Cleft Palate in a Marmoset: Report of a Case

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In 1966 the Cleft Palate Research Center of the University of Pittsburgh was given a number of spontaneously aborted marmoset fetuses for use in comparative studies of dental morphology. These specimens were the gift of the Institute for Dental Science of the University of Texas Dental Branch and were the product of a marmoset colony used by the Institute for the study of periodontal disease. Very little is known about the fetuses but it is believed that they were the fruit of pregnancies in normal mothers subjected to no special environmental insults and derived from no particularly inbred strain. Upon their arrival in Pittsburgh the fixed fetuses were imbedded, sectioned, and stained with a modified trichrome technique (*4*). A cleft of the secondary palate in one animal was discovered during routine microscopic examinations of the histologic sections. The presence of the cleft was not suspected until sectioning of the specimen had been completed; therefore cephalometric studies and photographs of the intact animal do not exist.

The cleft specimen is of scientific interest because it is believed to be the first of a nonhuman primate to be prepared for histologic analysis. Although records of clefts in nonhuman primates are not given in the standard indices of the medical and biological literature, at least two clefts in monkeys have been mentioned in articles dealing primarily with other subjects. Hill (*2*) in a report of deaths in 1953 at the Regents Park Zoo stated that a common marmoset, *Calathrix jacchus* (*Hapale jacchus*), one of twins, succumbed at the age of one week from inability to feed and parental abandonment and was found to have a cleft palate on autopsy. Schultz (*6*) showed drawings of a one week old capuchin monkey with a cleft primary palate. It is likely that clefts in nonhuman primates are not as uncommon as the paucity of published records might lead one to believe; surely many unreported specimens have been observed in menageries.

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FIGURE 1. *Saguinas fuscicollis*, the species of marmoset in which a cleft palate has been discovered (photograph courtesy of Dr. Philip Hershkovitz, Field Museum of Natural History, Chicago).

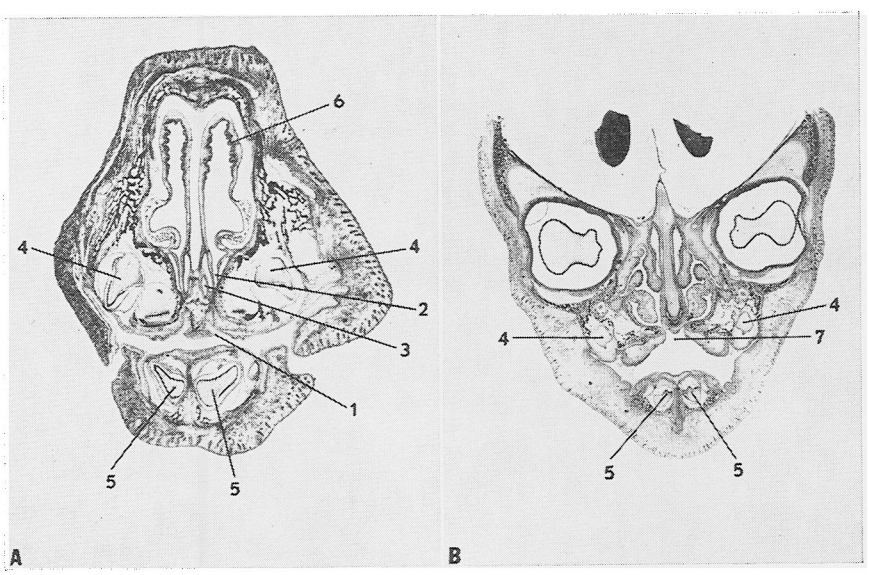

FIGURE 2. Comparative frontal sections of the cleft marmoset (A) and a 16–18 week human fetus with the Pierre-Robin syndrome (B). The sections pass through the incisive foramen. Key: (1) oral orifice of nasopalatine duct, (2) nasal origin of nasopalatine duct, (3) organ of Jacobson near its junction with the nasopalatine duct, (4) maxillary canine teeth, (5) mandibular central incisors, (6) olfactory epithelium, (7) anterior extremity of palatal cleft.

Marmosets are the smallest of all living monkeys. Their precise position on the evolutionary scale is disputed (*3*). They are quick moving, diurnal, arboreal, insect and fruit eating animals indigenous to the tropical rain forests of Latin America. *Saguinas fuscicollis*, the species to which our cleft specimen belongs, is illustrated in Figure 1. Although readily domesticated, marmosets are quite frail in cooler climates and the maintenence of laboratory colonies in the temperate zones requires skill, experience, and the most modern equipment for control of temperature and humidity. Supplementary ultraviolet irradiation is considered essential (*1, 7*).

Remarkably little is known about marmosets. The gestation period is believed to be about five months and the usual birth weight is in the neighborhood of 30 grams. The cleft specimen is believed to have been aborted at about 3½ months. It weighed 12.8 grams prior to sectioning, less than half the accepted normal birth weight. The weight

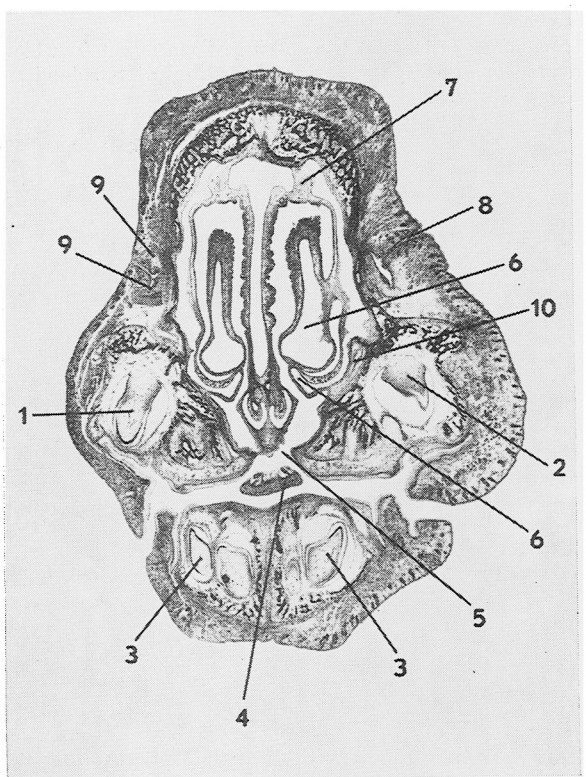

FIGURE 3. Frontal section of the marmoset specimen at the anterior extremity of the palatal cleft. Key: (1) right maxillary canine tooth, (2) left maxillary deciduous first molar tooth, (3) mandibular lateral incisors, (4) tip of tongue, (5) anterior extremity of palatal cleft, (6) turbinates, (7) olfactory nerve, (8) palpebral fissure, (9) lacrimal canaliculi, (10) nasolacrimal duct.

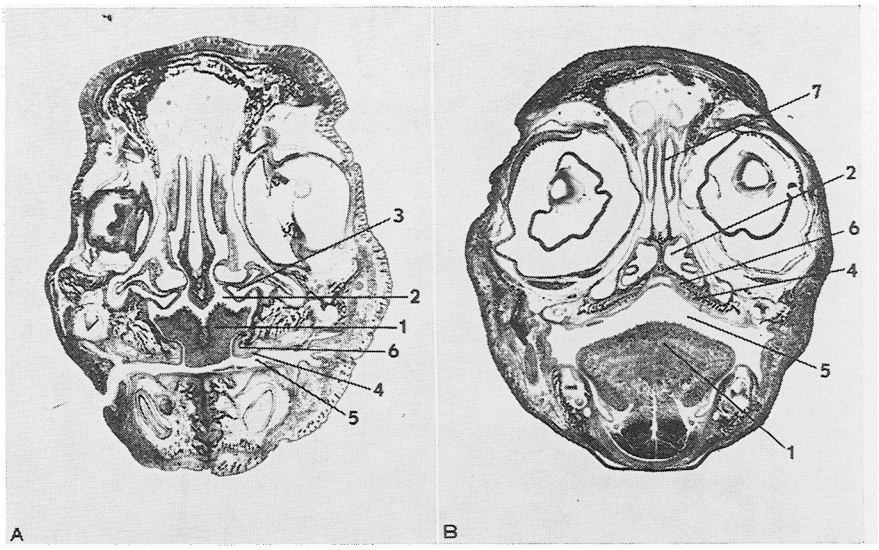

FIGURE 4. Comparative sections of the cleft marmoset (A) and a similarly sized normal marmoset (B) taken from the level of the junction of the maxillary and palatine bones. Key: (1) tongue, (2) nasal cavity (regio respiratoria), (3) inferior turbinate, (4) maxillary bone, (5) oral cavity, (6) palatine bone, (7) nasal cavity (regio olfactoria).

of the adult is reported to vary from 170 to 250 grams, the size of a small rat.

Comparisons of frontal sections of the cleft marmoset with those of a 16 to 18 week cleft human fetus show interesting similarities. Sections from the level of the incisive foramen are shown in Figure 2. At this level the marmoset specimen is normal. Because the cleft in the marmoset does not extend as far anteriorly as the incisive foramen, the anomaly can be considered an incomplete cleft of the secondary palate. The defect in the human specimen is complete. The human fetus used in the comparison is a proved example of the Pierre-Robin syndrome and has been reported in the literature previously (*4, 5*). In the human specimen it is to be noted that the small mandible with its receding chin brings the mandibular central incisor teeth into the same frontal plane as the maxillary canine teeth. Casual inspection of the marmoset section might lead one to conclude that this specimen also is an example of cleft associated with mandibular hypoplasia. However, there is reason to believe that the marmoset sections are not truly frontal but oblique, with the superior aspects more posterior than the inferior and the left margins more posterior than the right. It is likely, then, that the appearance of mandibular hypoplasia seen in the marmoset sections is an artifact of the sectioning procedure.

The anterior extremity of the marmoset cleft is shown in Figure 3.

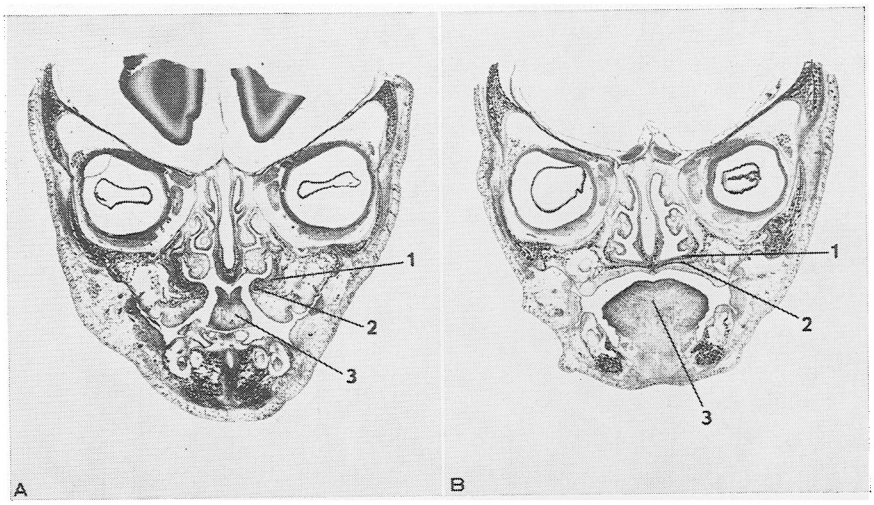

FIGURE 5. Comparative sections of the 16–18 week human Pierre-Robin specimen (A) and a 16–18 week human normal (B). Key: (1) palatine bone, (2) maxillary bone, (3) tongue.

At this level there is complete discontinuity of the left palatal shelf and vomer although there is a delicate strand of tissue connecting the right palatal shelf and vomer. The tip of the tongue can be seen coming into view. The visible teeth are identified for orientation. In studies of marmoset embryos it is important to remember that the dental formula for these animals differs from that of humans. On each jaw the marmoset has three deciduous molars and three premolars, but only two permanent molars.

Comparative sections of the cleft marmoset and a normal animal of similar size taken at the level of the junction of the maxillary and palatine bones are shown in Figure 4. Of particular interest is the tongue-in-nose configuration seen in the cleft marmoset specimen and often seen in the human Pierre-Robin patient.

Comparative sections of the human Pierre-Robin fetus and a normal human specimen of similar size are shown in Figure 5. These human sections are to be compared with the marmoset sections of Figure 4. Although there are similarities between the marmoset cleft and the human Pierre-Robin specimen at this level, it is to be emphasized that the diagnosis of Pierre-Robin syndrome in this marmoset cannot be substantiated.

Conclusions

Man's primate relatives are not immune to clefts, as some previously have supposed. The possibility presents itself that laboratory investigation of clefts can be carried out in primates.

Summary

Details of the first known study in histologic section of a cleft palate in a nonhuman primate are presented. Two other known clefts in monkeys are cited.

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