Human Tails and Pseudotails

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A case of a tail in a 2-week-old infant is reported, and findings from a review of 33 previously reported cases of true tails and pseudotails are summarized. The true, or persistent, vestigial tail of humans arises from the most distal remnant of the embryonic tail. It contains adipose and connective tissue, central bundles of striated muscle, blood vessels, and nerves and is covered by skin. Bone, cartilage, notochord, and spinal cord are lacking. The true tail arises by retention of structures found normally in fetal development. It may be as long as 13 cm, can move and contract, and occurs twice as often in males as in females. A true tail is easily removed surgically, without residual effects. It is rarely familial. Pseudotails are varied lesions having in common a lumbosacral protrusion and a superficial resemblance to persistent vestigial tails. The most frequent cause of a pseudotail in a series of ten cases obtained from the literature was an anomalous prolongation of the coccygeal vertebrae. Additional lesions included two lipomas, and one each of teratoma, chondromegaly, glioma, and a thin, elongated parasitic fetus. HUM PATHOL 15:449–453, 1984.

The human tail is a rare anatomic finding, and the subject of much curiosity. A child with a tail causes anxiety for the parents and, in some cases, a feeling of stigma and shame. The human tail offered early scientists a notion of recapitulation involving phylogeny and ontogeny, or "reversion to a lower species." These concepts were popular in the late 19th and early 20th centuries, when many cases of human tails were reported. Bartels,[1] in 1884, compiled 126 instances of caudal appendages. Many of his cases, however, were anomalies associated with spina bifida and sacrococcygeal malformations, designated by us as pseudotails. Most of those early observations were poorly documented by modern standards. Interest in the human tail then waned, and only sporadic cases have been described recently.

Among descriptions of tails published from 1859 to 1982, we found 32 cases sufficiently detailed to evaluate.[2–29] We report here an additional case and review the literature. We classify human tails as true (persistent vestigial) tails and pseudotails and consider ontogenetic as well as phylogenetic data.

REPORT OF A CASE

This 2-week-old, black male infant was admitted to the hospital in March 1981 for removal of a tail. The child was a healthy, normal infant, a product of term pregnancy with uncomplicated labor and delivery. The tail and a left club foot were observed at birth. The mother was 17 years old, gravida I, para O. The maternal grandmother was said by family members to have had a tail removed when she was a child. The appendage in our patient was located 1 cm above the coccyx and was 8 cm long and 1 cm in diameter. It was covered with pigmented skin. The tip was bent upward and inward. Radiographs did not reveal spina bifida or bony elements within the tail. Some observers saw spontaneous movements of the appendage. Shortly after admission, the tail was surgically removed. The child recovered well and was free of symptoms a year later.

Grossly, the specimen was curled and somewhat resembled the trunk of an elephant (fig. 1). The tail was soft and flexible except at the tip. Microscopy revealed a central core of mature adipose tissue containing thin fibrous septa, degenerated longitudinal fibers of skeletal muscle, dilated blood vessels, and peripheral nerve fibers (fig. 2). The skin contained adnexal structures, including hair follicles and sweat glands. Bone and cartilage were not present.

DISCUSSION

Caudal Appendages, Tails, and Pseudotails Defined

An appendage is "a part or outgrowth from the body or from an organ, small relative to the whole."[30] The term caudal appendage includes tails, but it is also used to describe protrusions such as lumbosacral myelomeningoceles, lipomas, or other abnormal outgrowths in the lower part of the back. In this paper, we distinguish true or persistent vestigial tails from other forms of caudal appendages or pseudotails. Vestigial is used here to mean a remnant of a structure found in embryonic life or in ancestral

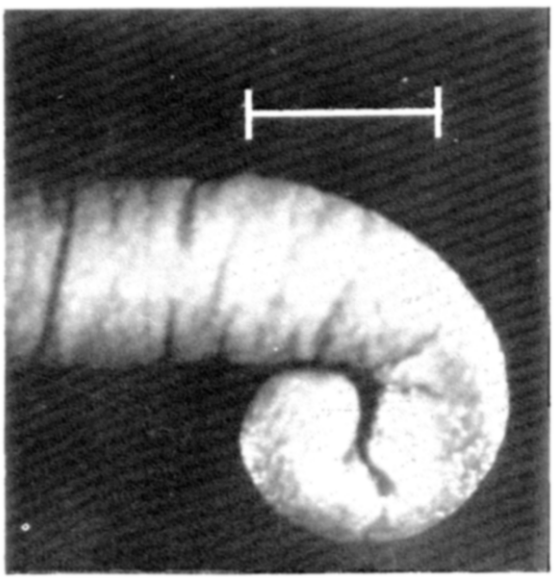

Figure 1. Distal portion of the gross tail specimen. The marker indicates one centimeter.

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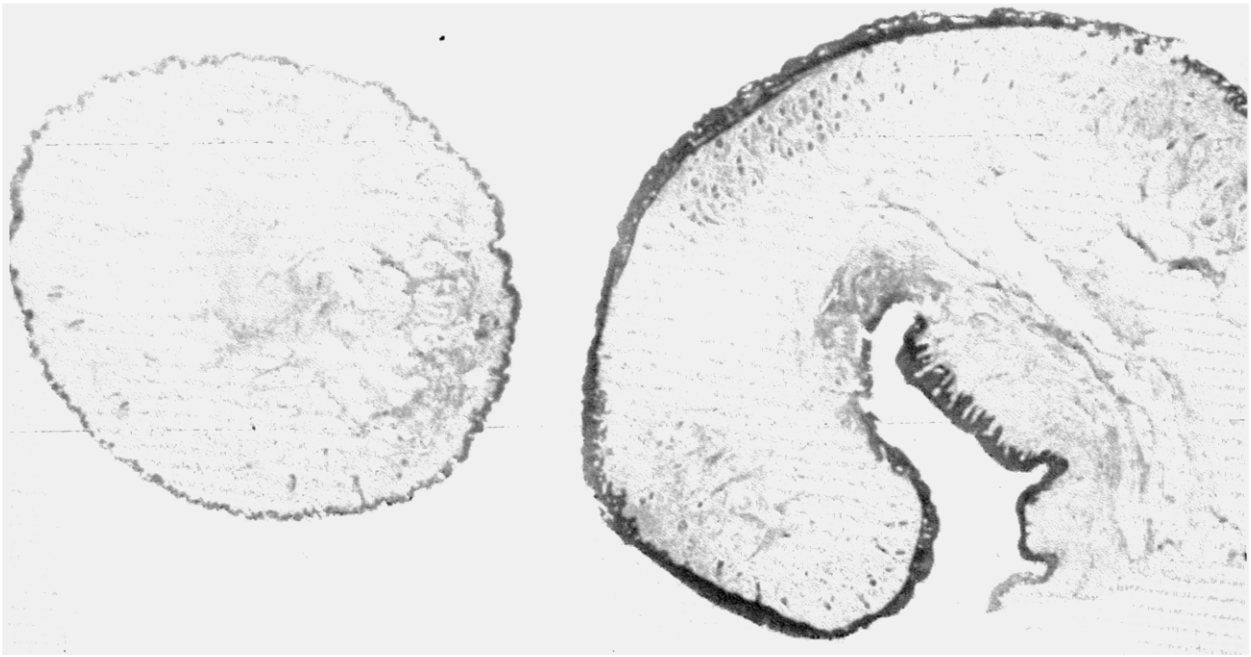

Figure 2. *Left,* cross section of the base of the tail. *Right,* longitudinal section of the distal segment. Muscle fibers surrounded by adipose tissue form the central core; skin and dermal appendages the outer rim. (Hematoxylin–eosin stain. ×7.)

forms. A true tail is defined as a vertebrated, caudal, midline protrusion capable of spontaneous or reflex motion, consisting of skin covering a combination of muscle, adipose and connective tissue, and normal blood vessels and nerves. In humans a true tail, is vestigial, however, and never contains vertebrae. A pseudotail is a caudal protrusion composed of other normal and abnormal tissues.

The tail is the hindmost part of the body, prolonged beyond the gluteal region. In birds, the tail is feathered; in quadrupeds, it is often covered with hair. Tails in the phylum Chordata are composed of attenuated caudal vertebrae covered by skin. The distal end of the chordate tail does not contain bone for a variable distance, as is true of the persistent vestigial tail of humans. A boneless tail occurs as a mutation in mice.[31]

The human tail lacks vertebrae in all cases. The suggestion has therefore been made that it is a dermal appendage, a protrusion of skin coincidentally located in the caudal region.[29] This concept does not account for the mechanism of protrusion, the location in the sacrococcygeal region, or the spontaneous contractions and motion.

Embyrogenesis of the Tail in Humans

The embryo changes from a simple disc to a more complex organism during the fourth week of development. The head forms cephalad to the primitive knot. This knot moves caudad, shortening the primitive streak, and in its wake forms most of the notochord and the floor of the neural tube. By the time most somites have formed, during the fourth week, the remaining primitive knot and streak is a compact mass at the caudal end of the embryo and is called the tail bud or end bud. Continued uneven growth causes the tail bud to extend and curl beneath the hindgut.

In the fifth and sixth weeks, the trunk of the body ends in a conspicuous tail, containing ten to 12 caudal vertebrae. A short distal portion lacks bone and is composed of mesodermal elements. The human tail at this stage of development is similar to the embryonic appendage of those species that normally have tails as adults. In addition to caudal vertebrae, it contains notochord, the end of the spinal cord, and branches of the middle sacral artery and vein.

The tail regresses in the seventh and eighth weeks as the vertebrated portion retracts into the soft tissues. The nonvertebrated part projects temporarily but finally also disappears. By the end of the eighth week, the tail usually has completely disappeared, but the exact time varies. Kunitomo[32] states that a tail had disappeared in a 24-mm embryo but was present in another embryo that was 39 mm long. It is not known why the tail persists longer in some cases or why it remains at the birth of a few children.

Evolution and Uses of the Tail

The tail is the principal means of locomotion in aquatic animals. The earliest fishes and the living cyclostomes had tails but lacked fins.[33] Fishes later developed these organs, the tail being the caudal fin. The tail was the major organ of locomotion and helped maintain equilibrium.

Reptiles had the greatest use of tails, as judged by their development of the largest posterior sacral

and caudal spinal roots. These segments are also well developed in cats and in arboreal monkeys, which possess prehensile tails.[33] Animals normally without tails, including humans, lack caudal spinal roots. The filum terminale, a vestigial structure containing glial fibers and ependyma, is the remains of these roots. Some lizards have tail autonomy, allowing easy loss of the tail as a means of escape. This loss has important social consequences, in that the rate of death among tailless lizards is higher.[34]

The tail in the ruling reptiles contained multiple vertebrae, almost to the tip. In many instances it was longer than the remainder of the animal. It became a strong muscular weapon, supported bipedal locomotion, and aided balance. The tail could also be of value in leaping and as an aid in turning, a function better developed later in the kangaroo.

The tail has diminished in size and in importance, although birds still use it as a rudder. It is absent in higher apes and humans but retains useful function in some mammals. The cat, for example, uses the tail for balancing. The prehensile tail of the spider monkey operates as a fifth hand. The tail also acquired ancillary functions. The cow and many other species use it as a fly-swatter. Morgan[35] suggested that the tail tucked between the legs when an animal is on the ground protects the anus, urethra, and vagina. Animals often reveal emotions by twitching, elevating, or depressing the tail. Some birds use the tail as a sexual attractant; Darwin[36] noted that the length of the tail in pheasants is greater in males than in females. The tail may be used in dark tunnels and passageways to measure lateral distances. Beagles have been bred to raise the white tail-tip for visibility in the field. The tail may even be used as a depot for storage of fat.[37]

REVIEW OF THE LITERATURE

Of the 33 cases reviewed, 23 were cases of true tails[3,5,7–11,13,15,17,19,21–26,28,29] and ten were pseudotails[2,4,6,12,14,16,18,20,22,27]. A tabulation of the two series is available on request from the authors.

Age, Sex, and Country of Origin of Patients

Patients with vestigial tails usually were seen at birth or shortly thereafter, but a few came to medical attention as adults. One patient was 14 years old when first seen by the authors,[23] and two others had the appendage well into adult life.[10] Most tails were removed in the neonatal period. Of the ten pseudotails, five were extirpated within a few weeks or months after birth; the remaining five patients did not undergo surgery.

Vestigial tails occurred more often in males, in a ratio of 15 to 7 (one not specified). Pseudotails were more frequent in females, by 6 to 3 (one not specified). The United States was the principal source of cases, with 13. Four cases from Spain were reported, but only one or two cases from other countries were found. Chinese and Japanese patients were not identified. Gould and Pyle,[38] however, cited without further comment the case of a 12-year-old boy from the Moi tribe of Cochin China (now South Vietnam) with a tail one foot long (30.5 cm). This length greatly exceeds any of the better documented cases of our series but was not included because verification was lacking. Other groups with purported high frequencies of caudal appendages included a tribe of Indians in Paraguay[38] and several cases of hairy growths in the sacral region of recruits in the Greek army.[3] We are uncertain of the exact nature of these lesions and therefore did not include them in our study.

Anatomic Location

In most cases, the vestigial tail was attached to the skin of the sacrococcygeal region close to the midline; in three instances[15,22,24] it was in the lumbar region. The tail could be as much as 1.5 cm to one side.[29] Pseudotails were also usually coccygeal, but in the unique case of a parasitic fetus the pseudotail was in the lumbar region.[20]

Gross Appearance and Movement

Vestigial tails were described as resembling a penis, finger, sausage, pigtail, stump, or elephant's trunk. They were often covered by pigmented and hairy skin. Short, stubby tails were straight, but longer ones were usually curved and twisted upward or to one side. The length ranged from 3 to 13 cm, the diameter from 0.7 to 3 cm. The skin at the base was superficially ulcerated in a few cases.

Movement or contraction of the tail was recorded in six cases, including ours[5,8,9,13,19]; information was not given in the other instances. Harrison[8] wrote the most detailed description: the tail contracted when the child was irritated and cried or coughed. The middle and distal segments had considerable movement between them. The distal portion could be drawn in sharply, telescoping the middle segment and making the tail shorter and thicker.

Pseudotails were often short, stump-like, and occasionally "bulging." One "occult" pseudotail was completely covered by the buttocks.[12] The parasitic fetus described by Jolly[20] is unique in the annals of tails. It was long, thin, and cylindric, arose at the L3–L4 level, curved to the right around the abdominal wall, and finally attached to the right iliac fossa.

Microscopic Appearance

Persistent vestigial tails contain a central core of mature fatty tissue divided into small lobules by thin fibrous septa. Small blood vessels and nerve fibers are scattered throughout. Bundles of longitudinally arranged striated muscle fibers aggregate in the center and are sometimes degenerated. The surface is covered by skin with normal hair follicles and sweat glands. The dermis usually is thicker than normal. Robeson and Dickey[11] reported the unusual finding

of well-developed neurons, glial fibers, and calcification in what was diagnosed as a glioma. Their description otherwise did not differ from that of most vestigial tails.

Tissues identified in pseudotails include teratomatous components of the embryonal kidney type,[16] adipose tissue in lipomas,[17,22] and cartilage in a case of hyperplastic chondrodystrophy.[27]

Bonafide cases of human tails containing bone have not been documented. The atavistic tail noted by Bartels[1] probably has never occurred in human beings. Three reports should be considered with respect to this question. Gould and Pyle[38] mentioned a 22-year-old Turkish man described in 1820 and said to have four vertebrae in the tail. We eliminated this case because verification of the statement was lacking. Radiographic evidence of a human tail containing three vertebrae was found in a second case.[14] The total number of vertebrae in this patient, however, was normal. The appendage resembled an abnormally long coccyx; the last two coccygeal vertebrae were in the excised specimen. The third case was an "occult" tail formed by a coccygeal bone, 8 inches long.[12] Radiographically, it contained six distinct segments. The protrusion was fully covered by the soft tissue of the buttocks and was not seen externally; hence the term occult. We consider both these recent cases to be pseudotails related to protrusion of anomalous coccygeal bones, and not tails with additional vertebrae.

Associated Anomalies

Associated congenital anomalies were observed in five cases (22 per cent) of vestigial tails and in five of the ten cases of pseudotails. There were four cases of spina bifida, two with true tails and two with pseudotails. There was one case each of cleft palate, clubfoot, von Recklinghausen's disease, syndactyly of the right fourth and fifth toes, and abnormally small left fourth toe. Spina bifida is the most frequent coexisting anomaly.

Rate of Growth

The rate of growth of the tail was recorded in three instances. In Harrison's case, the length was 4.4 cm when the patient was 2 weeks old, 5 cm at 2 months, and 7 cm at 6 months.[8] Growth of the tail was said to be proportionate to that of the infant. In Lundberg and Parson's case,[19] the tail was 2 cm long at birth, and 5 cm at 3 months of age. In our case, the tail gained 1 cm in length in two weeks. The rate of growth, therefore, ranges from 1 to 5 mm per week.

Family History

Siblings were not mentioned in most reports. Indeed, two authors have denied the existence of familial cases.[25,29] Wilson's patient,[2] however, had a brother with a tail. Our patient had a maternal grandmother whose tail was said to have been removed in childhood.

In Reynold's case,[12] spina bifida was noted in one sibling. One patient had a twin sister who was reportedly normal. Cleft palate in the mother of a child with a tail was cited by Lundberg and Parsons.[19]

Treatment and Outcome

Surgical removal of the appendage was performed in 21 cases, without complications. These patients all recovered and had no ill effects from the operation. Reasons for not treating the others were given only in the case of an Indian boy with a tail 3 1/2 inches long, whose parents earned money exhibiting the child.[9]

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