Weight Gain in Children with Cleft Palate From Birth to Two Years

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The weights from birth to 2 years of 77 babies with palatal clefts were compared with the weights of normal babies (Pomerance, 1979). Babies with clefts did not differ from normal infants in mean birth weight, but they lagged behind thereafter. Males were more impaired than females.

Weight gain in infants with palatal clefts has been a major concern to both clinicians and parents. It has been assumed that such babies gain poorly in the early months of life because of low birth weight, feeding problems, psychosocial dynamics, the effects of associated malformations, or some combination of these factors. However, available data confuse rather than clarify the issue.

A number of studies (Hospital for Sick Children, 1960; Drillien et al, 1966) have suggested a lowered mean birth weight for infants with clefts, especially when associated malformations are present (Lutz, 1959). Ranalli and Mazaheri (1975) did not support those findings. The Hospital for Sick Children (1960) also concluded that children with clefts have impaired physical development, but Avedian and Ruberg (1980) reported that "catch up" occurred by 6 months of age.

The objective of this study was to compare weight gain in the first 2 years of life of children with palatal clefts with that of normal children in an effort to determine the need for more extensive growth studies, which are now being contemplated.

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PROCEDURE

Subjects

Data for this study are based on weights from birth to 2 years for 77 Caucasian babies with clefts born between January 1, 1975, and December 31, 1979. Eighty-three additional children were excluded from the study because they had other congenital anomalies in addition to clefting or there were other limiting factors, such as travel time. Fifty of the 77 children (65 percent) were males, and 27 (35 percent) were females. Twenty-nine children (38 percent) had clefts of the secondary palate only; 48 (62 percent) had clefts of the primary and secondary palates. Data for normal children were taken from Pomerance (1979).

The socioeconomic status of the families was based on the Hollingshed Scale as reflected by the father's occupation, and the distribution was comparable to that of the normal sample.

Protocol for Collecting Weights

As a part of a long-term, longitudinal study of otitis media, the weights of infants with clefts were recorded periodically by the pediatric staff at the Cleft Palate Center, University of Pittsburgh. Each child was seen once a month in the first 6 months of life, bimonthly during the second 6 months, and at least once every 3 months thereafter. Some patients obviously missed appointments or came earlier or later than the times specified. This led to missing and mistimed weights for some children and resulted in a variable number of observations at each age level from birth to 2 years.

Statistical Methods

Comparison of weight gain between the two groups was done by the percentile method. Weights of children with clefts were converted to percentiles on the basis of NCHS normative statistics (National Center of Health Statistics, 1976). McNemar's test was used to assess the statistical significance of change in the percentile values from birth to 24 months of age. For some children, the latest weights available were between 20 and 24 months, and those weights were used in the study.

Monthly weights from birth to 2 years for normal children and those with clefts were compared using an ordinary t-test.

RESULTS

Table 1 shows the distribution of normal subjects and those with clefts, males and females, at each age from birth to 24 months, along with the mean weights and standard deviations. Figure 1 suggests that males with clefts do not differ from normal males in birth weight. However, a statistically significant difference ($p = 0.001$) was found between the birth weights of the normal and cleft males. The actual difference between the means was less than one-quarter of a kilogram and was not thought to be clinically significant. From 1 to 24 months, however, the mean weights of normal males were at consistently higher levels than the mean weights of males with clefts (see Table 1 and Figure 1).

The mean weights at birth for normal and cleft females were not different ($p = 0.33$). Thus for both males and females, the average weights for the normal and cleft groups at birth did not differ to a clinically significant extent. Although the subsequent mean weights for females with clefts were lower than for normal females, the differences did not reach significance ($p = 0.05$) at most age levels (see Table 1).

It should be noted that 17 means for males and 17 means for females were compared by the t-test. Thus, there is a 58 percent chance for both males and females of falsely detecting at least one significant difference when, in fact, none exists. This calculation uses Bonferroni's approach and assumes an initially stated significance level of 0.05. If each mean is tested at the 0.05 level, then thirteen means are significant for males and six for females (see Table 1). In order to maintain an overall alpha risk of 0.05, each difference of the means in Table 1 can be evaluated at the 0.003 level. Nine of the comparisons for males and two for females were significant at the 0.003 level as shown in Table 1. The remaining

TABLE 1 Monthly Mean Weights and Standard Deviations in Kilograms for Normal Males and Males with Clefts and Normal Females and Females with Clefts During 24 Months of Life

	Normal Males+		*Males with Clefts*			*Normal Females*		*Females with Clefts*		
Age (Mo)	*N*	*Means±SD*	*N*	*Means±SD*	*p-values*	*N*	*Means±SD*	*N*	*Means±SD*	*p-values*
0	1951	3.29±0.43	50	3.51±0.50***	0.008	1786	3.17±0.42	27	3.25±0.47	
1	1487	4.17±0.49	35	3.87±0.57***	0.008	1377	3.95±0.43	13	3.75±0.57	
2	1387	5.31±0.57	34	4.79±0.62**	0.000006	1250	4.20±0.54	15	4.26±0.55	
3	1272	6.20±0.62	23	5.63±0.68**	0.001	1185	5.71±0.64	16	5.11±0.72**	0.0002
4	1206	6.95±0.69	34	6.16±0.64**	0.0000002	1092	6.40±0.69	15	5.87±0.84*	0.03
5	1124	7.59±0.78	27	6.81±0.78**	0.00004	1032	7.01±0.78	10	6.47±0.73	
6	1116	8.14±0.83	26	7.17±0.76**	0.000002	1008	7.53±0.82	21	6.89±0.73**	0.0004
7	1033	8.62±0.91	23	7.83±1.01**	0.0009	917	8.01±0.89	10	7.39±0.94*	0.03
8	979	9.05±0.98	22	8.49±1.09*	0.03	895	8.42±0.94	13	7.79±0.81*	0.02
9	956	9.43±1.04	20	8.34±0.68**	0.0001	844	8.81±1.02	11	8.31±0.56	
10	919	9.76±1.06	17	8.81±0.75**	0.002	808	9.11±1.02	10	8.39±1.09	
11	900	10.04±1.10	9	9.47±1.23		846	9.44±1.08	7	8.54±0.89	
12	1323	10.35±1.14	30	9.64±1.30		1210	9.70±1.11	15	9.19±1.08	
13			14	9.64±1.21				2	9.00±0.57	
14			12	10.24±1.43				5	9.96±1.40	
15	864	11.39±1.21	12	10.18±1.22***	0.006	815	10.43±1.23	7	9.19±0.89*	0.04
16			9	10.83±1.48				6	10.22±1.53	
17			10	10.81±1.60				4	10.13±1.28	
18	656	11.54±1.28	11	10.83±1.29		618	11.03±1.33	11	10.20±1.20	
19			13	11.41±1.51				5	11.48±2.92	
20			12	11.19±0.77				3	9.80±0.35	
21	492	12.16±1.39	12	10.54±1.51**	0.00008	468	11.57±1.48	4	11.38±1.45	
22			12	12.00±1.94				4	11.55±2.05	
23			7	12.46±1.79				5	10.36±0.98	
24	671	12.68±1.47	12	11.59±0.92		661	12.12±1.51	11	11.53±0.96	

* Significant at 0.05 level
** Significant at 0.003 level
*** Significant at 0.008 level
\+ Source: Growth standards in children, Pomerance (1979)

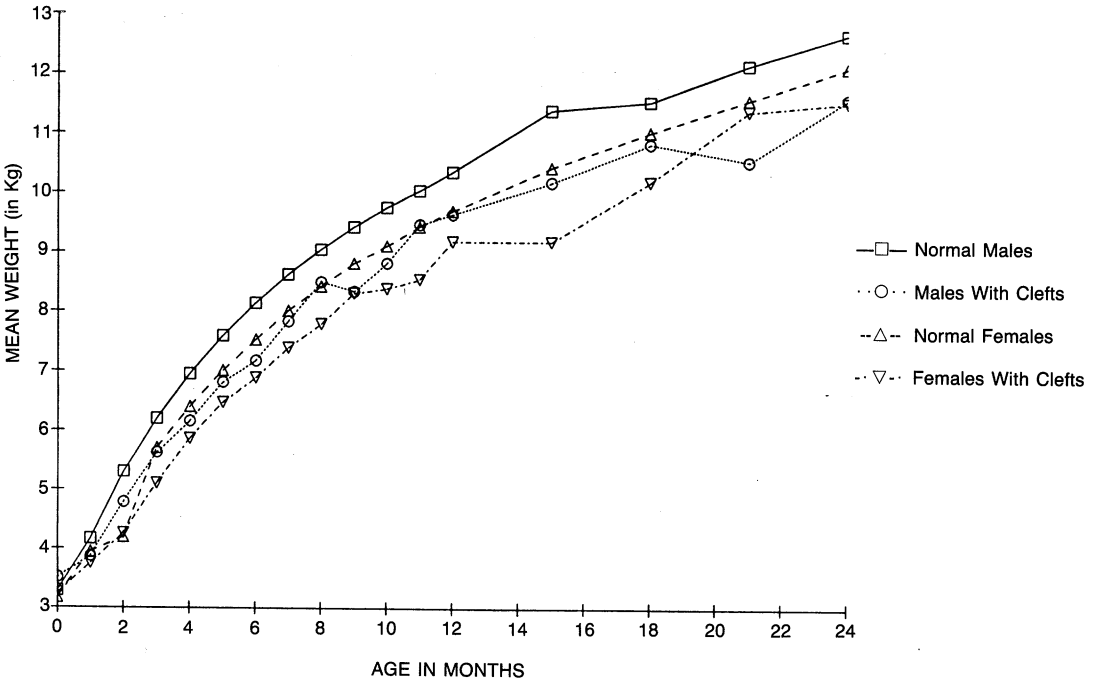

FIGURE 1 Mean weights for normal males and females and males and females with clefts from 0 to 24 months of age.

eight differences in means were significant at the probability values 0.008 and 0.02 ($0.008 \leq p \leq 0.02$, Table 1). It should be noted that Bonferroni's correction is overly conservative.

For computing the change in the percentile weight of a child from birth to 24 months, we would have preferred to measure each child's weight at exactly 24 months, but it was not always possible to do so. Weights taken between 20 and 24 months were, therefore, used as a satisfactory approximation. Sixty-one of the 77 children with clefts were actually weighed between 20 and 24 months, and these weights were used for computing the changes in percentiles. This was an arbitrary decision made to utilize data on the maximum number of children.

Table 2 shows the weight percentiles relative to NCHS normative data at birth and at 20 months or beyond for these 61 children. Of the 40 males, 21 (52.5 percent) were below the 50th percentile at birth. This number increased to 32 (80.0 percent) at or beyond 20 or more months of age. This was statistically significant ($p = 0.02$). Twelve (57.1 percent) of the 21 females were below the 50th percentile at birth, and this number had increased to 14 (66.7 percent) 20 or more months later ($p = 0.72$).

Thirty-one males (77.5 percent) and 15 females (71.4 percent) had lower relative percentile weights at 20 or more months than they had at birth (Table 3). Of these, 12 males (30.0 percent) and six females (28.6 percent) lost between one and 20 percentile points; 14 males (35.0 percent) and seven females (33.3 percent) lost between 20 and 50 percentile points; and five males (12.5 percent) and two females (9.5 percent) lost more than 50 percentile points by 20 months of age (Table 3).

The mean percentile weight at birth for all 50 males with clefts was 52 with a SD of 27. The mean percentile weight dropped to 35 with a SD of 25 at the last observations. The mean percentile weight at birth for all females with clefts was 50 with a SD of 27. The mean percentile weight dropped to 36 with a SD of 29 at the last observations.

Sixteen children (10 males and six females) were not weighed at or beyond 20 months of age. If we limit our analysis to the 61 children

TABLE 2 Number of Subjects in Each of Six Percentile Categories at Birth and at Least 20 Months Later Based on the NCHS Normative Data

	At Birth				*≥20 Months Later*			
Percentile	*Male*		*Female*		*Male*		*Female*	
Weight	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*
<3	0		0		1	2.5	1	4.8
3–25	10	25.0	4	19.0	18	45.0	9	42.9
25–50	11	27.5	8	38.1	13	32.5	4	19.0
50–75	10	25.0	5	23.8	4	10.0	3	14.3
75–97	7	17.5	3	14.3	2	5.0	4	19.0
≥97	2	5.0	1	4.8	2	5.0	0	
Total	40		21		40		21	

TABLE 3 Number of Subjects Showing Change in Percentile Weight at Least 20 Months After Birth

	Decrease In Percentile Weight								*Increase In Percentile Weight*					
	>50		*20–50*		*1–20*		*No Change*		*1–20*		*20–50*		*>50*	
Sex	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*
M (N=40)	5	12.5	14	35.0	12	30.0	1	2.5	4	10.0	2	5.0	2	5.0
F (N=21)	2	9.5	7	33.3	6	28.6	1	4.8	3	14.3	—		2	9.5

weighed at or beyond 20 months, the numbers do not change appreciably. The mean percentile weight at birth for the 40 male children was 51 with a SD of 27. These numbers dropped to 33 and 24 respectively at or beyond 20 months. The mean percentile weight at birth for the 21 females was 49 with a SD of 27. These numbers dropped to 35 and 29 respectively at or beyond 20 months of age.

The variability in weights as reflected in the standard deviations of percentile weights at birth and at or beyond 20 months, may be specific to the cleft population. Infection, medical and surgical intervention in early life, and genetic factors might have added to the amount of fluctuation in weights resulting in large SDs. Measurement errors and sample size also might have contributed to the variability in weights.

In the computation of mean percentile weights, children falling above the 97th percentile were considered to be at the 97th percentile since extrapolation beyond the 97th percentile in NCHS tables is unreliable. One female and two males were above the 97th percentile at birth. These three children had dropped to lower percentiles by their final weighing. The female child had dropped to the 42nd percentile at 23 months. One of the two males had dropped to the 77th percentile at the 24th month and the other one to the 81st percentile at 23 months.

DISCUSSION

It is well documented that a child's weight gain is influenced by birth weight. If children with clefts had had low birth weights compared to normal children, the causes of the low birth weights would have had to be examined in order to understand impaired weight gain in this population. While it has been noted previously that children with cleft palates often have low birth weights (Lutz, 1959; Drillien et al, 1966), this was not the case in our sample. Statistical significance ($p = 0.001$) between birth weight of the male children with clefts and the normal male children could very well have resulted from the difference in sample sizes of the two groups (see Table 1). There is an average difference of less than a quarter of a kilogram (3.29 kilograms vs 3.51 kilograms or 7.24 pounds vs 7.72 pounds) in birth weights between the two groups. This difference is not a biologically significant difference. Also, the mean percentile weight at birth for males was 52 and, for females, 50. Thus, since low birth weight was not a primary factor, these children should not have been at increased risk for impaired weight gain in the first 2 years of life unless other conditions prevailed.

Another factor which could influence both birth weight and subsequent development is prematurity, which occurred in 5.2 percent of our babies. Babies with birth weights of less than 2,500 g were considered to be premature. This percentage is lower than the 6.5 percent reported by Drillien et al (1966) for the normal population and than the 6.5 percent of the premature live births in Pennsylvania for 1980 (Pennsylvania Vital Statistics, 1982) using the same criterion. Interestingly, all four premature babies were female. Two of these four babies were at the 83rd and the 91st percentiles when their weights were finally recorded at 22 months. One of the four was at the 7th percentile at 11 months, and the other one was at the 3rd percentile at 23 months.

In the present study, the weight percentiles found at birth for males and females with clefts had declined significantly 20 months after birth. The average weight percentile for males dropped from 51 to 33 and for females from 49 to 35. This is a drop of 35.3 percent for males and of 28.6 percent for females. At least 71 percent of both males and females had lower relative percentile weights at 20 to 24 months than they had at birth.

The differences in mean weights of normal male children and male children with palatal clefts are quite marked and are maintained throughout the 2-year period of the study, but the differences between the mean weights of normal females and females with palatal clefts were not as marked as for males (Fig. 1 and Table 1). Throughout the 2-year period, there was a trend toward lower average weights for the males and

females with clefts compared to the normal males and females. The average weight for the males with clefts at 15, 21, and 24 months and at 15 months for the females with clefts was lower by more than a kilogram compared to the normal children.

It appears that males with palatal clefts are more impaired in weight gain than are females in the first 2 years of life. The reasons for this are not clear.

Possible causes of poor weight gain unrelated to low birth weight include nutritional and feeding problems. However, in our Center, such problems are minimal because there is careful parent education and continuous monitoring of the children by the pediatric staff. Thus, other causes must be explored.

One possibility is middle-ear disease. There is no controversy regarding the increased occasions of middle-ear problems in these children. This may possibly contribute to impaired weight gain. Studies of infection and growth have been reported in the literature (Cole and Parkin, 1977; Black et al, 1982; Baumgartner and Pollitt, 1983). No such study is available for children with palatal clefts, who often have ear disease without infection. Such information will be available at the conclusion of the longitudinal study from which the present data were taken.

Genetic influences on a child's growth can be assessed through family history and adjusting the physical measurements of the child to those of his or her natural parents. This is work that should be attempted in the near future.

In view of the embryologic relationships of the lip, palate, and adenohypophysis, it seems possible that, if below average weights and heights are found in this population, they may result, in some cases, from growth-hormone deficiency. There are reports in the literature of the association of growth-hormone deficiency and cleft lip, cleft palate, or both (Frances et al, 1966; Laron et al, 1978; Rudman et al, 1978; and Stewart et al, 1983). A much higher frequency of growth-hormone deficiency in this population, compared to a normal population, was reported by Rudman et al (1978). These possibilities require systematic study. Children who begin life with low birth weights should also be carefully evaluated as a subgroup of the cleft population.

CONCLUSIONS

This study supports a lag in weight gain of cleft children compared to normal children over a period of 2 years. These data do not support previous reports of catch-up gains in weight in the first 2 years.

Work designed to minimize the limitations of this study is indicated as is exploration of factors which might influence weight gain and physical growth in this population.

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