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CASE REPORT
Reconstructive

Combination of Cultured Epidermal Autograft and Meshed Skin Graft Enables Full-thickness Excision of Giant Congenital Nevus

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Summary: Giant congenital melanocytic nevus (GCMN) is a skin condition characterized by an abnormally dark, noncancerous skin patch. Two main issues with GCMN are aesthetics and malignant transformation. Various methods of treatment are reported, but each method has its own disadvantages, such as risk of recurrence or restriction in the treatable area. We report three cases of GCMN treated with full-thickness excision and immediately covered with cultured epidermal autograft (CEA) combined with split-thickness skin graft (STSG). This is a single-center, single-arm, retrospective report of three cases. The nevus was excised at full skin thickness. Meshed STSG taken from scalp was grafted to the defect, and CEA was grafted over simultaneously. Two weeks later, CEA was applied again as a booster. The same procedures were performed until all nevi were excised. In all cases, nearly complete epithelialization was achieved at several weeks after operation. The reconstructed skin was elastic, and there was no persistent joint contracture. Vancouver Scar Scale score was 4–8. Mesh-like appearance was observed. A hypertrophic scar appeared in the area without meshed STSG. An intractable keloid was observed in one patient. No recurrence of the nevus was observed during the follow-up period. The donor site scar on the scalp was well hidden by the hair. Our method enables full-thickness resection and reconstruction of a wider area in a single operation while improving the take rate of CEA, with reasonable degree of scarring compared with conventional methods. *(Plast Reconstr Surg Glob Open 2024; 12:e6157; doi: 10.1097/GOX.0000000000006157; Published online 18 September 2024.)*

Giant congenital melanocytic nevus (GCMN) is a skin condition characterized by an abnormally dark, noncancerous skin patch that is present at birth and will reach a diameter of 20 cm or more in adulthood.[1,2] Two main issues with GCMN are aesthetics and malignant transformation. Various methods of treatment are reported for GCMN, but each method has its own disadvantages (Table 1). Split-thickness excision such as curettage carries a risk of repigmentation or malignant transformation. Full-thickness excision with serial excision, tissue expanders, or flaps carries such disadvantages as limited operable area or number of operations required.

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Cultured epithelial autograft (CEA) can cover a large area with a small donor site. A major disadvantage is that the dermis must be preserved in the recipient site for CEA to take. Hence, many report split-thickness excision.[3,4]

To overcome these disadvantages, we conducted full-thickness excision covered with CEA and a meshed split-thickness skin graft (STSG) from the scalp. Full-thickness excision eliminates risk of recurrence, CEA enables reconstruction of a wide area in a single operation, and the STSG improves its take rate.

METHOD AND RESULT

This is a single-center, single-arm, retrospective study. The indication of this method was patients with a GCMN too large to resect by serial resection or skin expander. Cases in which healthy skin could not be obtained for epidermal culture or in which general anesthesia was not possible were excluded. The price of CEA set by national

Disclosure statements are at the end of this article, following the correspondence information.

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Table 1. Examples of Treatable Areas

		Treatable Area in Total	Treatable Area in Single Stage	Risk of Malignancy and Re-pigmentation	Aesthetics
Split-thickness excision	Curettage	XL	XL	+	Fair
	Laser ablation	XL	XL	+	Fair
	Covered with meshed STSG	L	M	+	Fair
	Covered with CEA	XL	XL	+	Fair
Full-thickness excision	Serial technique	L	M	–	Excellent
	Sheet skin graft	S	S	–	Excellent to good
	Tissue expander	L	M	–	Excellent
	Skin flap	M	M	–	Excellent
	CEA with artificial dermis	XL	XL	–	Good
	CEA with meshed STSG	XL	M	–	Good

Examples of treatable area in total: XL: entire back side. L: entire back. M: half of the back. S: part of face. Examples of treatable area in single stage: XL: entire back. L: half of the back. M: 1/3 of the back. S: part of face. Examples of aesthetics: excellent: normal skin. good: scarred skin. fair: scarred skin with pigmentation. Examples of extensibility: excellent: no contracture. good: some contracture. fair: severe contracture freedom in treatable body part: excellent: almost no limitation. good: some limitation. fair: limited.

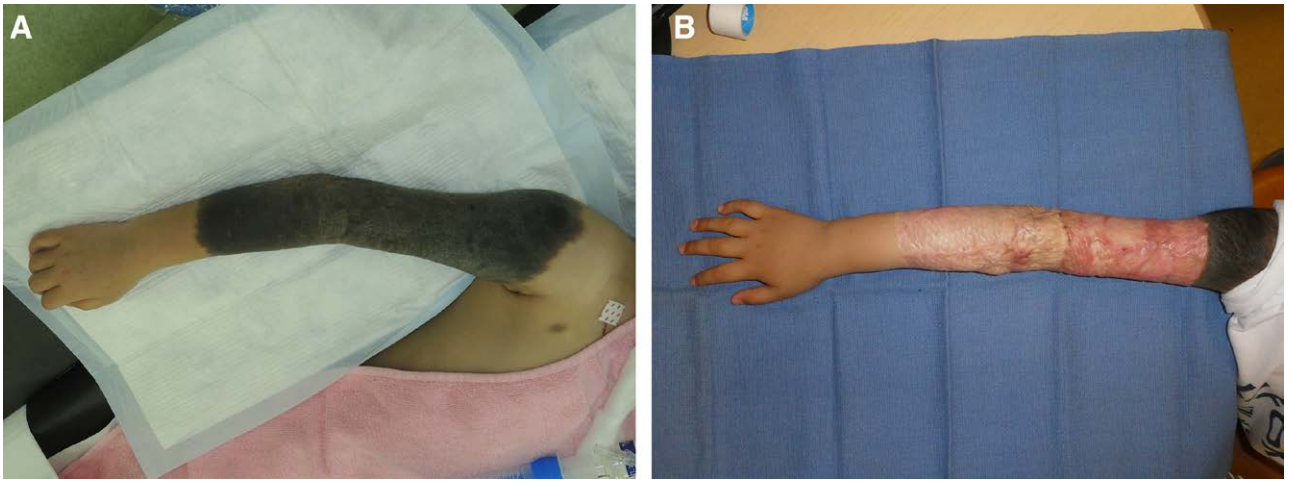

Fig. 1. A 5-year-old male child with GCMN on the right upper extremity, treated with full-thickness excision with meshed STSG and CEA. A, photographs of the first operation before excision. B, Photographs of the treated arm of dorsal side 1 year after the first operation and 6 months after the second operation.

health insurance reimbursement is 4,380,000 Japanese yen for epidermal culture and 151,000 Japanese yen for each sheet (8 × 10 cm). Depending on the residential area and age of the patient, 70%–100% of the cost is covered by national and local governments.

CASE REPORT NO. 1

A 5-year-old Japanese male child had GCMN of the right upper extremity (Fig. 1A). In the first operation, a small amount of skin (2cm^2) was excised for culturing of CEA. In the second operation, GCMN of the forearm was excised at full thickness. STSG was taken from the scalp, meshed (mesh ratio 1:3) and grafted to the defect, and CEA was grafted over simultaneously. [**See figure, Supplemental Digital Content 1,** which displays (A) an intraoperative photograph of the first operation after transplantation of STSG and CEA in case 1 and (B) the donor site at the scalp six months after the second operation in case 1. The donor site scars are completely hidden by the hair. **http://links.lww.com/PRSGO/D496**.] Two weeks later, when the dressing was changed under general anesthesia, nearly complete epithelialization was observed. CEA was applied again as a booster at this stage. Nine months later, the second stage operation was performed using the same protocol.

The donor site on the scalp completely healed by two weeks after each operation. A hypertrophic scar appeared in the area without meshed STSG. The patient was instructed to put on moisture cream and a pressure bandage to prevent hypertrophic scarring and avoid sunlight to prevent hyper-pigmentation for 6 months. Range of motion (ROM) training was instructed until full range was achieved. No special care was instructed for the donor site of the STSG. At 5 years postoperative, no repigmentation was observed (Fig. 1B). A mesh-like appearance was observed in the entire area. The reconstructed skin was elastic, and ROM of the elbow was full. Vancouver Scar Scale (VSS) score[5] was 5. The scar on the scalp was well hidden by the hair.

CASE REPORT NO. 2

A 1-year-old Japanese female infant had GCMN of the right lower extremity. This patient underwent four stages of operation with the same method as case 1.

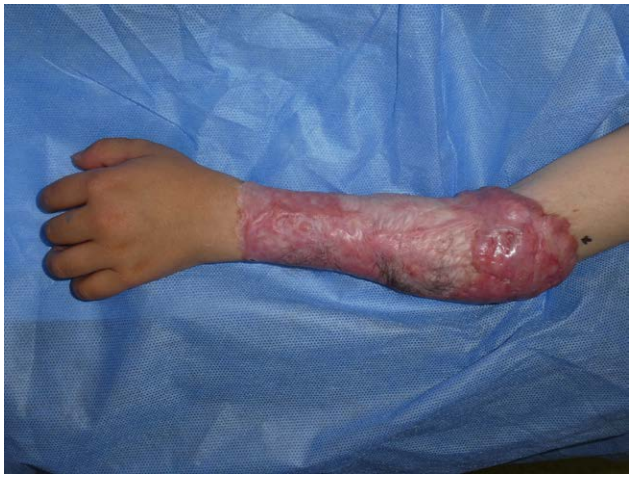

Fig. 2. A 1-year-old male infant with GCMN of the left upper extremity, treated with full-thickness excision with meshed STSG and CEA. Photographs of the treated extremity of the palm side 1 year after the second operation. Hypertrophic scar remained despite three steroid injections.

Transient limitation in ROM was observed, which resolved 2 years after the exercise (From flexion 80 and extension 0 to both full). At 4 years after final operation, no repigmentation was observed. VSS score was 4.

CASE REPORT NO. 3

A 1-year-old Japanese male infant had GCMN of the left upper extremity. A two-stage operation was conducted. This patient had a relatively large area of persistent hypertrophic scarring despite treatment with steroid tapes and injections. It was resected simultaneously in the second stage with the nevus. At 1.5 years after the final operation, no repigmentation was observed, and the scar on the scalp was well hidden by the hair. VSS scale score was 8 (Fig. 2). The patient was referred to another hospital for treatment of an intractable keloid.

DISCUSSION

Our method achieved both full-thickness excision and a high CEA take rate. Dermis has to be preserved in the recipient site for CEA to take. Various innovations have been challenged to apply CEA on the full-thickness defect. The take rate of CEA on allograft is reported to be 31%[6]–70%[7] in burns, and that of CEA on granulation tissue that grows on the artificial dermis is reported to be 43% in burns[7] and 8% in GCMN.[8] These methods have the drawbacks of low take rate and the need for wound bed preparation. Therefore, we introduced the method of combination with CEA and meshed STSG, which was first reported in 2018 for burn treatment.[9]

The combination significantly increases CEA take rate[10] by controlling the contamination of the wound bed.[7] Our patients also showed high take rate and rapid epithelialization. This allowed us to shorten the recovery time, leading to reasonable appearance and good extensibility, which made it applicable even to joints.

Using STSG compromises the minimally invasive nature of CEA, but the use of the scalp as a donor site reduces this drawback. The scalp has the advantages of rapid reepithelialization, an inconspicuous scar hidden by the hair, reharvesting capability, and a relatively large donor site area compared with the body surface in children.

Our method is a promising treatment, but several points are required for further improvement. In terms of appearance, mesh-like appearance can be a cosmetic problem. A persistent keloid was observed in case 3, in whom postoperative care was inadequate. Furthermore, there is a need for more patients, more objective evaluation methods, and longer follow-up to determine the risks of hypertrophic scar and other possible complications such as lymphedema and growth inhibition.

CONCLUSION

Full-thickness excision and immediate coverage with CEA and meshed STSG from the scalp is a promising treatment of GCMN, theoretically eliminating future risk of malignancy with near-total removal of nevus cells and providing reasonable aesthetic results for GCMN of various sites and sizes.

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DISCLOSURES

Dr. Kaneko was the chief investigator of the physician-initiated clinical trial conducted from 2012 to 2014 and investigator of the industry-sponsored clinical trial conducted from 2014 to 2015 to expand the indication of JACE (cultured epithelial autograft product used in this study) (Japan Tissue Engineering Co., Japan) for treatment of giant congenital melanocytic nevus. Dr. Hikosaka was a co-investigator of the same trials. Dr. Hikosaka is a member of the independent evaluation committee for postmarketing surveillance of JACE. All the other authors have no financial interest to declare in relation to the content of this article. This work was supported by Child Health and Development Research funding (institutional fund; grant number 2021A-1).

DECLARATION OF HELSINKI

This study was conducted in accordance with the Declaration of Helsinki.

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