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Congenital Dysplasia of the Hip in the Navajo Infant

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Accurate diagnosis of congenital hip disorders during early infancy remains a challenge. Several arbitrary variations from normal have been recognized, both physically and roentgenographically, but their diagnostic and prognostic significance has remained largely unproved. In an endeavor to define more clearly and to validate the diagnostic features of congenital dysplasia of the hip in the neonatal period, 1,956 *randomly selected* Navajo infants under 3 months of age were studied. The study was accomplished at the Public Health Service Indian Hospitals of Fort Defiance, Arizona, and at Shiprock and Gallup, New Mexico. The author personally conducted the physical examination, interpreted each of the roentgenograms and supervised the treatment when indicated and when permitted by the parents. This is an analysis of the findings on the children, covering a 3-year period.

The data includes 1,956 x-ray examinations of the pelvis, including 1,155 cases in which both physical and roentgenographic examinations of the hips were accomplished. Utilizing physical and roentgenographic criteria which are detailed subsequently, 77 cases of congenital dysplasia of the hip were found in the total of 1,155 children, an overall incidence of 6.7%. Also recorded were the age, the sex, the birth weight, the birth history and the family history as the last related to congenital dislocation of the hip. On the basis of their ages at the time of

examination, the cases were arbitrarily placed into 3 groups: (1) newborn to 1 month, (2) 1 to 2 months and (3) 2 to 3 months of age.

DEFINITIONS

The term "congenital dysplasia" was introduced by Hilgenreiner[12] and denotes, as is believed by Gill,[7] a prenatal defect in development of the hip joint and its associated structures. It is my opinion that it is an entity in and of itself, *besides* being a precursor to subluxation and dislocation. Putti[22] distinguished between subluxation and dislocation on the basis of the relationships between the articular surfaces of the femoral head and the acetabulum. In subluxation the femoral head is in an abnormal position in the socket, whereas in dislocation the femoral head lies completely out of the acetabulum. In addition to these definitions, it is also important to emphasize that this study deals with children who are otherwise essentially normal from a musculoskeletal standpoint. As far as could be determined, these fell into Hass's "typical" or "Class I" category.[11] No known cases of multiple anomalies are included.

PHYSICAL EXAMINATION

On physical examination, considerable variability of the findings was observed at different times during the early months of infancy. As has been noted by Pray[21] and others, this ostensibly reflects changes which occur during evolution of the disease. It was
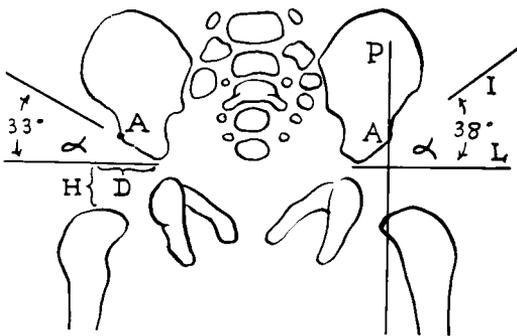
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FIG. 1. Drawing from roentgenogram of pelvis of newborn infant. (This infant's hips were normal on physical examination.) (A) Antero-inferior iliac spine. (L) Horizontal line of Hilgenreiner, drawn through comparable points on triradiate cartilage. (I) Line drawn parallel with the acetabular roof. The angle formed between "I" and "L" is the acetabular index. (P) Perkins' line, a perpendicular dropped through the antero-inferior iliac spine at right angles to "L." (H) The distance between "L" and the highest point on femoral neck. (D) The distance between the triradiate cartilage and the intersection of "H" and "L."

my observation that during the early newborn period the most prominent and reliable physical finding is manual displaceability of the femoral head from the socket. This sign is actually a "jerk" of exit, followed by a "jerk" of entry of the femoral head as it rides over the posterior acetabular rim. This has been called "subluxation provocation" by Palmen.[18] It is similar to, if not identical with, the maneuver described by Ortolani.[17] The significance of this early finding has been challenged by Harris et al., who believed it to be of no diagnostic importance. However, the majority of observers recognize it as evidence of an unstable hip joint, as described by Chapple.[4] Whether this is due to a shallow posterior acetabular rim, as shown by Ortolani's autopsy studies on newborn dysplastic hips, or whether it is the result of a developmental error in both acetabulum and femur, as suggested by Badgley[1] and by Brewer,[2] is not shown conclusively. It is possible that, as believed by Massie and Howorth[14] and Vogt,[23] excessive laxity of the

ligaments about the hip joint may also contribute to this instability. During this *early* period, limitation of abduction, unilateral shortening and asymmetric thigh creases are very unreliable and have little correlation, either with roentgenographic findings, or with the displaceability of the femoral head. This supports the same finding in an earlier study by me and agrees with the observation of Harris et al.,[9] Hart[10] and others.

After the first 2 or 3 weeks of infancy, the "jerk of exit" is very uncommon, and persistent limitation of abduction of the flexed thigh appears to be the most reliable physical sign of abnormality, an observation with which Harris et al.[8] agree. Speculating, it can be argued that with growth the newborn dysplastic hip becomes more stable, but as the muscles acquire greater tone, an adduction contracture develops. This is possibly because the femoral head tends to subluxate superiorly as the adductors contract. Limitation of abduction of the flexed thigh is difficult to evaluate in the Navajo infants, most likely because of the tightly adducted swaddled position in which they are usually carried. Arbitrarily, limitation of abduction was considered to be significant only if it was above 45° or *persistently* asymmetric.

Physical signs such as asymmetric skin creases and apparent shortening—findings which are frequently employed in the diagnosis of congenital dislocation in older infants—were difficult to interpret and were not felt to be significant, unless accompanied by limited thigh abduction. In summary, then, the 2 useful, reliable physical signs during this period include manual displacement of the femoral head from the socket during the early *newborn* stage and persistent, unequivocal limitation of abduction of the flexed thigh in later weeks.

ROENTGENOGRAPHIC
EXAMINATION

The 1,956 roentgenograms were divided into 3 groups: (1) those on clinically normal infants (1,078); (2) those on infants with

TABLE 1. Measurements of Acetabular Indices on 1,078 Clinically Normal Navajo Children (2,123 Hips)

Angle (Degrees)	Birth to 1 Month				1 to 2 Months				2 to 3 Months				Total
	Male		Female		Male		Female		Male		Female		
	L	R	L	R	L	R	L	R	L	R	L	R	
Below 15	2	2		1	3	3			2	2	1		16
15		1			4	1			1				7
16	2	2			3	3		1	1	1			13
17	2	1			2	6	2	2	1	3		1	20
18	2	6	3		4	9	1	4	1	2		1	33
19	3	1	1		1		2					2	10
20	15	8	5	4	16	16	3	5		2			74
21	8	5	6	4	3	7	5	4	2		1		45
22	30	17	5	9	15	12	3	8	2	3	1	2	107
23	32	20	12	9	23	12	12	10	5	3	3	4	145
24	27	29	13	11	8	9	6	6		2	4	1	116
25	30	43	20	22	14	19	13	9	6	4	2	1	183
26	37	29	17	21	8	10	7	13	4	1	2	2	151
27	29	32	24	23	8	9	14	13	1	5	2	3	163
28	37	48	41	35	5	10	17	12	1	2	4	1	213
29	15	17	14	21	9	1	8	7	1			3	96
30	33	48	49	50	6	8	19	22	2	1	3	5	246
31	15	22	15	16	1	2	3	3					77
32	17	15	26	24	2	2	12	6	1		2	1	108
33	12	17	26	25	1	1	8	8			2		100
34	9	4	15	9			1	3					41
35	14	11	15	20	2		1	3			2	1	69
36	7	2	12	10	1		2					1	35
37	5		7	11	1		1						25
38		2	4	7	1		1	2					17
39		1	1	1									3
40	1		4	5									10
Total[*]	384	383	335	338	141	140	141	141	31	31	29	29	2123
Average	25.8	27.2	29.3	29.7	23.9	23.4	27.1	27.0	22.7	22.6	25.7	26.2	26.9

[*]The totals are slightly different on the two sides because occasionally one hip was shielded, making accurate measurement impossible.

TABLE 2. Measurements of Acetabular Indices on 77 Clinically Abnormal Navajo Children (106 Abnormal Hips)

Angle (Degrees)	Birth to 1 Month				1 to 2 Months				2 to 3 Months				Total
	Male		Female		Male		Female		Male		Female		
	L	R	L	R	L	R	L	R	L	R	L	R	
Below 20	1(19)												1
20													
21													
22		1					1						2
23			1				1						2
24													
25	1		3										4
26			1				1						2
27		1	2	1			1						5
28		1	1	2				1					5
29			3		1								4
30	1	1	2	1			1	2			1	1	10
31				1									1
32			1	1			1				1		4
33			2	2									4
34			1				1						2
35	2		3	1			1	2				2	11
36			1	1				2					4
37			1		1						1		3
38	1		1	1	1	1	2						7
39		1		1									2
40				2		1		1					4
41		1		4									5
42			5	5		1							11
43			4	2									6
44				1			2						3
45			1	1									2
Above 45			2(48)										2
Total	6	6	35	27	3	3	12	8			3	3	106
Average Angle	30.3	31.2	35.0	37.8	34.7	40.0	32.6	33.7			33.0	33.3	34.8

TABLE 3. Measurements of Acetabular Indices of Navajo Infants Based on 801 Random Pelvic Roentgenograms (1,590 Hips)

| Angle (Degrees) | Birth to 1 Month | | | | 1 to 2 Months | | | | 2 to 3 Months | | | | Total |
| | Male | | Female | | Male | | Female | | Male | | Female | | |
	L	R	L	R	L	R	L	R	L	R	L	R	
Below 15													
15		1		1									2
16					1	1							2
17	1	5	1	2			1						10
18	6	9	4	1					1	1	1	1	24
19	3	2	2	1									8
20	22	9	5	3			1		3	3		1	47
21	7	5	4	3	1					1	1		22
22	17	15	12	5	2	3	2						56
23	24	21	17	12		1	2		1	1			79
24	26	21	18	11	1	1	1						79
25	35	40	13	24	1		3	2	1			1	120
26	26	18	20	17				2					83
27	27	26	22	34			2	5		1			117
28	55	42	40	30	1		1	3	1		3	3	179
29	22	23	20	18	1	1	1	2					88
30	34	44	42	47	1	1	4	2				1	176
31	20	21	17	19									77
32	24	27	30	33			1						115
33	18	13	26	33							1	1	92
34	8	12	13	18				1					52
35	4	15	20	15		1							55
36	2	5	9	9							1		26
37	3	4	10	8									25
38	3	5	10	15									33
39		1	1										2
40	2	1	6	4									13
41*													
42	1		3										4
43	1		1										2
44			1										1
45													
Above 45		1(48)											1
Total**	391	385	368	363	9	8	19	18	7	7	7	8	1590
Average	27.5	27.8	29.6	29.9	24.1	23.5	26.7	27.2	22.0	21.2	27.4	26.3	28.6

*Arbitrarily, all cases above 40 degrees should be considered dysplasia. However, by including them a more accurate cross sectional study is available.

** The totals are slightly different on the two sides because occasionally one hip was shielded, making accurate measurement impossible.

clinically abnormal hips (77); and (3) those on infants not subjected to a physical examination by the author (801). This last group thus represents a random roentgenographic study of the average Navajo pelvis during the early newborn period. The roentgenograms were subjected to the conventional analysis indicated in Figure 1. All findings were recorded with respect to age, sex and laterality. Observations on acetabular indices are recorded for the 3 age periods in Tables 1, 2 and 3.

Analysis of the data on the acetabular indices revealed several interesting features. First, on the random roentgenogram examination during the first 3 months of life, the average acetabular index is 28.6°. The index is higher in girls and slightly higher on the right hip; it decreases slowly between birth and 3 months. Secondly, in the hips clinically normal, the acetabular angle is 26.9°, some 1.7° lower than the average of the first group. It is also higher in girls and slightly higher on the right side, and it also decreases steadily after birth. Thirdly, in the clinically abnormal hips, the average acetabular index is 34.8°, which is 7.9° higher than the average hip on the clinically "normal" child. Also, in this group the index is higher in girls and higher on the right side.

The controversy concerning the diagnostic and prognostic significance of the acetabular index is not clarified appreciably by this study. To some extent it supports the evidence presented by Caffey et al.,[3] which seriously challenges the significance of the index. It appears that a single determination of the index, in and of itself, has sharply limited diagnostic value during this newborn period unless the value is extremely high. However, that the index probably has some meaning is supported by 2 findings: (1) that it is higher on the average in females, in whom congenital dislocation of the hip is more common; and (2) that it is higher on the average in hips which exhibit one or the other, or both, of the abnormal physical signs mentioned earlier. On the other hand,

the significance of the index is vitiated by the fact that the values in the Navajo Indians, in whom the incidence of dislocation is very high, are no greater at birth than those found in a smaller but comparable group of whites.[5] In contrast to those who believe that indices above 30° are abnormal, these data support an earlier finding by the author wherein the index was diagnostically helpful only if above 40°. On the other hand, it is important to recognize and to emphasize the fact that a normal acetabular index may be found in a dislocated hip or in a hip in which instability or persistent adduction contracture can be demonstrated. This has been shown previously.[5,13]

There are other roentgenographic signs which have greater diagnostic significance than the acetabular index. The most important of these during the early newborn period is the relationship of the proximal femoral metaphysis ("beak") to the rim of the acetabulum. Perkins'[19] line is a vertical line drawn through the anterior inferior iliac spine, perpendicular to the horizontal "Y" line of Hilgenreiner (Fig. 1). It was found in this study that the "beak" always lay medial to the line in the hips having normal physical signs; whereas, in the hips exhibiting the subluxation provocation, or "jerk of exit," that the "beak" was at or lateral to this line in 51%. Conversely, in all cases having a laterally displaced femoral "beak" on the roentgenograms, abnormal physical signs could be demonstrated.

Shortening of the vertical distance between the horizontal line and the most superior point on the femur ("H" of Hilgenreiner) was of diagnostic value in unilateral disease only, and validity of this sign depended entirely upon a very accurate anteroposterior view of the pelvis. It has no diagnostic application in bilateral hip dysplasia because its significance is governed by comparison with the opposite, presumably normal, hip. Absolute figures are not valid, being influenced by the infant's size, pelvic tilt and other factors. As the infants grew, 2 other roent-

genographic signs were found to be helpful: failure of the acetabular roof to reduce its slope and failure of the roof to form an arch over the head during growth of the pelvis.

Notwithstanding the well-known controversy about the diagnostic and prognostic importance of neonatal roentgenograms, it becomes evident that several roentgenographic determinations are available to us which, when interpreted properly, can be diagnostically helpful and assist in the diagnosis of hip dysplasia in this early neonatal period. These are summarized as follows: (1) an acetabular index of above 40°; (2) lateral disposition of the femoral "beak" with relation to the vertical line of Perkins; (3) *unilateral* shortening of "H" line of Hilgenreiner; (4) failure of the acetabular roof to reduce its slope during the early months of growth; and (5) failure of the roof to form a graceful curve over the developing femoral head. It should be emphasized again that in each of the above it is essential that the roentgenogram be a true anteroposterior view of the pelvis.

SIGNIFICANCE OF BIRTH HISTORY AND PATIENT HISTORY

The age, the sex, the family history and birth history were investigated in 1,078 of the cases examined. Historical data obtained from the parents included specifically whether any disorder suggesting congenital dislocation of the hip had occurred in any close member of the family.* Evaluation of the family history was quite difficult, not only because of the language and the intellectual barrier, but also due to the loose and often poorly defined family genealogy. Notwithstanding this, it is apparent that the data presented in Table 4 indicate that the incidence of hip dysplasia is about 5 times higher in infants who have a family history of congenital dislocation, as in those with a negative family history. The data are consistent

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* No further removed than grandparent, uncle or aunt, or first cousin.

TABLE 4. Family History as Related to Congenital Dislocation of the Hip

	Non Dysplastic	Dysplastic
Number interrogated	1078	77
Number having positive family history	66	25
Per cent of cases having positive family history	6.1%	32.5%

with Palmen's observation, wherein 25% of his cases had a family history of congenital dislocation of the hip.

Whether or not a cradle board was used seemed to be inconsequential after several hundred mothers were interrogated, since nearly all Navajo infants, during the prewalking period, are tightly bound with their legs in adduction in both winter and summer, irrespective of whether the cradle board is used.

There was one case of dysplasia in a breech birth, but because of the small number of cases, the significance of the mechanism of delivery cannot be assessed accurately. Differences in the newborn birth weight and whether or not the infant was premature had no detectable bearing on the incidence of congenital hip dysplasia.

SEX PREDOMINANCE AND LATERALITY

In the abnormal hips, females predominated 63 to 14, or 81.8%. This agrees with

TABLE 5. Follow-up Study on 77 Cases of Congenital Hip Dysplasia

Not followed (parents refused to return)....... 42
Followed (minimum length of follow-up, 3 years). 35
   Treated:...................... 12 cases
        Normal............. 10
        Dysplastic........... 1
        Probably normal...... 1
  Untreated:...................... 23 cases
        Normal............. 5
        Dysplastic........... 9
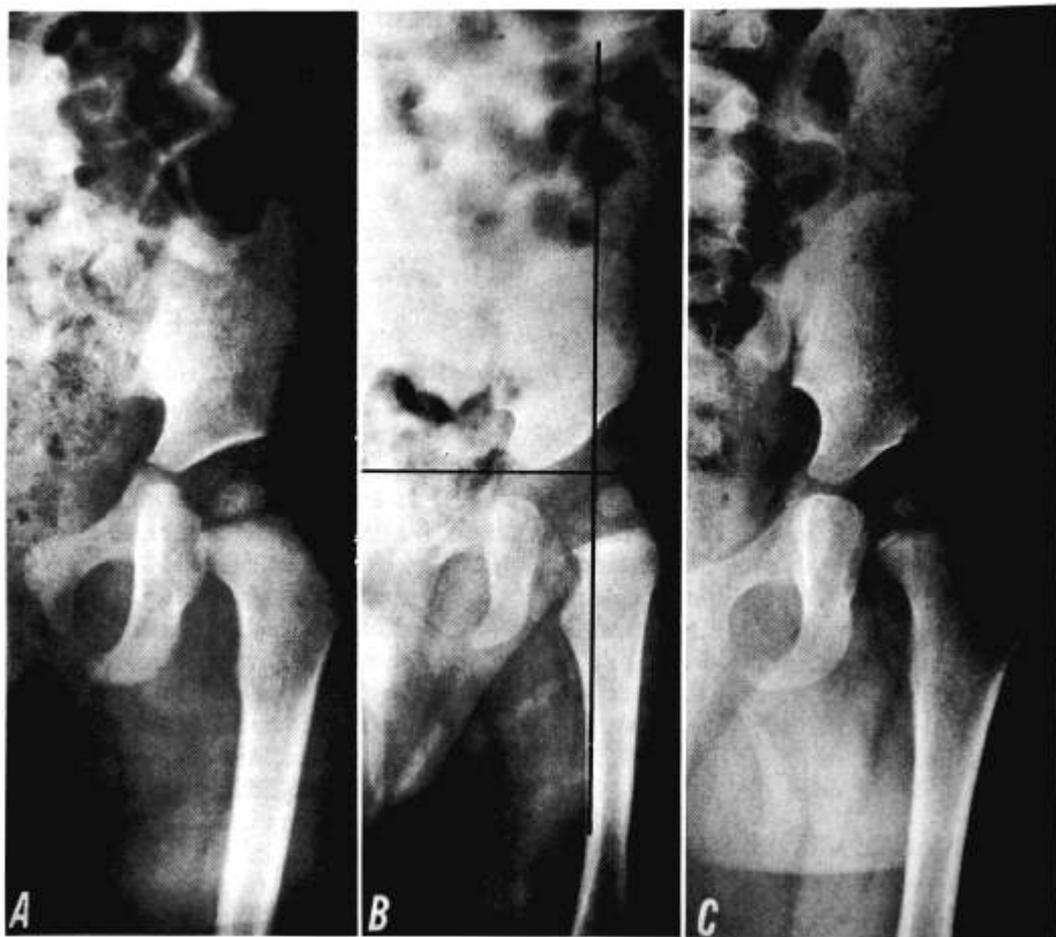   Subluxation.......... 3
        Dislocation.......... 6

Fig. 2. (A) A normal hip joint in an 18-month-old male. The femoral head is well seated, the acetabular index is within normal limits, the roof of the acetabulum has formed a graceful arch over the femoral head and exhibits a uniform shadow of articular cortex. (B) A 12-month-old child with subluxation of the femoral head. The acetabular index is above normal limits for this age; the acetabular roof is convex rather than concave; Shenton's line is broken; and the socket is shallow. (C) An 18-month-old child with residual dysplasia of the hip. The femoral head is well developed and lies congruously in the socket, although there is some extrapelvic protrusion. The acetabular index is elevated for this age, but the acetabular roof is gently concave. The shadow of articular cortex is developed only at the lateral aspect of the acetabulum. Shenton's line is disturbed.

the studies of Putti, who found 84.9% females in a review of 1,879 cases of dislocation. No one has yet offered a convincing explanation for this concentration in females. The results of genetic studies now in progress[6] on the Navajo Reservation and elsewhere may be helpful in the future in this consideration.

There were 29 with bilateral and 48 with unilateral dysplasia, and a predilection in the unilateral cases for the left, 30 to 18. An explanation for the predominance in the left hip is wanting. The incidence of unilateral occurrence of 62.3% agrees with most published accounts.

CLINICAL BEHAVIOR

When a diagnosis of dysplasia was made,
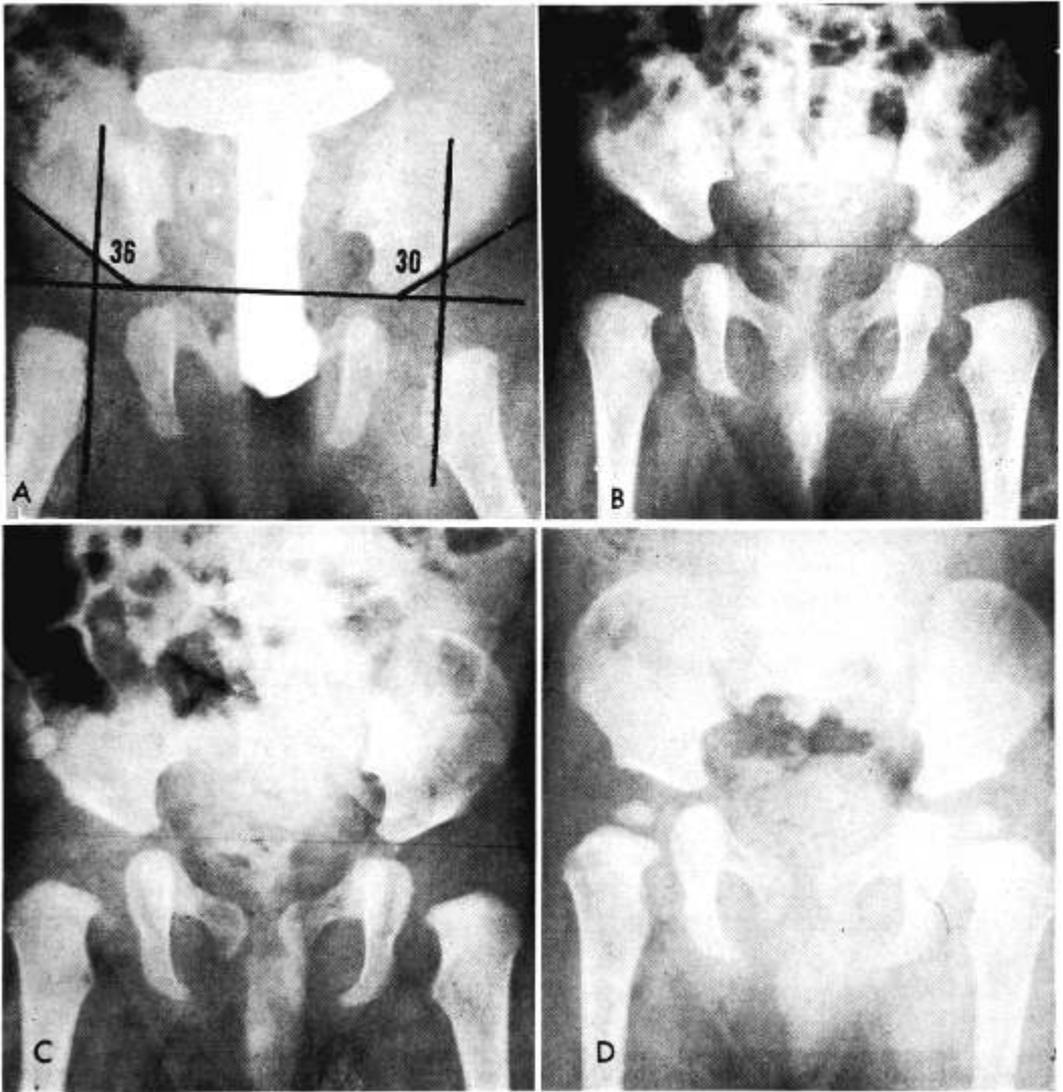
FIG. 3. Case 3. On examination at 6 weeks of age, the right hip of this female infant could be easily displaced from the socket. The roentgenogram (A), taken 2 days after birth, shows lateral disposition of the "beak" and unilateral shortening of the "H" line on the affected side. The indices are within normal limits. The mother did not accept the proposed program of therapy. The film (B) was taken at 3 months of age and shows improvement, although the acetabular indices have not reduced at all. In (C) and in (D), taken at 6 months and at 1 year of age, respectively, steady progress toward normal development is demonstrated.

abduction splinting was recommended in all. Of the 77 cases only 35 could be followed; and due to a variety of uncontrollable factors, appropriate abduction splinting could be instituted effectively in only about one third of these cases. Such circumstances provided a fortuitous control series; therefore, 2 different treatment groups could be identified: those treated (12), and those untreated (23). The follow-up data covering
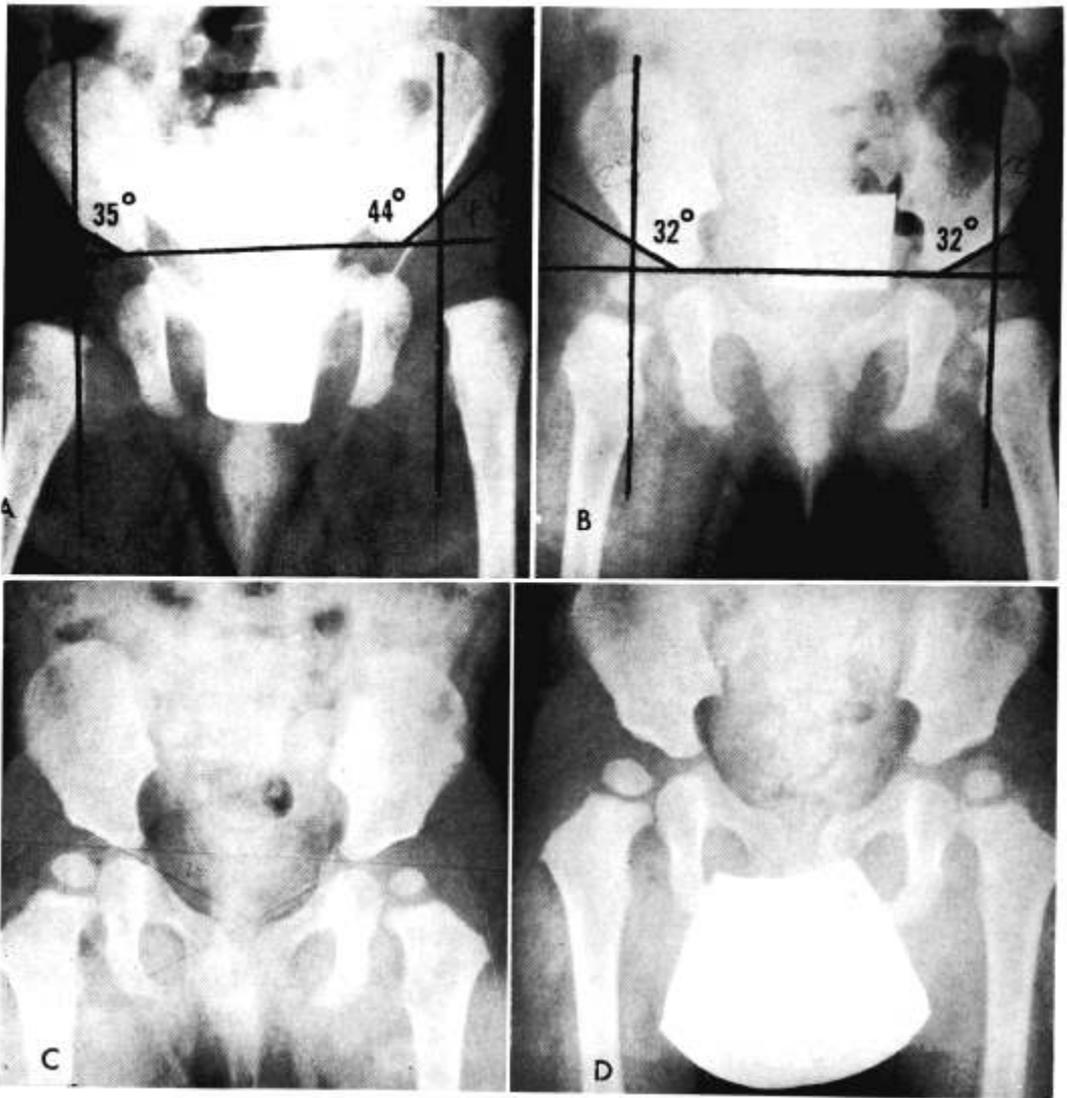
FIG. 4. Case 4. The left hip on this female infant could be displaced readily from the socket when first examined at 6 weeks of age. The roentgenogram (A) was taken at 3 days of age and shows an abnormal acetabular index (44°), lateral disposition of the femoral "beak" and equivocal shortening of the "H" line on the left. Prescribed splinting was discarded for the more practical cradle board. (B) Taken at age 6 months, (C) at 9 months, and (D) at 15 months. Though showing steady improvement through 9 months, the roentgenogram at 15 months shows failure of further improvement and retention of dysplastic features.

a minimum of 3 years is summarized in Table 5. Through analysis of these data, some impressions of the clinical behavior of this condition were gained, and these are discussed briefly, as follows:

1. *Dislocation of the hip at birth is rare.*

No case of complete dislocation was found in any of the infants examined during the 1st month following birth.

2. *Spontaneous correction of congenital dysplasia may occur.* Twenty-three cases of dysplasia which could be followed received
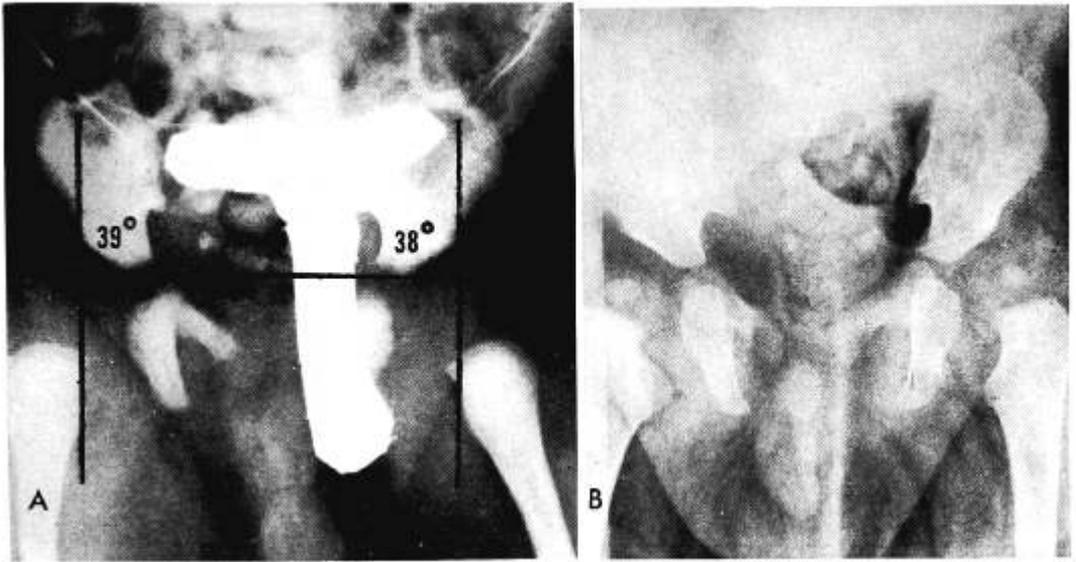
FIG. 5. Case 5. This newborn male infant had unstable hips demonstrable at 4 weeks of age. The roentgenogram (A) was taken at age 5 days and shows no convincing abnormalities. The right acetabular index is at the upper limits of normal (39°), but other findings are negated because of a slight amount of pelvic rotation in the film. Treatment was refused. Seven months later a roentgenogram (B) showed definite subluxation of the left hip and residual dysplasia on the right. This boy was hospitalized to assure regular, effective treatment. (C) Result 6 months later.

no treatment or were treated ineffectively. Utilizing roentgenographic criteria illustrated in Figure 2, 5 of those who went untreated were considered to have normal hips by physical and roentgenographic study. Case 3, Figure 3, illustrates this group.

3. *Dysplasia of the hip may persist.* Of the 23 cases of untreated dysplasia which were followed, 9 showed roentgenographic signs of residual dysplasia, including either continued elevation of acetabular index, or shallow socket with extrapelvic protrusion of the femoral head. However, each hip was entirely normal on clinical examination. This was one of the most disconcerting observations in the study, since it emphasized how easily dysplastic hips in older age groups may pass unrecognized despite critical physical examination. Case 4, Figure 4, illustrates this problem.

4. *Dysplasia may proceed to subluxation of the hip.* Three of the 23 cases showed evidence of subluxation, as illustrated by Case 5, Figure 5. A distressing feature of this group was that abnormal physical findings were completely absent in 2 of these. All 3 were subsequently admitted to the hospital for long-term abduction treatment and are now normal.
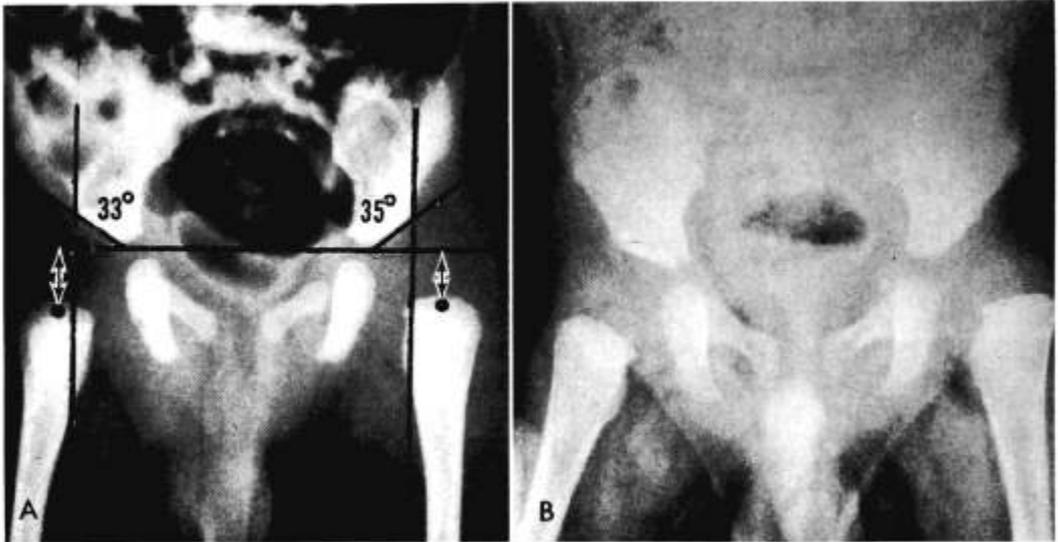
FIG. 6. Case 6. The left hip on this male infant could be displaced upon examination at age 3 weeks. The roentgenogram (A) was taken at 3 days of age and shows normal acetabular indices and the femoral "beak" lying medial to the vertical line. Suggestive unilateral "shallowness" and foreshortening of the "H" line are present, despite the slight rotation in the film. The roentgenogram (B), taken at 4 months of age, shows dislocation of the left hip. Clinically also, the hip was dislocated, and the Ortolani sign of "entry" could be elicited.

5. *Dysplasia may progress to complete dislocation of the hip.* Six of the 23 cases proceeded to complete dislocation. These cases offer greater strength to the validity of the early diagnostic criteria, and 2 of these are presented in Figures 6 and 7.

6. *Abduction treatment is almost uniformly effective.* Twelve hips were treated by abduction splinting, utilizing a plastic "Craig" splint. All but one resulted in physically and roentgenographically normal hips at the time of follow-up. The one exception was normal on physical examination but had some degree of extrapelvic protrusion of the femoral head on x-ray examination.

7. *The importance of repeated physical examination.* Interval examinations during the 1st year of life are essential, as stressed by Case 8, Figure 8. This patient was examined by me at birth and was considered to be normal. Unfortunately, a pelvic roentgenogram at birth was not made. At 10

months, a clinical and roentgenographic examination showed bilateral hip dislocations (Fig. 8). Undoubtedly, dislocation would have been recognized much earlier had regular interval examinations been made.

DISCUSSION

Several comments relative to the clinical behavior of congenital dysplasia of the hips seems to be justified on the strength of this preliminary study. In analyzing the physical and the roentgenographic findings, it was found in general that physical signs are of greater importance than the roentgenographic signs during the newborn and neonatal "dysplastic" period, whereas, roentgenographic features assume more consistent diagnostic significance during the later months of infancy, particularly in cases of residual dysplasia or cases of subluxation. In the latter instances, the roentgenogram may provide the only diagnostic information.

That this condition is a dynamic process

FIG. 7. Case 7. A 6-week-old white female. The femoral heads could be displaced manually from the acetabulum, and there was a 35° limitation of abduction of the flexed thigh, bilaterally. Roentgenogram at that time (*top*) shows suggestively disturbed Shenton's line and borderline acetabular indices. The mother refused treatment. The child returned to the clinic at 14 months of age with bilateral hip dislocation (*bottom*).
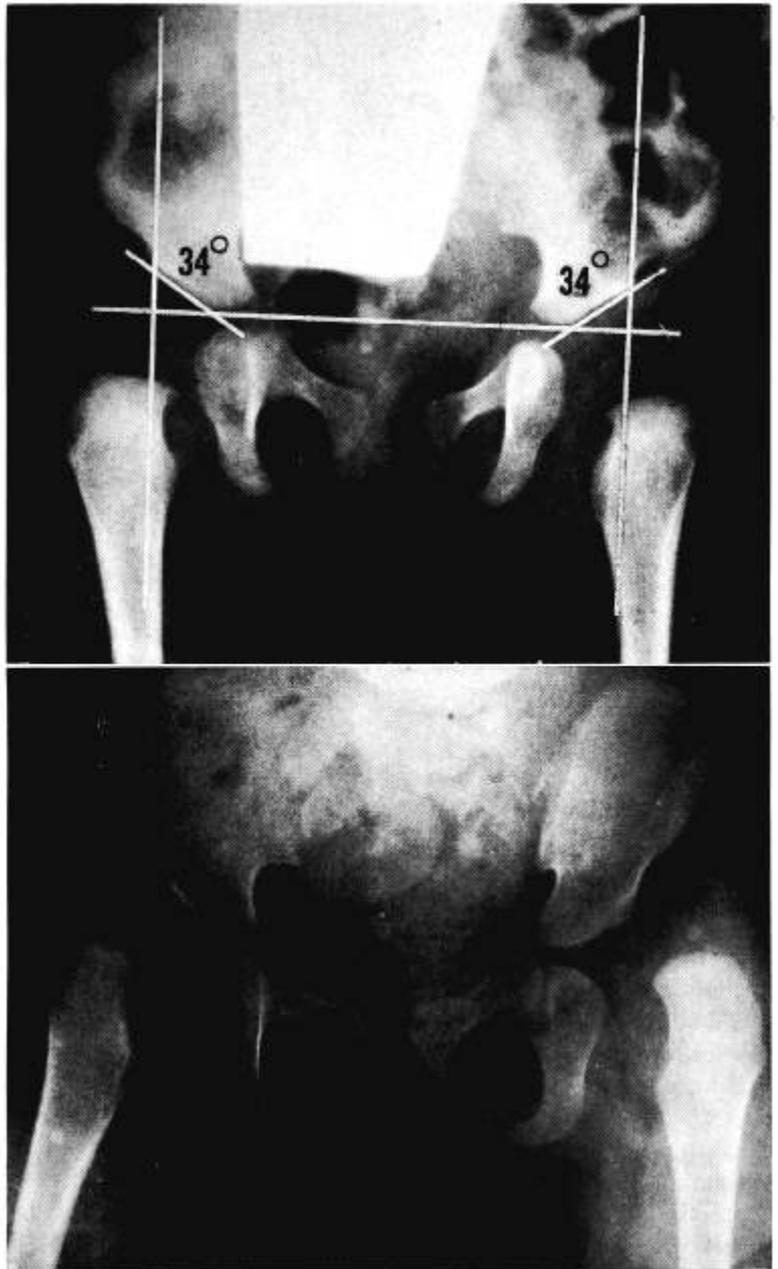
during the neonatal period must be apparent in analysis of the cases presented. There is abundant evidence to show that spontaneous restitution occurs in a significant percentage of cases of congenital dysplasia, while at the same time, a diagnosis may be missed in the newborn, even by an experienced examiner, only to present at a later period with clinical and roentgenographic evidence of dislocation. Thus, under no circumstances can one be dogmatic about the clinical behavior of this disease during the 1st year of life when the pelvis undergoes its most rapid and impressionable growth. In this study on the Navajo

FIG. 8. Case 8. This female infant was examined clinically at birth by the author and was considered to be normal. Unfortunately, no roentgenogram was taken at that time. At 10 months of age, when seen because of other illness, clinical examination showed bilateral dislocation of the hips, with a "jerk of entry" demonstrable. This diagnosis is supported by roentgenographic examination.

infant, there was no seasonal variation encountered in the incidence of dysplasia, and it was found that these infants during the 1st year of life are usually swaddled the same in both winter and summer.

Although not infallible, the roentgenographic and the physical signs listed earlier, when placed in their proper perspective, permit one to "chart a course" of diagnosis and therapy. During this early age, abduction treatment in a splint, as emphasized by Ponseti,[20] is all that is required. Though many of these patients may eventually become normal without treatment, as noted earlier, and as stated by McCarroll[15] and others, it is impossible to predict with any degree of accuracy what the ultimate fate of a dysplastic hip will be if treatment is denied.

SUMMARY

1. 1,155 Navajo infants under 3 months of age have been examined both physically and roentgenographically for signs suggesting congenital dysplasia of the hip.

2. Utilizing both physical and roentgenographic criteria, a diagnosis of dysplasia was made in 77, an overall incidence of 6.7%. Females predominated in 81.8% of the cases, and there was a predilection for unilaterality in the left hip.

3. 35 cases were followed for a period varying from 4 months to 3 years. The remaining 42 cases could not be followed. In 12 of the 35, the parents permitted and cooperated in the treatment program, and in the remaining 23, treatment was refused.

4. Analysis of the 35 cases which could be followed indicate that congenital dysplasia of the hip, when treated properly by simple abduction splinting at an early age, most often results in a normal hip; whereas, when *untreated* or treated improperly, congenital dysplasia of the hip may resolve spontane-

ously, may retain dysplastic stigmata, may proceed to subluxation, or may proceed to frank dislocation.

5. Congenital dysplasia of the hip is a dynamic process, having subtle and unpredictable expressions, which do not permit accurate prognosis in any case unless treated.

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