the wound can be sutured properly.[11]

Finally, during the closure of each surgical site, layered tension-reducing sutures should be used. For wounds on the face, limbs, and trunk, the incision should be slightly elevated during suturing, and after skin closure, adhesive tapes should be applied externally to reduce skin tension.

During the excision of pigmented nevi, the formation of the "dog ear" phenomenon is commonly observed.[13] To avoid this issue, the incision design should prevent excessive angles at both ends, and the skin at the ends of the incision should be appropriately mobilized during suturing to allow for necessary adjustments. For mild "dog ear" complete removal is usually unnecessary, as tissue redistribution occurs during the healing process, and in most cases, they will flatten out over time. However, if "dog ear" present sharp angles during suturing, it is often difficult for them to naturally flatten, necessitating correction.

Post-suture, it is essential to continue using adhesive tapes to reduce skin tension and apply anti-scarring medications to prevent scar widening or hypertrophy.[14] Regular postoperative follow-ups should be scheduled; if there are signs of scar hypertrophy, timely interventions such as intralesional injections, localized compression, or laser treatments should be implemented.

Patients or their families should be advised to gently pinch and pull the surrounding skin perpendicular to the incision daily. This practice aims to create an effect similar to external expansion, thereby "increasing" the skin around the

pigmented nevus, which helps relax the soft tissue and facilitates the excision of more pigmented nevi during subsequent surgeries. It is recommended to space the two procedures at least 3 months apart, as a longer interval allows for better skin relaxation and scar softening, enabling the removal of more pigmented nevi while reducing the number of surgeries needed, ultimately improving the final outcome.

Conclusion

In summary, staged excision is suitable for large congenital melanocytic nevi that cannot be completely removed in one session, particularly in special locations such as the upper eyelid, lower eyelid, perioral area, and nasal tip. By employing precise measurement methods during the initial excision, it is possible to avoid excessive or insufficient removal, thereby reducing complications related to skin grafting and flap transfers. This geometric-marking quantification provides a reliable, reproducible approach for first-stage excision of large congenital melanocytic nevi, demonstrating 100% technical success in our cohort. Its standardized protocol warrants clinical adoption to replace subjective estimation methods, significantly reducing complication risks.

Data Sharing Statement

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Ethics Approval and Consent to Participate

Ethics approval was obtained from the ethics committee of University of South China and informed consent was obtained from all participants.

Consent for Publication

Written informed consent was obtained from all participants for the publication of their personal/clinical details and any identifying images, with anonymization applied where necessary.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Disclosure

The authors declare that they have no competing interests in this work.

References

1. Yeh I. Melanocytic naevi, melanocytomas and emerging concepts. *Pathology*. 2023;55(2):178–186. doi:10.1016/j.pathol.2022.12.341
2. Zhang J, Tan K, Tang Y, et al. SF method for removing small skin melanocytic nevus. *Front Surg*. 2024;11:1451660. doi:10.3389/fsurg.2024.1451660
3. Namgoong S, Lee KI, Han SK, et al. Staged Excision Technique to Reduce Scar Length. *J Plast Reconstr Aesthet Surg*. 2022;75(8):2775–2783. doi:10.1016/j.bjps.2022.02.043
4. Beveridge J, Taher M, Zhu J, et al. Staged margin-controlled excision (SMEX) for lentigo maligna melanoma in situ. *J Surg Oncol*. 2018;118(1):144–149. doi:10.1002/jso.25109
5. Son D, Harijan A. Overview of surgical scar prevention and management. *J Korean Med Sci*. 2014;29(6):751–757. doi:10.3346/jkms.2014.29.6.751
6. Bosbous MW, Dzwierzynski WW, Neuburg M. Staged excision of lentigo maligna and lentigo maligna melanoma: a 10-year experience. *Plast Reconstr Surg*. 2009;124(6):1947–1955. doi:10.1097/PRS.0b013e3181bcf002

7. Lin A, Lu S. Plastic Surgery Roles in Wound Centers in the Northeastern United States. *Ann Plast Surg*. 2023;90(Suppl 5):S674–S676. doi:10.1097/SAP.0000000000003497
8. Yang S, Shu C, Hu H, et al. Dermoscopic Image Classification of Pigmented Nevus under Deep Learning and the Correlation with Pathological Features. *Comput Math Methods Med*. 2022;2022:9726181. doi:10.1155/2022/9726181
9. Zhang J, Han P, Yuan H, et al. Clinical application of absorbable collagen thread and cosmetic suture technique in emergency treatment of children's facial trauma. *J Paediatr Child Health*. 2022;58(11):2039–2043. doi:10.1111/jpc.16147
10. Zhang J, He Z, Tang Y, et al. CO(2) fractional laser combined with triamcinolone acetonide injection for the hypertrophic scars: which is first? *Lasers Med Sci*. 2022;38(1):7. doi:10.1007/s10103-022-03693-y
11. Sun J, Du F, Huang J, et al. Staged excision of a cheek congenital melanocytic nevus: a case report and literature review. *J Cosmet Dermatol*. 2022;21(10):4605–4608. doi:10.1111/jocd.14829
12. Escandon-Perez S, Landeta-Sa AP, Gonzalez-Jasso Y, et al. Giant congenital melanocytic nevi. *Bol Med Hosp Infant Mex*. 2019;76(6):251–258. doi:10.24875/BMHIM.18000103
13. Jaibaji M, Morton JD, Green AR. Dog ear: an overview of causes and treatment. *Ann R Coll Surg Engl*. 2001;83(2):136–138.
14. DeBruler DM, Blackstone BN, McFarland KL, et al. Effect of skin graft thickness on scar development in a porcine burn model. *Burns*. 2018;44(4):917–930. doi:10.1016/j.burns.2017.11.011