Alpaha actin 2 (ACTA2) is an alpha-actin isoform that functions as part of the contractile apparatus of vascular smooth muscle cells, regulating blood pressure and flow. Patients with the ACTA2 mutation commonly suffer thoracic aortic aneurisms, as well as medium and small-vessel occlusive disease presenting as early-onset coronary artery disease, ischemic stroke, moyamoya disease, and livedo reticularis. Histologically, vessels of individuals with ACTA2 mutation demonstrate medial degeneration, focal areas of smooth muscle cell hyperplasia, and disarray and stenosis of the vasa vasorum.

Our plastic surgery service was consulted for reconstruction of a large scalp wound in a patient with the ACTA2 mutation. An extensive literature review yielded no reported cases of free flap reconstruction in such patients.

CASE REPORT

A 21-year-old female nursing student with ACTA2 mutation, diagnosed by genetic testing at age 18 after a stroke, presented to our emergency room with left internal carotid artery thrombosis. This was treated with urgent stenting, complicated by cerebral edema requiring decompressive hemicraniectomy. Two weeks post-operatively the plastic surgery service was consulted for management of the hemicraniectomy flap necrosis (Fig. 1).

The patient underwent multiple debridements followed by left latissimus dorsi free flap anastomosed to the facial artery and external jugular vein. The flap was inset over a dural regenerative matrix placed by the neurosurgery service (DuraGen Matrix, Integra LifeSciences, Plainsboro, N.J.). Prophylactic dosing of low molecular weight heparin and 81-mg aspirin daily were used for anticoagulation. On Post-operative day 1, the patient required return to the operating room for salvage of venous thrombosis with intra-flap tPA and revision of the venous anastomosis with a saphenous vein graft. Ultimately the distal 75% of the flap was lost, leaving the dura exposed. The patient’s course was further complicated by multiple wound healing complications: large areas of necrosis of the latissimus and saphenous vein donor sites, the neck vessel recipient site, and the right hand after IV infiltration. She ultimately healed with a regenerative tissue matrix strategy. Reconstructive options with no or minimal donor site morbidity should be considered in patients with the alpha actin 2 mutation. We encourage further reporting of outcomes in these patients.

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repeated applications of bovine collagen / silicone bilayer matrix (Integra Bilayer Matrix Wound Dressing, Integra LifeSciences, Plainsboro, N.J.) were performed followed by an autologous, homologous skin construct (SkinTE, PolarityTE, Salt Lake City, Utah). During the last follow-up at 1.5 years, the scalp was nearly healed (Fig. 3).

**DISCUSSION**

This is, to our knowledge, the first reported case of attempted free flap reconstruction in a patient with ACTA2 mutation. ACTA2 mutation is known to have associated aneurismal and vascular-occlusive manifestations. However, with a large defect and no reported cases to reference in the literature, we proceeded with free flap reconstruction. This not only failed to adequately cover the wound, but also caused significant donor and recipient morbidity, mitigated with regenerative tissue matrices.

After flap failure, other muscle and fasciocutaneous flaps, omentum, and composite tissue allotransplantation were considered. In the setting of poor wound healing and potential for repeated partial or total flap loss, autologous options were considered to be a too high risk by our team and the patient. Composite tissue allotransplantation would offer the ability to replace bone and soft tissue with no donor morbidity, but risk of flap loss and lifetime immunosuppression had undesirable risks as well. With input from the patient and family, we proceeded with a regenerative tissue strategy to prevent further donor site morbidity.

Genetics, dermatology, rheumatology, and vascular medicine workup failed to identify an underlying explanation for delayed wound healing. Extensive workup for common and rare coagulopathies was negative. Our patient reports normal healing after remote sternotomy but has a widened scar. It is possible that wound healing problems are a later manifestation related to disease progression, as our patient is beyond the median survival of 17 years. A literature review also failed to reveal a direct association between ACTA2 mutation and wound healing problems. However, 1 familial ACTA2 mutation has been noted to have myofibroblast dysfunction.

The specific impact of ACTA2 mutation on flap failure is also unknown. That the proximal portion of the flap survived implies an intra-flap etiology of failure. We hypothesize that the known intima and media proliferation with medium and small vessel stenosis related to ACTA2 may predispose flaps to occlusive thrombus and flap loss.

We cannot make definitive guidelines for treatment of patients with ACTA2 mutation who require microsurgical reconstruction based on this single case report. However, when this rare situation arises, reconstructive surgeons...
now have a basis for counseling patients and developing a treatment plan. We encourage further reporting of outcomes to clarify flap failure and delayed wound healing in such patients.

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PATIENT CONSENT
The patient provided written consent for the use of her photographs.

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