An 18-Year Experience in the Management of Congenital Nevomelanocytic Nevi

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Background: Children with giant congenital nevomelanocytic nevi (CNN) are referred to our pediatric burn center for the surgical management of this disfiguring and potentially malignant skin disorder. Use of tissue expanders has contributed significantly in limiting donor site morbidity associated with treatment of giant CNN. Cultured skin substitutes (CSS) have also shown promise as an alternative wound coverage. With recent controversy regarding the effectiveness of excision in preventing melanoma risk, we wished to review our surgical management of giant CNN and to determine the incidence of malignancy in these patients.

Methods: A retrospective chart review of patients with giant CNN was performed from 1985 to 2003. Charts were reviewed for age, sex, percentage total body surface area (TBSA) involved, age at initiation and completion of treatment, surgical treatment, complications, histopathology, and length of follow-up.

Results: Of the 40 patients treated at our facility, the mean extent of skin involvement was 10% TBSA (range: 0.5%–75%). The mean age at initial operation was 5.1 years, and the majority of surgical interventions were completed within a mean of 1.3 years. Twenty-two patients (55%) required more than 1 surgical procedure. Excision and split-thickness skin grafting was the most common surgical procedure (n = 22) followed by excision with primary closure (n = 18). Ten patients were treated with tissue expansion, while 4 received cultured skin replacements. One patient died of extracutaneous melanoma during the course of surgical treatment. Three patients demonstrated histopathologic evidence of cytoatypia but remained clinically free of malignancy during a mean follow-up of 11 years.

Conclusions: Giant CNN are both important cosmetic and medical problems. With an associated lifetime risk of melanoma in 4%–10% of patients, excision of CNN is recommended despite the fact that 50% of melanomas arise extracutaneously. Depending on the extent of body surface area involvement, wound closure can be obtained with conventional split- or full-thickness skin grafts, tissue expansion, and/or cultured autologous cultured skin substitutes. The latter 2 modalities provide improved cosmetic results, with minimal donor site morbidity.

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Congenital nevomelanocytic nevi (CNN), also known as congenital hairy nevi, affect approximately 1% of newborn infants. Present at birth or within the first months of life, most congenital nevi are less than 3–4 cm in diameter. In contrast, giant nevi, defined as those lesions greater than 20 cm in diameter, are rare, with an incidence of 1 in 500,000 births.[1] Most giant CNN involve the trunk and have a predominant bathing suit distribution (Fig. 1). Giant CNN can also be associated with systemic syndromes such as dysplastic nevus syndrome and, if located centrally, leptomeningeal melanoma. Although the cosmetic impairment can be significant, the major concern with CNN is its potential for malignant transformation. Historically, there has been a 15% risk of melanoma associated with giant nevi; however, the NYU-LCMN registry recently reported the incidence of malignant transformation to be a lifetime risk of 4%–10%, with an estimated 5-year cumulative life-table risk of 2%–3%.[1–4]

Initial surgical assessment of CNN usually occurs within the first 6 months of life. Management depends on the size and location of the lesion(s) and the risk for malignant transformation. In general, removal of smaller lesions is delayed as long as visual monitoring can be performed on a yearly basis. For cosmetic concerns and malignancy potential, larger lesions are treated surgically. Coverage of the excised bed can be challenging, especially with nevi involving greater than 20% of the total body surface area (TBSA). Use of tissue expansion and flaps has limited donor site morbidity and disfiguration. As another alternative option for wound coverage, we have recently employed the use of autologous cultured skin substitutes (CSS).[5,6]

With recent controversy concerning the role of excision in the absence of a decreased risk for malignancy, we wished to review our surgical management of this disease and patient outcomes to assess the effectiveness of our management protocol and to determine the incidence of malignancy associated with giant CNN in patients treated at our hospital.

FIGURE 1. Congenital nevomelanocytic nevi: Bathing-suit distribution.

MATERIALS AND METHODS

We performed a retrospective chart review of all patients with giant CNN treated at our facility from 1985 to 2003 after obtaining approval from the University of Cincinnati College of Medicine Institutional Review Board.

Charts were reviewed for age, gender, extent of skin involvement as a percentage of TBSA, age at initiation and completion of treatment, type of treatment prior to and after admission to our hospital, complications, histopathology, and length of follow-up. The study was limited to giant CNN classified as nevi greater than or equal to 20 cm in diameter.

RESULTS

Forty patients were treated at our facility for the management of giant CNN from 1985–2003. Patient demographics are listed in Table 1. Twenty-five patients (62%) were female. All but 4 patients were Caucasian (90%). Patients presented to our facility for surgical treatment at a mean age of 4.8 years (range: 1 month to 15 years). Seventeen patients had previously been evaluated for surgical intervention at an outside hospital, 13 of whom had undergone at least 1 previous surgical procedure prior to the initiation of treatment at our facility. The mean extent of skin involvement was 10% TBSA, with a range of 0.5% to 75% TBSA. The mean age at time of the initial surgical procedure at our institution was 5.1 years, reflecting an interval of 4.7 months from the first outpatient visit. The majority of patients completed their surgical treatment within a mean of 1.3 years from the time of initial surgical treatment. However, 8 patients continue to require additional procedures due to the presence of multiple small nevi (5 patients) and the process of tissue expansion (3 patients).

TABLE 1. Patient Demographics

Total number of patients	40
Gender	
Male	15/40 (37%)
Female	25/40 (63%)
Race	
Caucasian	36/40 (90%)
Hispanic	3/40 (8%)
Native American	1/40 (2%)
Mean total body surface area	10% (range: 0.5–75%)
Mean age at presentation, y	4.75 (0.4–15)
Mean age at first surgery, y	5.14 (0.5–15)
Mean age of last surgery, y	6.43* (0.75–15)

*Excludes 8 patients whose serial excisions are not yet completed.

TABLE 2. Surgical Procedures

Surgical Procedure	Number of Patients
Excision and split-thickness skin grafting	22
Excision and primary closure	18
Tissue expansion with advancement flap	10
Excision and full-thickness skin grafting	7
Excision with cultured skin grafting	3
Excision with allografting (temporary)	3

Surgical procedures used are listed in Table 2. Excision and split-thickness skin grafting was the most common surgical procedure performed (Fig. 2), followed by excision with primary closure. Twenty-two patients (55%) required more than 1 surgical procedure. Of the 28 patients who underwent skin grafting, 3 had graft losses of less than 5%, for which 2 patients required regrafting (Table 3). Although not surgical complications per se, 9 patients required additional surgical procedures due to growth-induced scar contractures, hypertrophy, hirsutism, and pigment changes.

Tissue expansion was used in 10 patients. Of the 25 expanders used, 7 (28%) had infectious complications. Additional complications related to tissue expansion included malpositioning, flap necrosis, and port exposure (Table 3). One patient developed necrotizing fasciitis, necessitating debridement of the infected skin and skin grafting upon resolution of the infection.

Autologous CSS were used in 4 patients. One patient grafted with cultured keratinocytes at an outside facility required excision and regrafting for a significant posterior neck scar contracture. The remaining 3 patients received the bilayered autologous CSS developed at our facility (Fig. 3). A mean graft loss of 38% occurred in 2 of these patients (total mean take was 74%), one of whom subsequently underwent

FIGURE 2. Excision of thigh congenital nevomelanocytic nevi with split- thickness skin grafting.

FIGURE 3. Excision of congenital nevomelanocytic nevi involving torso with tissue advancement flap and placement of autologous cultured skin substitute.

TABLE 3. Complications

	No. of Complications per Patient
Total number of complications	9/40 (22%)
Total graft-associated complications	3/28 (10)
Graft loss	3/28 (10%)
Required regrafting	2/3
Total tissue-expander complications	7/25 Expanders (28%)
Infections	4
Expander malposition	1
Advancement flap necrosis	1
Exposed port	1
Total cultured autologous skin complications	2/4 (50%)
Graft loss	2
Required regrafting	2/2
Deaths*	1/40 (2%)

*Not treatment related.

TABLE 4. Histopathology

Histopathology Classification	No. of Patients*
Compound	16
Intradermal	14
Junctional	3
Neurotinization	2
Atypia	1
Dysplasia	1
Severe atypia	1
Melanoma	0

*Two patients did not have pathology reports.

excision and split-thickness skin grafting, while the other received coverage with a second application of the CSS.

Histopathological findings are listed in Table 4. Only 3 patients (7.5%) had findings of hyperplasia, dysplasia, or severe atypia. The mean extent of their skin involvement was 11.4% TBSA, and their mean follow-up was 11.25 years, without evidence of melanoma. One patient developed malignant melanoma and died of cerebral metastases 2 years after his initial presentation. His disease involved 60% TBSA, and the initial histopathology demonstrated only intradermal nevi, with no evidence of dysplasia or melanoma.

DISCUSSION

Approximately 2% of all melanomas occur in children and adolescents.[7] Unlike the disease in adults, melanomas in children tend to be more aggressive due in part to delays in diagnosis and the tendency of melanomas to be thicker (>1.5

mm) in children. One third of these melanomas arise from giant congenital hairy nevi.[8] Signs suggestive of melanoma include nodularity, irregular margins and texture, and color variations. These features also describe the normal appearance of congenital hairy nevi, thus making it difficult for clinicians to detect signs of malignant transformation. Malignant cells are also thought to arise from melanocytes situated deep in the dermis and subcutaneous tissue, making visual monitoring even more difficult.

The exact incidence of melanoma in giant CNN is unknown but is believed to involve a lifetime risk of 4%–10%.[1–4] There is no consensus as to when this increased risk occurs.[9–12] Since prospective studies are difficult to perform in this patient group, Quaba and Wallace[13] performed a 20-year retrospective review to better assess the risk for melanoma in patients with giant CNN. Their findings predicted a malignancy risk of 8.5% in patients with giant nevi involving 17% TBSA during the first 15 years of life. Combined with this increased risk and poor prognosis if melanoma was present, they recommended early prophylactic excision for patients with giant CNN.

Countering this recommendation is a recent literature review by Watts et al.[14] Although stating that 50% of malignancies develop in patients with large CNN in the first 3 years of life, with 70% presenting by puberty, they question the role of complete excision of large CNN, given the absence of evidence in the literature demonstrating a decrease in the occurrence of melanoma after excision. Furthermore, 50% of melanoma cases are extracutaneous. Centrally located nevi in particular are associated with an increased risk of leptomeningeal melanosis, further supporting that excision alone may not decrease the risk of melanoma.[12,15] These findings have led to the current controversy—should excision be performed for large CNN?

With studies both supporting and questioning excisions, we reviewed our patient group and found that none of the patients treated at our facility had histopathologic evidence of melanoma, including the patient that died of cerebral melanoma. There were, however, 3 patients with an increased risk for the development of melanoma secondary to cytoatypia. These patients have been followed for a mean of 11 years and have not developed clinical findings suggestive of melanoma. Although this number is small, the potential malignancy risk is still concerning.

For both reasons of malignant potential and disfiguring cosmesis, we excise giant CNN after thorough discussion with family members as to surgical risks and benefits and malignancy potential. Crucial here is a surgical treatment plan that involves minimal donor site morbidity and results in a good esthetic outcome.

Ideally, we prefer to excise large CNN as early as 6 months of age (given the elasticity of tissue at this age and the increased risk of malignancy by the age of 3); however, due to referral patterns, our mean age of excision occurred at 5 years of age. To remove the deep-seated nevocytes, excision was performed down to fascia, with wound coverage being predetermined by size and location. Following the algorithm suggested by Gur and Zuker,[12] lesions of the head and neck were treated preferentially with tissue expansion and full-thickness skin grafting.

Although Vergnes et al[16] have recommended the use of repeated skin expansion for good functional and cosmetic results in CNN up to 40% TBSA, for large lesions of the trunk and extremities, we found tissue expansion not sufficient to provide complete coverage. Alternative options, such as tissue flaps as suggested by Margulis et al,[17] can provide coverage with minimal donor site morbidity and disfigurement. Traditionally, we used a combination of skin grafting and tissue expansion for coverage, but with the development of CSS, we now prefer to use CSS as an alternative wound coverage. It provides cosmesis, pliability, and durability comparable to skin grafting but with reduced donor site morbidity.[5] Twenty square centimeters of skin is harvested and can provide up to 1000–2000 cm^2 of CSS over a 4-week period, with prior surgical preparation of the excised bed using allograft.

Our use of CSS resulted in a mean graft take of 74%, which was comparable to CSS graft take in burn patients at that time. Graft loss was attributed to sheer, microbial contamination, and graft preparation techniques. Currently, CSS engraftment has improved to 80% in the burn population[6] due to changes in topical antimicrobial coverage and both wound bed and graft preparations. Though costly, at approximately $15.00 per cm, the decreased donor morbidity, as well as graft pliability and durability, is a justifiable expense. We feel this treatment modality continues to show promise for skin replacement in patients with giant CNN.

Both tissue expanders and CSS serve as good options for definitive wound closure after excision of CNN. Although both modalities had increased complication rates when compared with conventional split-thickness skin autografting (graft take of 95%), donor site morbidity was significantly decreased. Technical changes have improved our CSS engraftment. Use of tissue expanders was associated with a 28% complication rate, primarily due to infection. Cultures taken of nevi in preparation for CSS placement revealed multiple gram-positive and -negative bacteria, such as *Staphylococcus* and *Enterobacter*. Although comparable to complication rates in the literature, we surmise that part of the increased risk for infection may be hyperkeratosis of the hair follicles, leading to significant bacterial colonization and seeding of the expander pocket. Patient hygiene may also be a contributing factor. Nonetheless, we are more cautious with placement of tissue expanders and have added culturing of the excised wound bed for infection surveillance.

CONCLUSION

Giant CNN are both an important cosmetic and medical problem. They are associated with an increased risk of melanoma in 4%–10% of patients. Excision of these nevi may not decrease the risk of malignancy. Of the 40 patients who underwent excision, 3 exhibited cytoatypia, suggesting increased risk, though none were positive for melanoma. In management of this disease, limiting donor site morbidity and further disfiguration is essential. Use of autologous CSS

provides an improved cosmetic result, with decreased donor site morbidity.

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