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The clinical pattern of cretinism as seen in highland Ecuador[1]

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Nutritional iodine deficiency is firmly established as a principal, if not the only cause, of endemic goiter. Almost without exception, a mean daily intake of less than 40 μg of iodide is found whenever significant enlargement of the thyroid is found in more than 15 to 20% of periadolescent children. Only in the Cauca valley of Colombia has significant endemic goiter been found in spite of seemingly ample iodine intake. Auxiliary dietary or genetic factors probably modify the prevalence or the expression of the disease.

Wherever endemic goiter is severe, one usually encounters persons retarded in stature and intellect, often with profound neurological signs and deafness, who are traditionally called "cretins." In such regions, one is often impressed that there are an increased number of persons with short stature or subnormal intellectual attainment, but who do not show the more severe changes usually associated with cretinism. Endemic retardation gives importance to endemic goiter as a world health problem, but the clinical spectrum of endemic retardation has not been fully described.

In the rural villages of the Ecuadorian Andean provinces most affected by goiter, many defective persons are found who exhibit pronounced mental deficiency, severe impairment in hearing and speech, short stature, and motor abnormalities. Others are similar except for normal stature and gait (1–3). Most of these subjects do not appear to be hypothyroid. They have been designated cretins for the following reasons. They are found in a region where iodine deficiency is severe. (Protein-calorie malnutrition is also severe in this area.) In appearance many conform to the classic description of cretinism in Switzerland and elsewhere. Although all do not exhibit the full constellation of findings associated traditionally with this diagnosis, many do, and all show some of these manifestations. Thus, lacking any absolute or pathognomic criteria, we have used the term operationally to designate a group of patients for additional description and study. It may be noted that in the communities where these patients are found, one also encounters many others with lesser but perhaps related abnormalities, such as deafmutism, mental deficiency, and impaired speech.

For purposes of the present study, the fundamental fact taken into account for ascertainment was mental deficiency. This was obvious in our opinion and was confirmed by the manner in which the subject lived in relation to the rest of the community. He was considered by his family to be incapable of realizing the normal activities of the average inhabitants of the villages, such as agricultural tasks and small crafts. This criterion was employed because many of the inhabitants in the communities exhibited a certain degree of simplicity in comparison to residents of an urban area. Thus, between the patients chosen and the rest of the community there were only differences in degree in terms of intelligence. In evaluating the defective persons many difficulties arose. For example, how normal were the mutes in terms of hearing? How normal were the deaf in terms of speech? As with mental capacity, also in regard to communica-

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tion, many of the "normal" inhabitants of the villages appeared to present some degree of reduced speech and impaired hearing.

These studies were designed to obtain a spectrum of the defects traditionally associated with endemic goiter as seen in the Andean region. To the best of our knowledge, studies of endemic cretinism in other areas of the world refer only to "typical" cases, whereas it may be important to know the epidemiological spectrum of this disease.

Patient selection

For the survey, we chose two previously studied communities (2–4): Tocachi and La Esperanza, neighboring villages with a total population of approximately 3,500. They have had three characteristics in common: a severe chronic iodine deficiency, a high incidence and prevalence of goiter, and a moderate to severe degree of protein–calorie malnutrition. These characteristics are shared by numerous rural Andean communities of Colombia, Bolivia, Peru, and Ecuador (5–8). We had studied these two communities for approximately 10 years, enjoy the confidence and cooperation of the people, and know everyone because of many surveys. For our present study we chose 94 subjects (Table 1), i.e., almost everyone who had an immediately obvious abnormality in walking, speech, hearing, and mental capacity, separately or combined.

TABLE 1
Distribution of the study group by sex and age

	Age, years									
	5–10		11–15		16–20		21–40		40 on	
	Sex									
	M	F	M	F	M	F	M	F	M	F
No. of cases	4	6	4	3	4	8	16	21	17	11

TABLE 2
Distribution of the study subjects by mental age

Mental age, years	Chronological age, years	No. of cases
0 to 1	12 to 45	5
1 to 2	9 to 55	8
2 to 3	9 to 60	23
3 to 4	9 to 55	20
4 to 5	13 to 52	8
5 to 6	28 to 55	5
6 to 7	15 to 35	6
7.5	50	1
10.5	54	1

Results

Intelligence

The following formal psychological tests were employed: Gesell (9), Leiter (10), and Binet-Simon (11). The first two were used when the subject was deaf or mute because they do not depend on verbal responses. All three tests were employed when the subject was able to make verbal responses.

The results obtained in 77 subjects, ranging from 9 to 60 years of age (Table 2), can be summarized as follows: only two scored at the 7- to 11-year level, with intelligence quotients (IQ) over 50%. The rest, 97.4%, scored below the 7-year level, i.e., they were severely mentally deficient. These results are similar to those obtained by Dodge et al. (12), who studied obviously mentally defective persons from the same area, using the tests of Gesell and Leiter.

With these results in mind, eleven normal villagers were studied using the Binet-Simon test (13) (Table 3). Eight were chosen at

TABLE 3
Intellectual parameters of the "normal" villagers

Sex	Occupation	Chronological age, years	Mental age, years	Intelligence quotient
M[a]	Farmer	21	8–9	57
M[a]	Farmer	40	9	60
F	Housework, farmer	21	10–11	71
M	Farmer	26	11	73
M	Farmer	26	11–12	75
M	Student	13	10	76
F	Housework, farmer	19	11–12	78
M	Student	12	9–10	82
F	Assistant nurse	17	13–14	91
M[b]	Artisan	26	14	93
M	Mayor's secretary, local leader	28	More than 15	100

[a] Bradylalia and extremely low degree of dysarthria. [b] Five percent of the villagers are artisans in these communities.

random and three by purpose: the assistant nurse who was working at the dispensary in one of the villages, an artisan, and the Mayor's secretary. These eleven persons were normal from the point of view of hearing, gait, and occupation. Two of the subjects chosen at random showed a degree of verbal limitation, some bradylalia and dysarthria.

There was overlapping of intellectual levels between the "defective group" and the normal group (Table 4). These results suggest that in these villages between the two extreme groups, i.e., idiocy-imbecility and normality, there is no sharp dividing line. There was no reason to believe that the poor performance on the various tests reflected any difficulty in communication beyond what could be explained by low intelligence. Unaffected individuals in the population comprehended the tests and completed them satisfactorily without verbal clues. This indicated also that sociocultural factors were not limiting. Furthermore, only 11 of the 74 defective persons studied had attended school, and their scholastic performance was poor. Of these, only two progressed as far as the fourth grade, and three to the second grade.

Hearing

It was impossible to carry out highly sophisticated hearing tests in the field. Estimates of the degree of hearing impairment were made by producing various commonly recognized sounds at different intensities. On this basis, of the 94 subjects, only 6 had normal hearing, 72 had moderate to severe deafness, and 16 were completely deaf. In all but five, the opinion of the examiners corresponded with the history given by the subject's relatives.

Seven defective persons were brought to the hospital in Quito, where formal audiometric evaluations were performed (14). Three had audition thresholds averaging between 50 and 80 decibels, which is equivalent to a 70% hearing loss. The remaining four subjects had a hearing loss of more than 80 decibels for air conduction; for bone conduction they responded to the two low frequencies (between 25 and 30 decibles for the frequencies 125 and 250 cps). The latter frequencies may lack significance because they produce tactile and vibratory sensations. Thus, the loss of hearing in these four subjects was from 90 to 95%. The audiometric curves were horizontal and parallel to the bone conduction curves, consistent with perceptive deafness. The audiometric responses were similar in both ears. This favors a perceptive deafness due to a central cause, with lesions above the second neurone (supranuclear).

Two points emerged: *a*) most of the subjects had severe impairment in hearing, and *b*) there were mentally defective persons with normal hearing. The tympanic membrane had a grayish appearance in four of the seven defective subjects studied in Quito and showed good movement in all. In the field, 29 of the 94 subjects had normal tympanic membranes; those of 10 subjects were perforated in one side and in both sides in 5. There were two who had incurved external auditory canals.

TABLE 4
Distribution of defective and normal persons by intelligence quotient (Stanford-Binet)

Intelligence quotient (IQ)	No. of defectives	No. of normals	Classification Stanford-Binet
0–19	35		Idiocy
20–49	40		Imbecility
50–69	1	2	Mental weakness
70–79	1	5	Borderline
		1	defective
80–89		1	Low average
90–109		3	Normal or average

Speech

The subjects presented a wide range of impairment of understanding of the spoken word and in expressing ideas in speech. None was normal. Fourteen appeared to understand but had slow speech and dysarthria. Twenty-two had considerable limitation in understanding and also had severe dysarthria and dyslalia. Twenty-eight were virtually unable to understand words or to communicate but could articulate a few sounds. An additional 28, the most severely affected, produced only gutteral sounds or were completely mute. Thus with intelligence, so with language, there were only differences in degrees between normality and severe defects. In most of the subjects, the extreme mental retardation and the severely

impaired hearing may have contributed to the language deficit. Nevertheless, it was evident that others with extreme impairment in language were able to hear, and their mental age was not so low as to be the primary cause of the mutism.

Motor abnormalities

The spectrum of locomotor disorders was wide. There were some whose gait was as normal as in the nonaffected villagers. Abnormal gait was due to flexion and endorotation of the knees, spastic and bradybasic walking, and a general clumsiness of movement, in the most varied intensities and combinations.

Examinations by passive stretch showed spasticity of the lower extremities in 42 (45%); this was marked in 14. There was no demonstrable spasticity in 22, and questionable spasticity in 30. Sustained ankle clonus was elicited in 21 (23%), and at the knees in two. In 50 subjects (62%), tendon reflexes in the lower extremities were accentuated. Five had hyporeflexia, and in 25 the tendon reflexes were normal. The reflexes at the knees were in accord with those at the ankles. Dodge and his associates (12), studying mental defectives from the same area, found two patients in whom the reflexes were increased at the knees and much decreased or absent at the ankles. This suggested the possibility of an associated peripheral neuropathy of undetermined cause. It was difficult to elicit plantar responses because of the extreme callous formation of the soles arising from an absence of shoes. Nevertheless, a Babinski or Oppenheim response was demonstrated in 13, and a questionable extensor or no response to plantar stimulation in an additional 19. Plantar response was clearly flexor in 60 subjects. Accentuation of reflex activity and specific motor involvement of the upper limbs was demonstrated in 23 subjects (25%). Thus, it appeared that most of the subjects had pyramidal tract dysfunction involving predominantly the lower extremities.

A general clumsiness of movement beyond that attributable to the pyramidal tract disease was also observed in the majority of subjects. Furthermore, except in the six with normal gait, difficulty in hopping was always evident. In only three could cerebellar dysfunction have contributed, as indicated by intention tremor. The Romberg test was not positive in any subject in whom it could be tested. Significant neurological impairment was common in all subjects with abnormal gait. This appeared to be a spastic diplegia of variable severity which probably was of cerebral origin.

Twenty-seven subjects were brought to the hospital in Quito where they were studied radiographically. Most had flattening of the femoral head. In order to evaluate this objectively, the minor and major diameters of the femoral heads were measured (Fig. 1). As demonstrated in 100 normal adults from Quito, this ratio in all was 50% or more. By this method, most of the 27 subjects had flattening of the head of the femur. The degree of flattening was not the same on both sides (Table 5). Greater obliquity of the acetabulum than of the head of the femur was universal in those subjects presenting flattening of the femoral head (Fig. 2). In addition, the majority had an increased flexion angle of the femoral head, but there was no correspondence between the two sides (Table 6, (15); Fig. 3). Thus, an acetabulum of great obliquity, a flattened femoral head, and an increased flexion angle resulting in coxa valga was present in most of the subjects who had roentgenographic study. Coxa valga, increased or caused by spasticity, would explain the motor abnormalities found in these subjects. Flexion contraction and endorotation of the knees were found in 50%, flat feet in 45%, and varus, valgus, or varus–valgus deformities of the feet in 38%.

Height

Adults of the study group on average were shorter than the rest of the population (Table 7). In 4 of the 17 shortest subjects, the height could be determined only approximately because of severe flexion contraction and endorotation of the knees in 3, and frank kyphoscoliosis in one, but their shortness was evident. Most of the subjects were within two standard deviations of normal. The shortest was 1.10 m. In none was height as short as reported in the hypothyroid cretins of Idjwi Island (16). The severity of impairment in height did not appear to correlate with impairment in intelligence, audition, or language capacity.

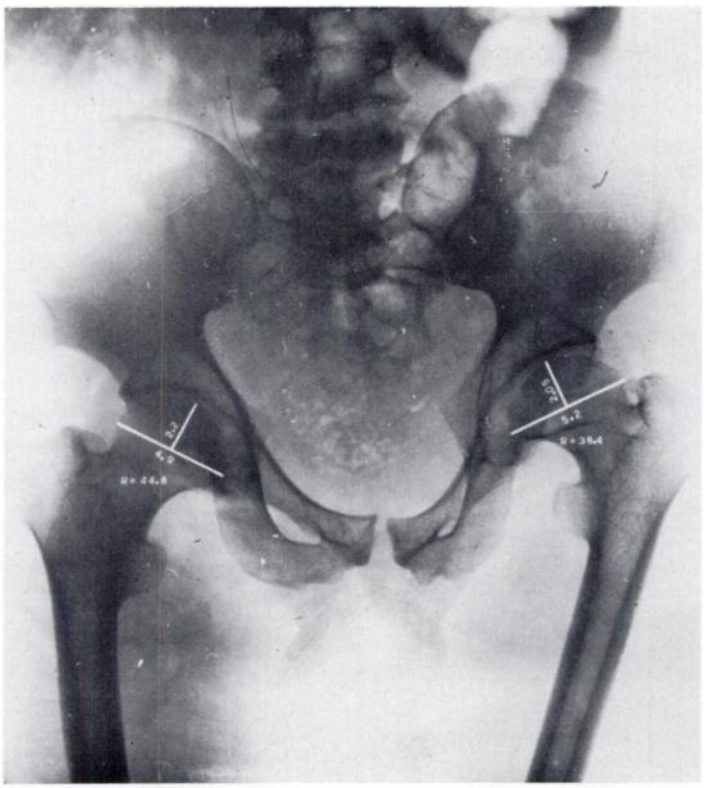

FIG. 1. Flattened head of femur evaluated according to the ratio (see Table 5).

TABLE 5
Flatness of the head of the femur in 27 subjects[a]

	Right hip	Left hip
Defectives (less than 50%)		
No.	18	16
Mean value	43.5	43.3
Range	34.2–47.9	34.4–48.9
Defectives (more than 50%)		
No.	9	11

[a] Evinced by the:

$$\text{Ratio} = \frac{\text{minor diameter of the head (d)}}{\text{major diameter of the head (D)}} \times 100.$$

Normals: $R = \frac{d}{D} \times 100 = 50\%$ or more (equal for both sides).

General appearance

The general appearance of individual subjects varied considerably. Most resembled other nonaffected members of the communities. The features of some of the older people seemed excessively coarse, whereas an impassive appearance characterized most of the young subjects. The forehead was narrow in 40, and 13 had saddle noses. Strabismus was present in 15. When the subject had a narrow forehead, saddle nose, and strabismus, the similarity to cretins described in New Guinea was striking (17) (Fig. 4). Except for these three characteristics, present in approximately 15% of the total subjects, the group under study was quite similar to the rest of the population, as pointed out by Carlucci, who studied normal and defective persons anthropologically from these same villages (18). Furthermore, only six subjects were found with typical hypothyroid facies.

Thyroid

Thyroid size was evaluated in accordance with the classification of Perez et al. (19) as modified (20); glands were considered abnor-

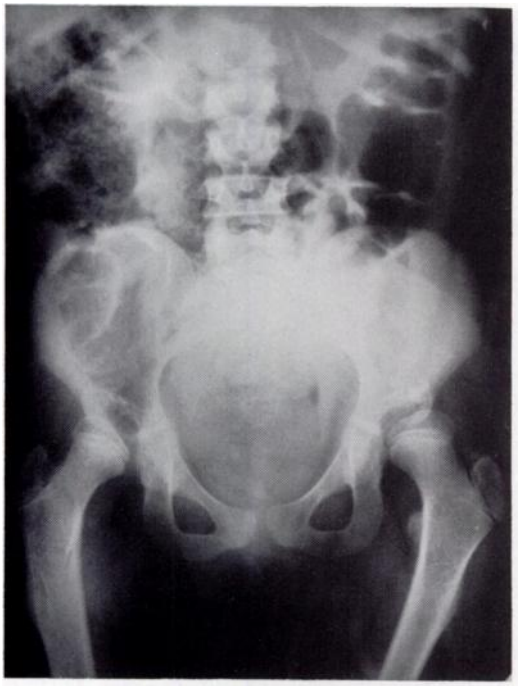

FIG. 2. Acetabulum of greater obliquity than of the head of the femur was universal in those cases presenting flattened femoral head.

mal when of grade I or larger (Table 8). Goiter prevalence in Tocachi and La Esperanza as a whole, including children below 5 years of age, was 61%. Therefore, with this limitation, goiter prevalence in the study group was similar to the prevalence in the total population. There was

TABLE 6
Flexion angle of the head of femur[a]

	Right hip	Left hip
Defective men		
Increased		
No.	12	14
Mean value	147.2	145.0
Range	136 165	135 157
Normal		
No.	3	1
Defective women		
Increased		
No.	12	13
Mean value	147.7	145.5
Range	142 160	135 157
Normal		
No.	2	1

[a] Normal: men, 128°; women, 127° (15).

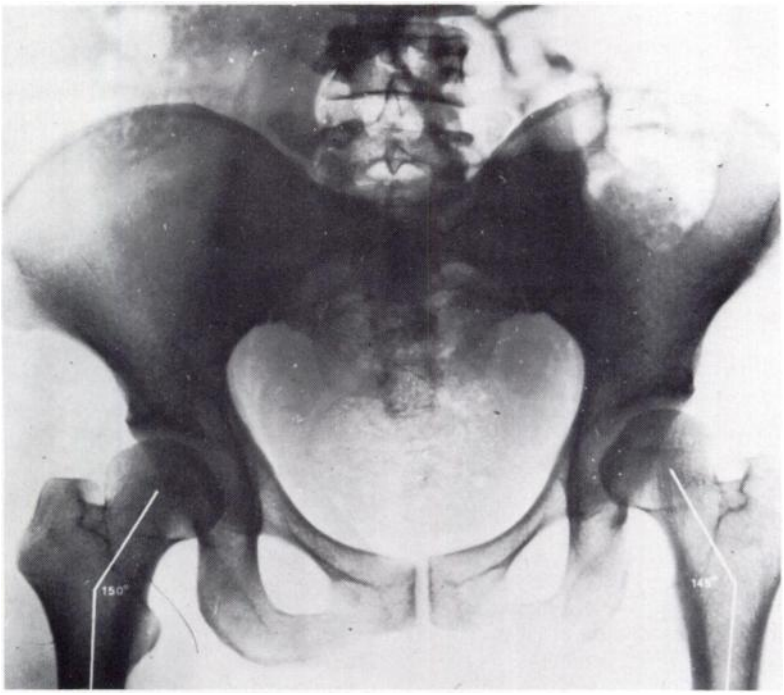

FIG. 3. Most of the defective persons studied presented increased flexion angle of the head of the femur. There was no correspondence between the two sides.

TABLE 7
Height in centimeters of 67 adult defective persons studied[a]

Defectives	Men	Women
Mean value	142.21	134.75
Range	110 157	110 157
Total defectives	**No.**	**Percentage**
Normal population, mean value ± 1 SD	33	49.2
Normal population mean value + 2 SD	50	74.6
Less than 2 SD of normal population	17	25.4

[a] Data of normal population: Tocachi: men: mean value, 152; SD, 8.3; women: mean value, 142; SD, 6.7. La Esperanza: men: mean value, 156; SD 6.7; women: mean value, 145; SD, 6.4.

no relationship between thyroid size and mental age.

As reported previously (14, 21), there was no difference between normal and defective persons in terms of thyroid function and metabolic state (Table 9). In iodine kinetic studies on 10 of these subjects previously reported with and without goiter (14), radioactive iodine uptake was strikingly elevated, and thyroid iodine turnover rate was elevated to a level far above normal. Secretion rates for thyroid-labeled iodine were also strikingly elevated. Administration of TSH resulted uniformly in increased radioactive iodine uptake and either constant or increased thyroid iodine release rates. These observations suggest that the thyroid was already well, but not maximally, stimulated by endogenous TSH. Triiodothyronine suppression

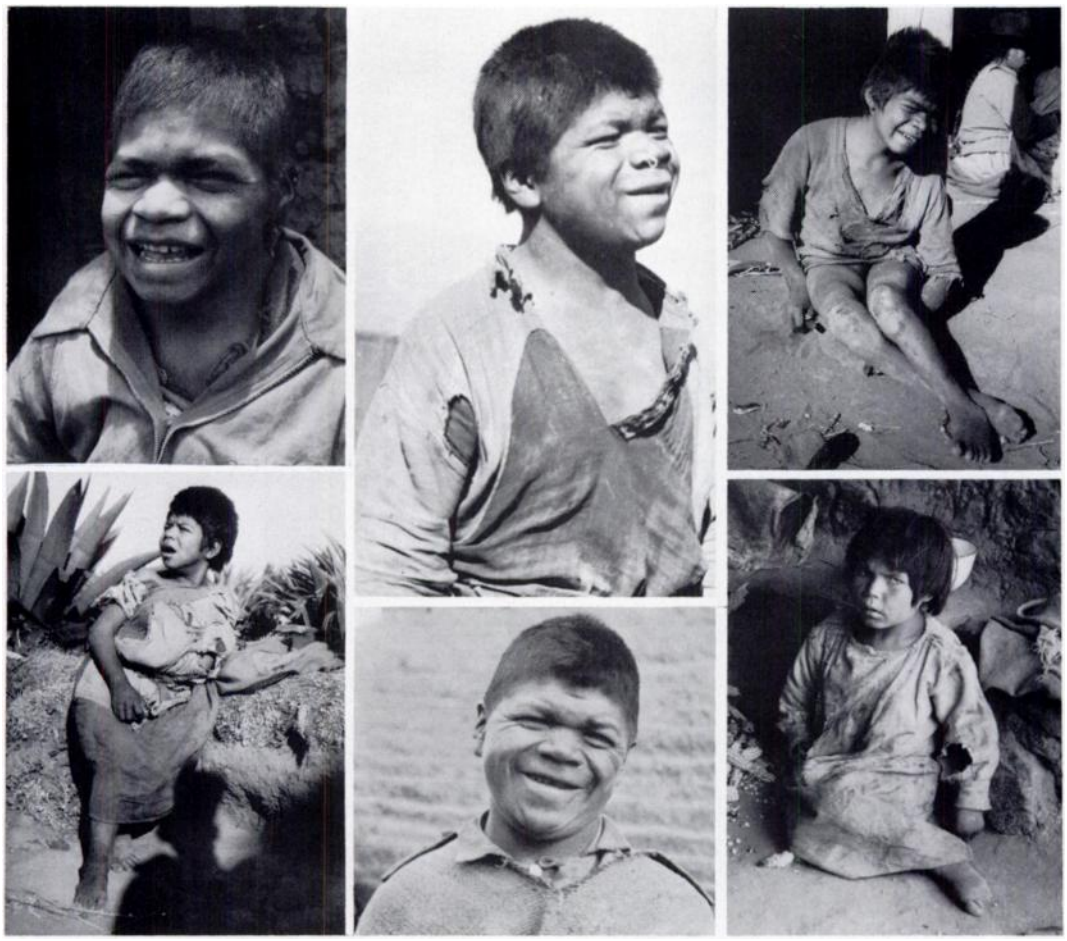

FIG. 4. When the defective subjects presented a narrow forehead, saddle nose, and strabismus, the similarity between them and cretins described in New Guinea is noticeable.

tests depressed the uptake in one instance and was ineffective in a second. Subjects without goiter had higher $PB^{131}I$ values, more rapid plasma iodide disappearance rates, and more rapid thyroid iodide release rates. These changes probably reflected differences in the size of the thyroid iodine pools.

Thyroid scans on the four subjects without detectable thyroid enlargement showed diffuse uptake in a small area typical of the normal position of the gland. In the other subjects with goiter, there was irregular distribution throughout the entire gland. After TSH stimulation, the thyroids originally showing diffuse uptake showed no change. Those having mottled areas of inactive and active tissue either remained the same, or in some areas acquired more activity.

Hypothyroid manifestations

No relationship was found between thyroid status by laboratory evaluation and mental age, hearing, speech, or motor abnormalities. Occasional subjects were encountered with laboratory evidence of hypothyroidism and retardation (22, 23), and also with signs suggesting a hypothyroid state (Table 10). Approximately 10% of the group had unequivocal clinical manifestations of hypothyroidism.

Of 19 males the genitalia were judged normal in 17. In one there was macrogenitosomia, and in the other bilateral cryptorchidism was found. Two were active sexually and one was married but without children. Seven had sexual interest and in 21 men libido was completely absent. In some, extreme mental deficiency might have contributed to the absence of libido. The gonadotropins of the four male cretins varied from 4 to 6 U (normal).

Among 33 women in the fertile age period, the following results were obtained: 23 had had pregnancies, 1 had primary amenorrhea, and another had secondary amenorrhea. Gyneco-

TABLE 8
Goiter prevalence in the group of defective persons[a]

Grade	No.	Percentage
Oa + Ob	37	39.4
I	32	34.0
II	13	13.8
III	9	9.6
IV	3	3.2
I to IV	57	60.6

In the classification, glands are considered abnormal when grade I or larger.

TABLE 10
Percentage incidence of signs possibly referred to hypothyroidism in the study group

Diagnostic signs	Percent
Hypothyroid feature	6
Hair remarkably dry and coarse	17
Hyporeactive pupillary reaction	13
Saddle nose	13
Prominent tongue	6
Bradycardia	3
Hypotension	19
Umbilical hernia	4
Lumbar lordosis or dorso-lumbar kyphoscoliosis	21
	21
Tendon hyporeflexia	6
Enlarged sella turcica	14
Delayed skeletal maturation	16
Impairment in the genesis of the head of femur	3

TABLE 9
Laboratory data obtained in subjects of the defective group and normal persons from the same villages

	Thyroid uptake % in 24 hr	PBI, μg/100 ml	BEI, μg/100 ml	Sponge resin uptake ^{131}I-labeled T_3	Achilles reflex (half-relaxation time in msec)
Defectives					
No.	40	26	37	22	35
Mean value	71	3.7	3.0	30	309
Range	45–87	1.2–5.6	0.8–5.5	26–38	220–420
Normals					
No.	38	40	20	18	390
Mean value	77	3.1	2.7	31	293
Range	55–90	1.8–5.8	1.3–4.8	26–35	220–400

logical observations were made on six women. One had marked secondary sexual characteristics at the age of 12, incongruent with her age and race. Another completely lacked those characteristics at age 13. The remaining four women, ranging from 25 to 40 years of age, showed normal secondary sexual characteristics and normal internal genitalia. One had been a mother three times and had excellent lactation (incidentally, the only patient having a positive serologic test for syphilis). Another of these four women had primary amenorrhea accompanied by low estrogen levels (vaginal cytology) and gonadotropins of 0.56 U. Vaginal cytology of the three remaining women indicated normal estrogen levels, and their gonadotropin concentrations ranged from 3.75 to 7.00 U (14).

From the foregoing it appears that most of the Andean cretins correspond to the so-called "nervous endemic cretinism" (24) as observed in New Guinea by Choufoer et al. (17). Approximately 10% correspond to what could be called "mixed endemic cretinism," i.e., a mixture of nervous endemic cretinism and "myxedematous endemic cretinism," the latter described by Bastenie et al. (25), and Dumont and his associates in the Zaire Republic (26). This 10% would be similar to patients with cretinism studied by Ibbertson and his associates in Nepal (27). None of the subjects in the study series presented a pure replica of myxedematous endemic cretinism. Recently in Malchingui, a neighboring village to Tocachi and La Esperanza, with a population of approximately 5,000, we encountered a family with two siblings, brother and sister, who had clinical characteristics entirely similar to those of endemic myxedematous cretinism. The parents had visible goiters, and normal gait, intelligence, hearing, and speech. One brother and two sisters were normal in terms of height and gait, but had defects in language and intelligence, and one was obviously deaf. One of the myxedematous subjects was brought to Quito. She is 28 years old (Fig. 5), unable to walk or stand, completely mute and deaf, and 75 cm tall. Using the Gesell and Leiter standards, her mental age was approximately 8 months and her IQ 5%. Bone age was 1 year and 6 months; PBI, 1.0 μg/100 ml; BEI, 0.6 μg/100 ml; total cholesterol, 232 mg/100 ml; total lipids, 950 mg/100 ml; and carotene, 250 μg/100 ml. The ECG was typical of the myxedematous heart. It was not possible to determine the thyroid uptake because a good amount of the tracer dose was spilled. Nevertheless, the thyroid scan showed diffuse uptake in a small area typical of the normal position of the gland. The sella turcica was normal in size. Epiphyseal dysgenesis was universal. Thus, clearly myxedematous cretinism is present in the Andes, but its incidence is low.

Occupation

Because occupation can indicate intellectual and motor capacity, the occupation of 76 of our subjects over age 10 was recorded. Sixty-six percent were able to perform useful economic tasks under supervision within the economic framework of the communities, but these tasks were such as could be readily performed by normal children of 8 or 9 years of age. Only two persons performed normally, whereas 16 performed productive work of a routine nature, but notably less rapidly than by normal persons. Ten subjects performed only marginally serviceable tasks or were unable to undertake any useful economic role.

Effects of thyroid medication

Six defective persons of the series were treated with thyroglobulin (Proloid, 65 mg/day). Significant neurological impairment and mental deficiency were common to all and a spastic diplegia was present in the majority. All had significant impairment of hearing and most presented severe defects in speech. They were re-examined periodically during the 5 years of treatment. In none was there significant improvement except for slight changes in the skin and hair, an increase in the degree of physical activity, and in some, changes in facies occurred. Six children with major developmental retardation were treated also with Proloid (32 mg/day). Some remained severely retarded in spite of early diagnosis and continued treatment. Others showed a slight rise in developmental quotient (DQ) as a consequence of an increment in motor maturation but without change in other neuromotor functions with treatment, such as in speech or intellectual capacities. Still others showed a rise in DQ almost to the low normal range because all neuromotor functions were improved. Thus, four of the six subjects had irreversible neurological damage. Others improved because of

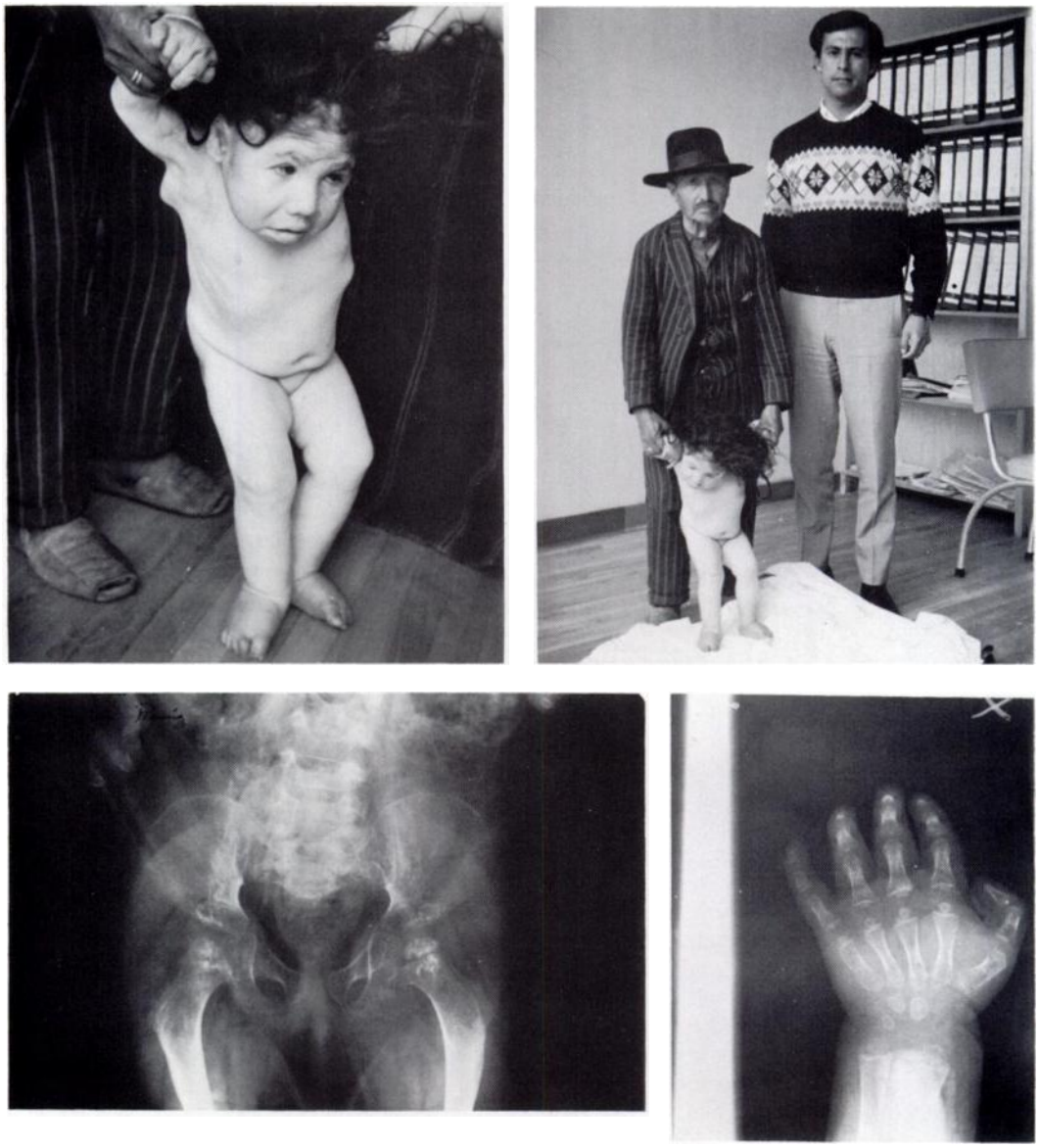

FIG. 5. A 28-year-old female with "myxedematous endemic cretinism." Height compared with the height of her father and the height of a normal Ecuadorean young urban man. Note the dysgenesis of the head of the femur and the retarded bone maturation.

correction of the hypothyroid component and because neurological damage was less severe. Thus, once the neurological component of the Andean endemic cretins is established, it is usually irreversible by thyroid medication.

Comments

This study was undertaken in order to describe the developmental abnormalities that are found in two villages in rural highland Ecuador where strikingly excessive numbers of defective persons have been obvious and long recognized. These villages have a high incidence of endemic goiter of severe grade, and are similar to many other Andean communities in this respect and in having a high incidence of developmental retardation. The region is one long established as having a severe degree of

nutritional iodine deficiency (19). In the villages of Tocachi and La Esperanza, the mean daily secretion of iodine has been recorded as 10.4 and 17.7 μg/0.9 g creatinine.

It is necessary to justify the application of the term "endemic cretin" to these defective villagers. This designation has been widely used for defective persons with varied clinical manifestations, but always with the understanding that somehow the disorder was related to faulty thyroid function. The difficulty that, at the time of study, thyroid function is frequently normal, has been dismissed because of the presumption that function was much reduced during early development because of a seasonal shortage of iodide or possibly other related or coexisting factors. Admittedly this is only a presumption, but it arises because some of the subjects are indeed clinically hypothyroid, and it seems reasonable to suppose that the others were hypothyroid at an earlier time during a critical developmental stage.

Use of the term "cretin," implying that an abnormality of thyroid function related to nutritional deficiency underlies these disorders, is legitimatized through several considerations. Thus, in a group of retardates associated geographically with endemic goiter, there is usually an immediately apparent subset of persons who bear a striking resemblance to persons who are found elsewhere, also in close association with severe endemic goiter. Historically, similar subjects have not appeared after endemic goiter has been effectively eliminated by iodide prophylaxis. All of this subgroup show goiter, epiphyseal dysgenesis, frank hypothyroidism, or deafmutism, or some combination of these findings, each of which may be related to hypothyroidism at some earlier stage of development. Although differing in some respects, the myxedematous cretin of Zaire (26) has: *1*) thyroid function distinctly lower than the community average, *2*) frank hypothyroidism, and *3*) striking retardation in bone maturation. There appears to be a good precedent and reason for applying the useful term "cretin" to our subjects who conform to a long-recognized and distinctive pattern.

Can the same terminology be applied to those retarded and defective persons with lesser manifestations? No dividing line separates them from the more severely affected persons. Indeed it seems probable that most if not all the subjects chosen for this study belong to the same group, differing only in degree from those with the classic features of endemic cretinism. A larger question is whether the lesser intellectual disabilities and hearing deficits found in the communities at large derive from the same basic defect, presumably primarily from thyroid deficiency at a critical phase in development. The answer must await further study, if indeed it can ever be unequivocally answered.

A further problem relates to the additional or auxiliary effects imposed by other nutritional factors. Thus, cyanogenic glycosides contained in certain foods such as cassava, or other goitrogens in other comestibles such as the brassica, or perhaps water contaminants as described by Gaitan (28) in Colombia, may modify the impact of iodine deficiency or be sufficiently goitrogenic or thyroid-damaging agents in themselves. One may suppose that endemic goiter and related endemic retardation arise through a varied and complex interaction of nutritional deficiencies and nutritional agents which have direct effects on the thyroid gland.

Summary

Ninety-four obviously retarded and defective persons from a region of severe endemic goiter in Andean Ecuador have been selected for intensive study. In terms of mental capacity, hearing, language, gait, and occupation, only differences in degree existed between extreme deficiency and normal subjects in the two communities from where these subjects were drawn. For purposes of definition, only those persons were considered cretins whose mental capacity corresponded to idiocy and imbecility, i.e., persons with IQ's below 50.

Subjects diagnosed as endemic cretins presented defects in language which ranged from normal to complete mutism, in hearing from normal to total deafness, and in gait from normal to total inability to walk. The motor disabilities were due to spastic diplegia of variable severity and to coxa valga. In addition to endemic cretins, the study group included subjects whose IQ's scored between 50 to 70%. There was no sharp distinction between these subjects and those who were typically cretin.

Among the cretins, 90% presented no clinical evidence of myxedema. Thus, the predominant form of the disorder in the Andean region

corresponds to the so-called "nervous endemic cretinism," rather than to the "myxedematous cretinism" of central Africa. Those cretins in whom both neurological impairment and hypothyroid manifestations were evident, would be examples of "mixed endemic creatinism."

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