

Observations on the Pathology in a Colony of Cleft Palate and Cleft Lip Dogs*

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Studies on the incidence, etiology and genetic aspects of spontaneous cleft lip and palate in dogs and, to a great extent, in rodents have stressed the hypothesis that environmental factors can influence the expression of a cleft in the (genetically) susceptible subject. Moreover, it has been established that these spontaneous defects are not so lethal in the dog, thus making this animal suitable for quantitative studies and evaluation (1, 3, 4).

Several genetic studies on spontaneous cleft palate have been reported in dogs and other investigators have described surgical correction, but there is a lack of information in the literature regarding other congenital malformations associated with cleft palate and cleft lip in this species (2). However, in humans, available data indicates a higher incidence of additional malformations in the cleft palate population as compared to the non-cleft groups (5). On the other hand, there is evidence indicating a need for further evaluating studies in humans since the reported incidence of congenital malformations among cleft palate populations range from 3% to 33%, which appears to be equivocal (5).

This paper summarizes the pathological findings in a cleft palate and cleft lip colony of dogs and presents the main causes of death. Special reference is made to congenital anomalies associated with cleft palate and cleft lip. Our observations suggest the importance of clinical examination for malformations associated with cleft lip and palate before determining whether or not surgical correction should follow.

General Methodology

Over a period of 4 years a breeding (admixture) colony of cleft palate and cleft lip and palate as well as phenotypically normal dogs, with a reported history of cleft lip and/or cleft palate in their ancestry, was maintained at Duke University Medical Center. Mongrel dogs and a variety of breeds were acquired for: 1) genetic studies in spontaneous cleft

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TABLE 1. Main causes of death in a colony of cleft lip and palate dogs.

<i>cause of death</i>	<i>frequency</i>
undetermined.....	12
bronchopneumonia.....	9
sacrificed for experimental purposes.....	3
cerebral contusion.....	1
pancreatic islet cell carcinoma.....	1
hepatitis.....	1
acute gastric dilatation.....	1
lung abscess.....	1
insecticide intoxication.....	1
aspiration pneumonia.....	1

palate with or without harelip; and 2) development of new surgical techniques for correction of these anomalies.

Adult animals in the colony were maintained on dry dog food and water ad libitum. The animals were housed in two different ways:

- 1) Some animals were kept individually in 36 x 36 x 36 inch galvanized cages. Shavings were used as bedding. Litter pans were changed daily and cages washed weekly. The temperature in the animal rooms was maintained at 25°C and the humidity was controlled at 50–60%.
- 2) Other animals were housed in indoor-outdoor runs. The indoor runs were temperature controlled. Runs were washed daily.

Animals born with cleft palate were fed artificial dog's milk (Esbilac¹) every 4 hours via stomach tube. They were maintained in a premature infant isolater.

Twenty-eight dogs died during the four-year period and 3 were sacrificed while in apparent good health for experimental purposes. Complete anatomical studies were done on each animal. Appropriate samples of major organs were fixed in 10% buffered formalin. After embedding in paraffin, sections were cut at 5 microns and stained with hematoxylin and eosin.

Findings

Table 1 illustrates incidence and main causes of death among animals in the colony. Nine out of 31 animals (29%) died from bronchopneumonia. In most instances, streptococci were cultured from the lungs. There were 12 cases, in which the cause of death could not be determined at necropsy.

Table 2 presents all major pathologic findings including those with cleft palate, cleft lip and/or other anomalies. Out of 21 dogs (12 males and 9

¹ A replacement for bitch's milk, manufactured by the Borden Company of New York.

TABLE 2. Major pathological findings in dogs with cleft palate, cleft lip and/or other anomalies.

<i>animal no.</i>	<i>breed</i>	<i>age at death</i>	<i>sex</i>	<i>cleft palate</i>	<i>cleft lip</i>	<i>other anomalies</i>	<i>other major pathological findings</i>
1	dachs. (LH)	4D	F	yes	no	none	bronchopneumonia
2	dachs. (LH)	1M	F	yes	no	hydrocephalus (intern.)	none
3	dachs. (LH)	8Y	M	no	no	congenital cataracts	pulm. adenoma, acute dermat.
4	dachs. (LH)	5D	F	yes	no	none	bronchopneumonia
5	dachs. (LH)	2Y	F	no	no	congenital cataracts	none
6	dachs. (LH)	1Y	M	yes	no	none	none
7	beagle	6D	M	yes	no	none	pulm. congestion with edema, ocular abscess
8	beagle	2M	F	no	no	stomach	bronchopneumonia, lymphadenitis
9	beagle	3M	M	no	no	spleen	bronchopneumonia
10	beagle	3M	M	no	no	unilat. renal agenesis	focal mycard. calcif., pulm. hemorrhage
11	boxer	5W	M	yes	yes	hydrocephalus (intern.)	interstitial pneumonia
12	boxer	7Y	M	no	yes	retained testicle	nodular hyperplasia, mitral valve
13	boxer	8Y	F	no	yes	hydrocephalus (intern.)	aortic body tumor
14	Maltese	2W	F	yes	no	hydrocephalus (intern.)	none
15	Maltese	10D	M	yes	no	hydrocephalus (intern.)	none
16	mixed	3Y	M	yes	no	none	none
17	mixed	7Y	M	no	yes	none	cystic hyperplasia, prostate
18	Eng. S. Sp.	3M	M	yes	no	none	bronchopneumonia
19	Weim	6D	M	yes	no	none	hepatitis, ocular abscess
20	poodle	1½Y	F	yes	no	none	cerebral contusion, pyeloneph.
21	Eng. bull	5Y	F	yes	no	hydrocephalus (intern.)	atrophic uterus

D = day, W = week, M = month, Y = year, dachs. (LH) = long haired dachshund, Eng. S. Sp. = English springer spaniel, Weim = Weimaraner.

TABLE 3. Major pathological findings in dogs without cleft palate, cleft lip and/or other anomalies.

<i>animal no.</i>	<i>breed</i>	<i>age at death</i>	<i>sex</i>	<i>major pathological findings</i>
1	beagle	10D	F	atelectasis, hepatic fatty degeneration
2	beagle	2½M	F	bronchopneumonia
3	beagle	3M	F	bronchopneumonia
4	beagle	8Y	F	pancreatic islet cell carcinoma with hepatic metas.
5	beagle	6Y	F	bronchopneumonia, interstitial nephritis, lymphad.
6	beagle	3M	M	bronchopneumonia
7	beagle	3M	M	pulmonary congestion with edema, lymphadenitis
8	Boston	10D	M	none
9	Boston	6Y	F	none
10	boxer	2D	F	pulmonary abscess

D = day, M = month, Y = year, metas. = metastases, lymphad. = lymphadenitis.

TABLE 4. Distribution of associated malformations and other anomalies observed in a colony of 31 dogs.

<i>animal no.</i>	<i>breed</i>	<i>cleft palate</i>	<i>cleft lip</i>	<i>cleft palate and lip</i>	<i>hydrocephalus</i>	<i>other anomalies</i>
11	beagle	1	—	—	—	3
6	dachs.	4	—	—	1	2
4	boxer	1	3	1	2	1
2	Maltese	2	—	—	2	—
6	others	5	1	—	1	—

females with ages ranging from 6 days to 8 years), 13 had cleft palate, 4 demonstrated cleft lip and one case had both defects. Internal congenital hydrocephalus was present in 6 cases. In 6 animals, anomalies other than cleft palate, cleft lip or hydrocephalus were present. Pneumonia was a frequent finding in these animals.

Table 3 demonstrates major pathologic findings in those animals without cleft palate, cleft lip and/or other anomalies. There were seven females and 3 males with ages ranging from 2 days to 8 years. Seven of the 10 animals in this group were beagles. Pneumonia was also frequent among beagles in this group (4 cases).

Comprising data from tables 2 and 3, distribution of associated malformations and other anomalies observed in the colony is summarized in table 4. As stated earlier, there was a total of 13 dogs (41.9%) who demonstrated cleft palate, 4 cases (12.9%) with cleft lip and only 1 case, a 5-week old male boxer, who showed both defects. There was a total of 6 cases with internal hydrocephalus. Also noteworthy, was the fact that none of the 11 beagles included in this study showed hydrocephalus. Only 6 cases showed anomalies other than cleft palate, cleft lip and hydrocephalus.

Summary

During a period of 4 years, a colony of cleft palate and cleft lip phenotypes and phenotypically normal dogs, with a reported history of malformation in their ancestry, was maintained at Duke University Medical Center. Of 31 dogs included in this study, twenty eight died and 3 were sacrificed during this period. Complete anatomical studies were done on each animal. Pathologic findings with special reference to congenital anomalies associated with cleft palate and cleft lip are reported. The importance of clinical examination for malformations associated with cleft palate and cleft lip prior to surgical correction is emphasized.

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