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Invited commentary

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In this article by Ohtsuka, Yamamoto and Okayama a large congenital defect of the scalp and skull in an 11-day-old infant is described. The authors suppose that this anomaly was caused by an immature arteriovenous malformation.

Aplasia cutis congenita or congenital absence of skin is a rare, poorly understood and sometimes fatal defect present at birth. This disorder was first reported by Cordon in 1767 [11] but after a more accurate description of two fatal cases of scalp cutis aplasia by Campbell in 1826 [9] it became known as Campbell's disease. Approximately 500 cases have been published [35] but the number is probably much higher because small defects are never reported.

Aplasia cutis congenita can occur in both sexes anywhere on the body but the vertex of the head is the most common site (65%), rarely it can appear on the occiput or behind the ear. Single skin defects on the head are 3 times as frequent as multiple lesions. Other areas which may be involved include the extremities (forearms, wrists, knees, feet), flanks, abdomen, face and neck. These defects on the trunk and extremities may occur alone [1] or with large scalp lesions [3, 8, 14, 39]. They are usually much more extensive, often multiple and appear bilaterally with symmetrical distribution [27].

This congenital defect may be superficial or deep and may be manifested in various degrees of absence of tissues. The defect may involve only skin or the skin, subcutaneous tissue and muscle. On the head, lack of tissue may extend down to dura [26]; in this situation the name aplasia cutis congenita is insufficient. A superficial defect involving only epidermis is observed as erosion. Absence of the entire thickness of the skin on the scalp is manifested as a single ulcer or several ulcers that measure approximately 3 cm in diameter. These lesions heal uneventfully by granulation and leave atrophic scars. When intrauterine healing has occurred the local absence of hairs is recognized as congenital alopecia.

The deep congenital defect usually is large and may measure 10 cm in diameter, it is a punched-out ulcer with visible convolutions of the brain covered by a thin translucent glistening parchment-like membrane. The area adjacent to the large defects on the scalp was especially analyzed by Demmel [13] in his review. In the vast majority the margins were sharp and smooth but they also were raised or rolled. In numerous cases the edges were pink-white and hairless, but in some they were densely haired. Also, a lock of hair of unusual length that grew from the margin of the lesion was observed by Kehrer [26]. Dilated and tortuous veins adjacent to large defects on the scalp were reported in a few patients [3, 15, 37, 42]. Shortly after birth, these large congenital scalp and skull defects may become infected, necrotic and there is a danger of meningitis. They may bleed due to rupture of the sagittal sinus and cause subsequent death [9, 32]. The mortality is about 20% [23].

Various congenital anomalies are frequently associated with the deep scalp defects. Frieden [18] has been trying to classify aplasia cutis congenita into nine groups according to the number and location of lesions and the presence of associated abnormalities. Numerous malformations that occurred together with the scalp defects are as follows: hydrocephalus, meningomyelocele, microphthalmia, cleft lip and palate, congenital heart diseases, polycystic kidney, eyelid colobomas, polydactylism, absent digits, syndactylia, short phalanges of the

feet, clubbed hands and feet, amniotic bands, leptomeningeal angiomatosis, and cutis marmorata teleangiectatica congenita. Capillary hemangiomas on the nose and lip [20], on the arm [30], and the tibia [15] were also observed in the patients with aplasia cutis congenita. Sporadically, chromosome 16–18 defect and trisomy 13, 4p-syndrome were associated with congenital absence of the skin [2, 42].

The etiology of aplasia cutis congenita is unknown. There are a few speculative theories, the most common being that of amniotic adhesion. Ingalls [23] postulated that the amniotic adhesions may coexist but they are not causal factors. Intrauterine infection such as lues has not been an acceptable explanation. Other factors such as intrauterine pressure of a pelvic exostosis and trauma during parturition were only found in a minority of cases [7, 13]. Stephan et al. [39] mentioned that pressure caused by cerebral development may cause this congenital skin defect. The embryologic theory maintains that aplasia cutis congenita is a primary failure of differentiation in embryonic life [17, 19, 40]. Maternal age and general health (nutritional and hormonal disturbances, vitamin deficiency, medications taken during pregnancy), as well as hereditary factors were also considered as a cause. Familial occurrence of this congenital anomaly in a few generations in autosomal dominant inheritance has been established in a number of cases [9, 12, 16, 17, 19, 21, 31, 36, 43]. Some investigators [10, 21, 22, 43] during microscopic examination of the margins of the defects found feature of skin hypoplasia i.e., thinning of the epidermis, reduced dermins, no dilated blood vessels, no sweat and sebaceous glands, no hair follicles, lack of elastic fibers, partial homogenization of collagen fibers and absence of the subcutaneous adipose tissue. Also, Irons and Olson [24] reported an abnormal vasculature on the arm in the patient with a large skin defect. An arteriogram revealed absence of ulnar and radial arteries but numerous small blood vessels without signs of arteriovenous malformations. This clinical and histologic evidence suggests that the poor vascular differentiation and limited blood supply during embryonic life may also be the factors for development of this congenital defect. However, a few authors [13, 25] observed very vascular connective tissue in the close vicinity of the large congenital scalp defect. Vasconez [42] even believed that the large scalp and bony defect is the result of thrombosed arteriovenous malformations.

In the patient presented by Drs. Ohtsuka, Yamamoto and Okayama there were fragile and thrombosed blood vessels under the eschar noted during surgery and dilated small and large blood vessels in the dermis surrounding the necrotic lesion on the scalp on microscopic examination. These authors also suggest that the above mentioned data as well as the presence of large dilated veins on the scalp are the basis for diagnosing the immature arteriovenous malformations and that they may be the cause of the congenital scalp and skull defects. Unfortunately, in all reported patients with the deep congenital defects showing huge dilated veins on the normal scalp and/or dilated blood vessels in histology there was no angiographic documented proof of the existence of an arteriovenous shunt. Undoubtedly, in the presented cases there were vascular abnormalities but, in my opinion, they were capillary-venous type with a low blood flow rather than arteriovenous malformations with a high blood flow. It is questionable if these vascular malformations play a role in etiopathogenesis of congenital scalp and skull defects. They coexisted with other associated abnormalities such as bilateral brachymesophalangia of the little fingers in the patient of Drs. Ohtsuka, Yamamoto and Okayama and short stubby distal phalanges on the fingers and toes as well as chromosome 16–18 defect in Vasconez' patient [42]. Vascular malformations on the scalp, capillary hemangiomas located in different areas and various other abnormalities with the aplasia cutis congenita probably constitute integrity of these congenital disorders.

Actually, for aplasia cutis congenita no single theory can explain the cause of the skin and other tissue defects and their coexistence with multiple associated abnormalities. Moreover, at least two similar etiologic theories exist for the so-called amniotic band syndrome (congenital ring constrictions) [38], spontaneous intrauterine amputation [5, 28, 40] and intrauterine decapitation [41]. Since these bizarre defects may occur together with aplasia cutis congenita [6, 29, 33] and both belong to the same group of congenital malformations, they have similar etiopathogenetic correlations [33]. Because these congenital defects recur in families further genetic studies are needed. In the near future it may be possible to identify the gene(s) primarily responsible for these congenital disorders and untie the etiologic puzzle.

Aplasia cutis congenita is a challenging disorder not only for geneticists and pathologists but also for clinicians: pediatricians, dermatologists, plastic surgeons, and neurosurgeons. Often the small lesions heal spontaneously making surgical repair unnecessary. The larger congenital scalp and skull defects, however, should be covered early by flaps before complications occur. A new approach to treatment of this disorder is tissue expansion [4]. This method allows flap reconstruction of large skull defects with multiple bone grafts and consequently reduces the risk of infection and hemorrhage.

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