FROM MALMÖ GENERAL HOSPITAL, MALMÖ, SWEDEN: DEPARTMENTS OF PEDIATRICS (HEAD: PER SELANDER, M.D.), ROENTGENOLOGY (HEAD: SÖLVE WELIN, M.D.), AND ORTHOPAEDICS (HEAD: SOPHUS VON ROSEN, M.D.)

EARLY DIAGNOSIS AND TREATMENT OF CONGENITAL DISLOCATION OF THE HIP JOINT[1]

By

SOPHUS VON ROSEN

The various problems touching upon congenital hip join luxation have long been the subject of orthopedic discussion. Not least among these problems is that of treatment. In the thirties *Putti* began to argue in favour of early diagnosis and treatment. *Hilgenreiner* did likewise. At this time one could start to survey and judge the late results of the treatment when it had been commenced at the age of 2–3 years according to the norms stated by *Lorenz*. These were not encouraging and did not correspond with the often very good primary results. Thus *Severin* showed from a very large Swedish series that "a well developed hip roentgenologically" is obtained in only 4.24 %, "a moderate deformation of the femoral head, neck or acetabulum, but well built joint otherwise" in 7.14 %. The functional result is indeed often better, but as is too well known a roentgenologically abnormal hip joint will sooner or later lead to functional disturbances, which are often severely incapacitating.

Nor have the hopes been fulfilled which were centred upon early treatment. The most optimistic had expected good results in 80–90 % and even more. That this is not so has been demonstrated by *Pitzen* amongst others. Even if early treatment has indeed been accepted in principle it seems only rarely to be started before the child is about 1 year old. The main reason for this is that the diagnosis is seldom made earlier.

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In 1935 *Ortòlani* reported that a click can be felt in newborns with luxation or subluxation, when the leg is maximally turned outwards in maximal abduction. Similar observation were made by *Schede* and *Hilgenreiner* on infants. This symptom should enable the diagnosis to be made immediately after birth and facilitate the commencement of treatment equally soon. *Ortolani*'s observations do not seem to have been given their due weight. The chief reason for this is probably that as far as newborns and children in the first months of life are concerned, the task of roentgenologically verifying beyond doubt that a luxation actually exists is considered impossible (*Jacobson, Ortolani, Palmén, MacFarland, Berglund*). Thus it has not been clear whether an *Ortolani* click can emerge without the presence of a luxation. *Ortolani*'s work seems to have won greater interest among the pediatricians than in the orthopedic field.

The City of Malmö has approximately 200,000 inhabitants. Practically all children are born in the obstetric department of Malmö General Hospital—during the years 1952–1955 11,995 babies, i.e. more than 99.5 % of all newborns—and are examined by a pediatrician a few days after birth. In 1952 *P. Selander* began a systematic search for Ortolani click. The first positive case was noticed in 1953, this was X-rayed and referred to the orthopaedic clinic for treatment. Later on 10 cases (with 17 clicking joints) were discovered and treated.

In the first 8 cases reported in table I—

1. the roentgen examination was found to correspond well with "the clicking".
2. the clicking observed by the pediatrician could in almost all cases be confirmed by the orthopaedic surgeon.
3. the treatment which consisted of keeping the legs in the abducted or the abducted and outward-rotated position was started almost immediately.
4. Two children had to be kept in the hospital after some months of ambulatory treatment, since their mothers found it difficult to carry out the treatment. The other six children were treated without hospitalisation.
5. The majority of the children began to walk at the age of about one year.
6. The 1–3 year follow-up showed 13 roentgenologically normal or almost normal hips and 1 with slight subluxation.

TABLE 1

CASE NR.	ORIGINAL EXAMINATION				AGE IN DAYS AT START OF TREATMENT	TREATMENT		STARTED TO WALK AGE IN MONTHS	FOLLOW UP EXAMINATION	
	ORTOLANI-CLICK		X-RAY			METHODS	REMARKS		X-RAY	TIME OF OBS. (YEARS)
	R	L	R	L					R L	
1	+	+	(+)	+	7	a. STICKING PLASTER 2.5 MONTHS b. PLATE 2 MONTHS c. PILLOW 5 MONTHS	AMBULATORY TREATMENT	11	N N	3
2	+	+	+	+	6	PILLOW 2 MONTHS	AMBULATORY TREATMENT	12	N N	2 9/12
3	+	+	+	+	9	PILLOW 4 MONTHS	AMBULATORY TREATMENT	12	N N	2 7/12
4		+		+	27	PILLOW 2 MONTHS	AMBULATORY TREATMENT	13	N N	2 7/12
5	+	+	+	+	4	a. PLATE 4 MONTHS b. PLASTER OF PARIS 4.5 MONTHS	HOSPITAL TREATMENT 6.5 MONTHS	16	(N) S	2 5/12
6		+	(+)	+	4	PLATE 7 MONTHS	AMBULATORY TREATMENT	10	N N	2
7	+	(+)	+	+	6	a. PLASTER OF PARIS 1 MONTH b. PLATE 6 MONTHS c. PLASTER OF PARIS 10 MONTHS	HOSPITAL TREATMENT 1 YEAR	21	(N) N	2 3/12
8	+	+	+	+	17	a. PILLOW 2 MONTHS b. PLATE 8 MONTHS	AMBULATORY TREATMENT CONTINUES	–	(N) N	11/12

+ CERTAIN
(+) POSSIBLE

+ CERTAIN
(+) INDICATED

N NORMAL
(N) SHALLOW ACETABULUM
S SUBLUXATION

DISCUSSION

It may appear surprising that the result of the X-ray corresponds so well with "the clicking", when the general opinion seems to be that X-rays do not give reliable information until the child is 4, perhaps 6 months old (*Jacobson, Palmén, Ortolani, MacFarland*). The photographs have been taken with the child lying in the supine position with the legs drawn straight down and again with the legs in outword rotation and abduction (Lauenstein's position). The central ray has been directed towards the upper margin of the symphysis.

Evaluation of the X-ray pictures is usually based on "Putti's triad", i.e., upward displacement of the upper end of the femur, sloping acetabular roof and poorly developed epiphyseal nucleus. In these cases the epiphyseal nucleus gives no information since it is not yet developed. In the reports made after the X-ray examination a more detailed analysis of the X-ray picture was not provided in the majority of cases. It should perhaps be pointed out that no case was examined until the diagnosis of hip luxation was suspected following on observation of the clicking.

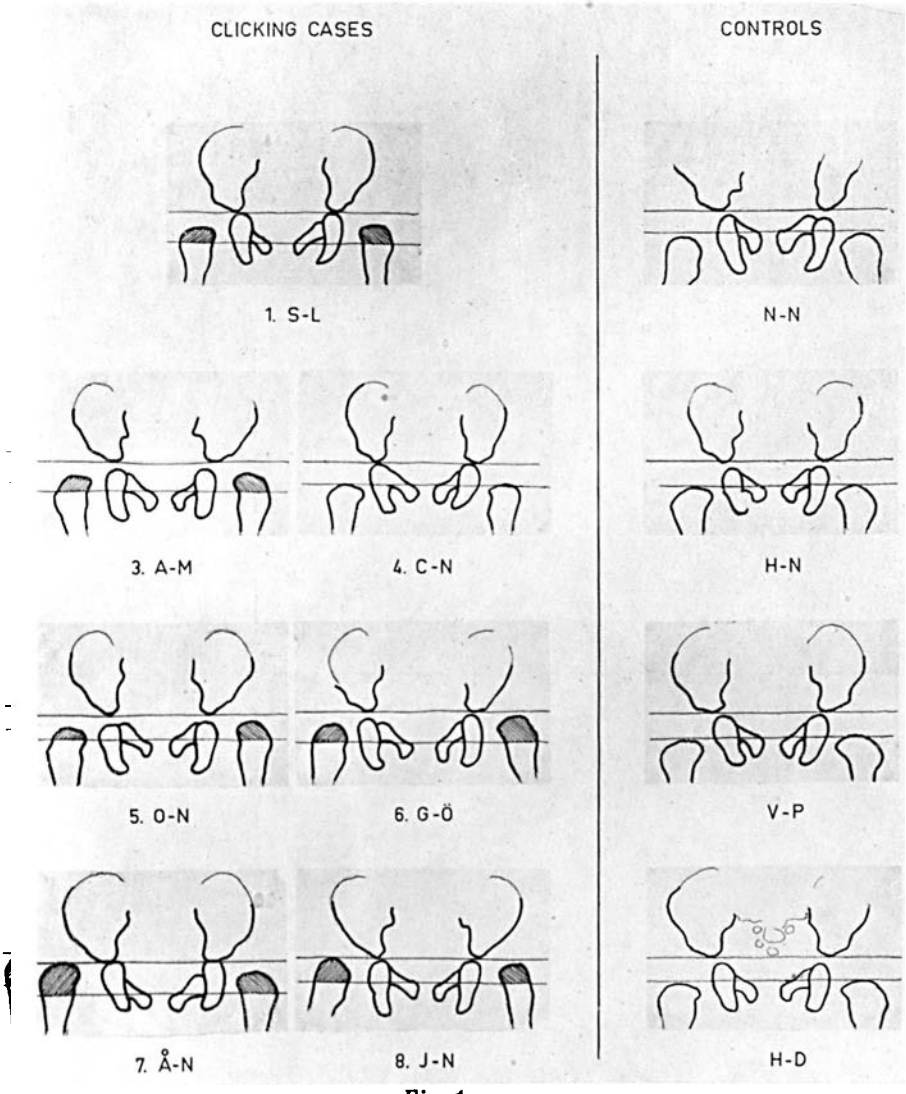


Fig. 1.

Radiographs in newborns. If a line is drawn through the lower corner of the ilium, the y-line, and a parallel line through the upper margin of the symphysis, the upward dislocation of the femur will be clearly seen in all the clicking hipps except for one (Case 4). In one of the clicking cases (Case 2) radiograph is missing.

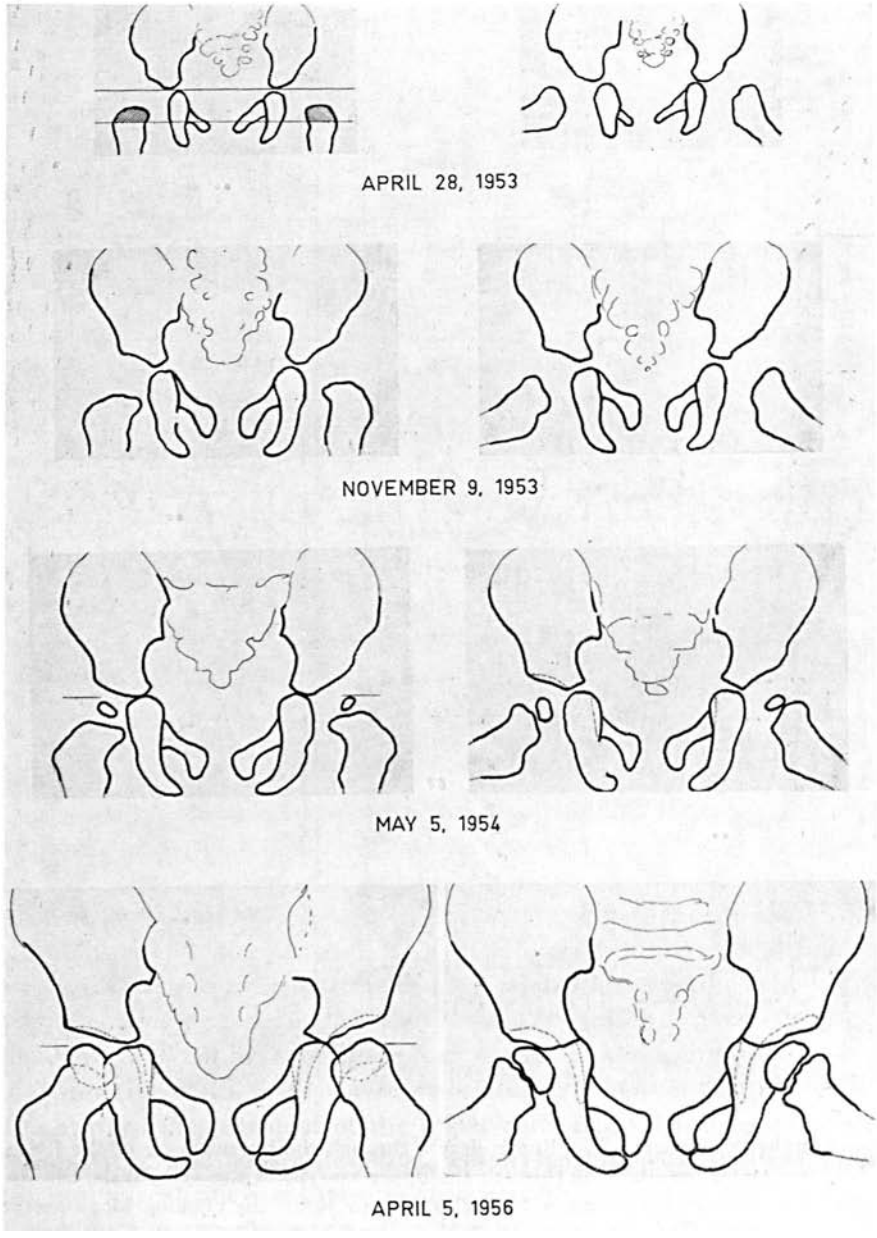


Fig. 2.
Case 1. Girl, S-L, born April 26, 1953.

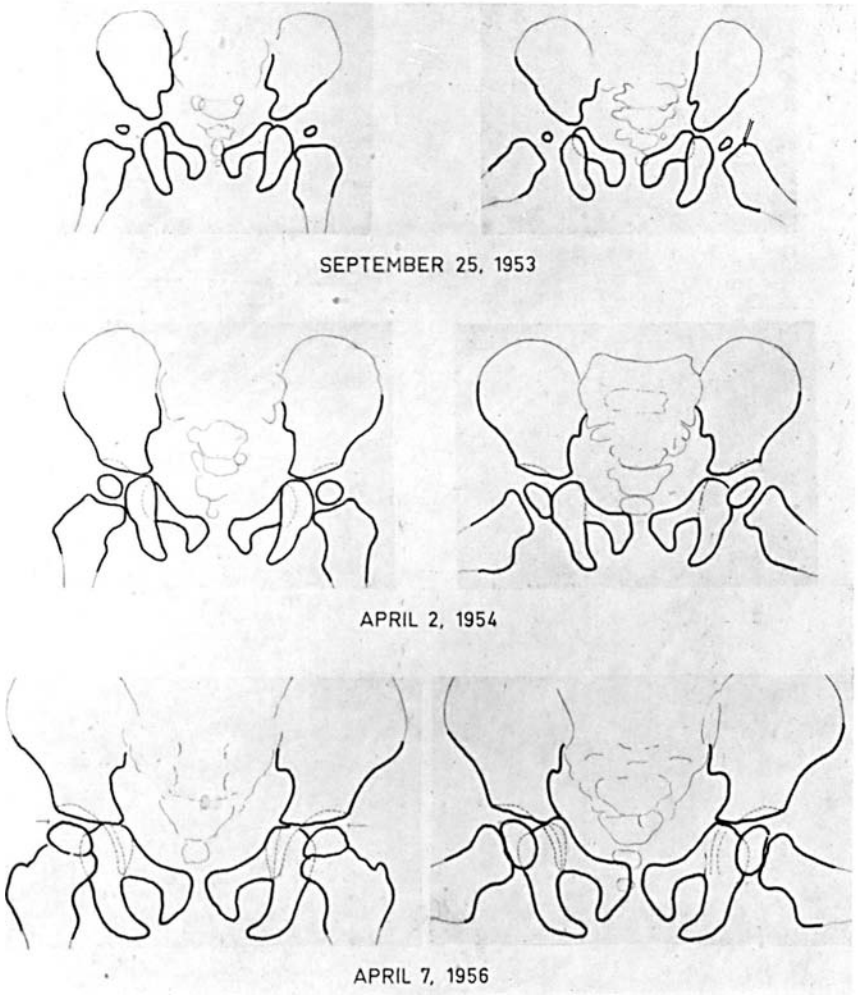


Fig. 3.

Case 2. Girl, Ö-N, born July 11, 1953.

First X-ray examination juli 14, 1953 showed "signs of a bilateral luxation of the hip joint". Radiographs lost.

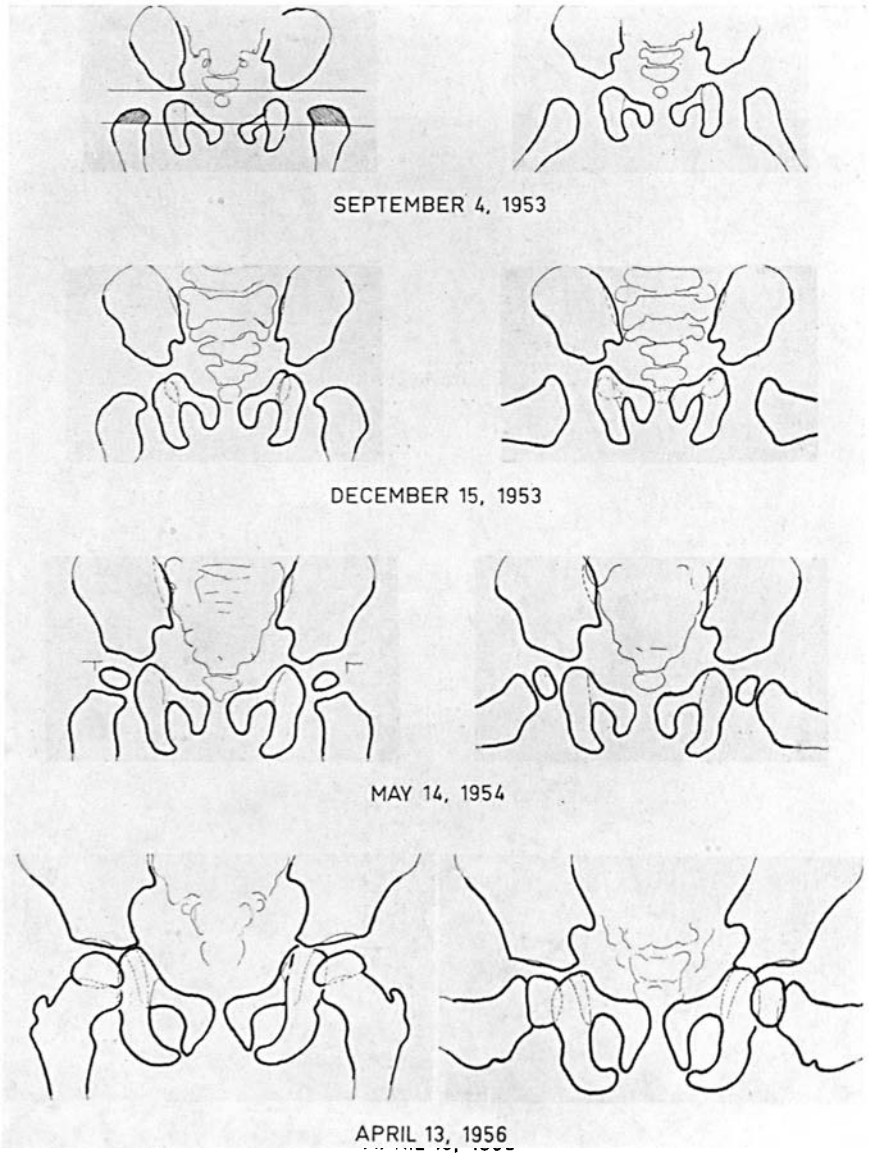


Fig. 4.
Case 3. Girl, A-M, born August 26, 1953.

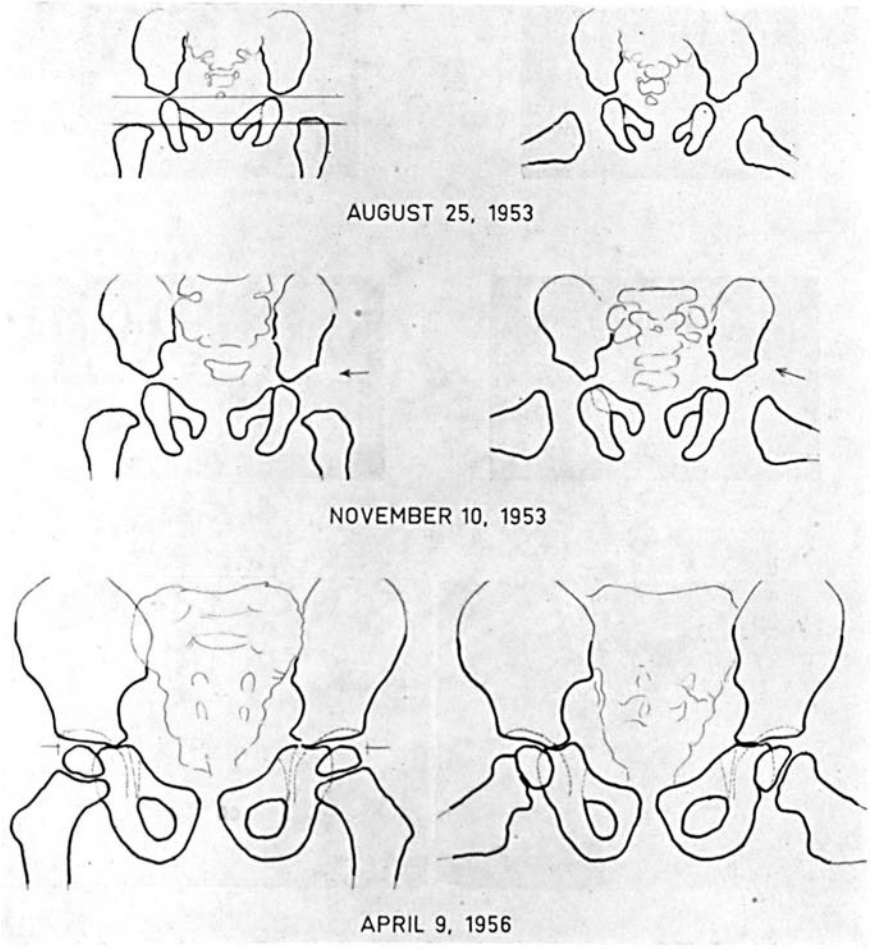


Fig. 5.

Case 4. Girl, C-N, born August 22, 1953.

In this case there is no obvious upward displacement of the femoral diaphysis. By comparison with the other side a clear lateral displacement is however seen on the left clicking side.

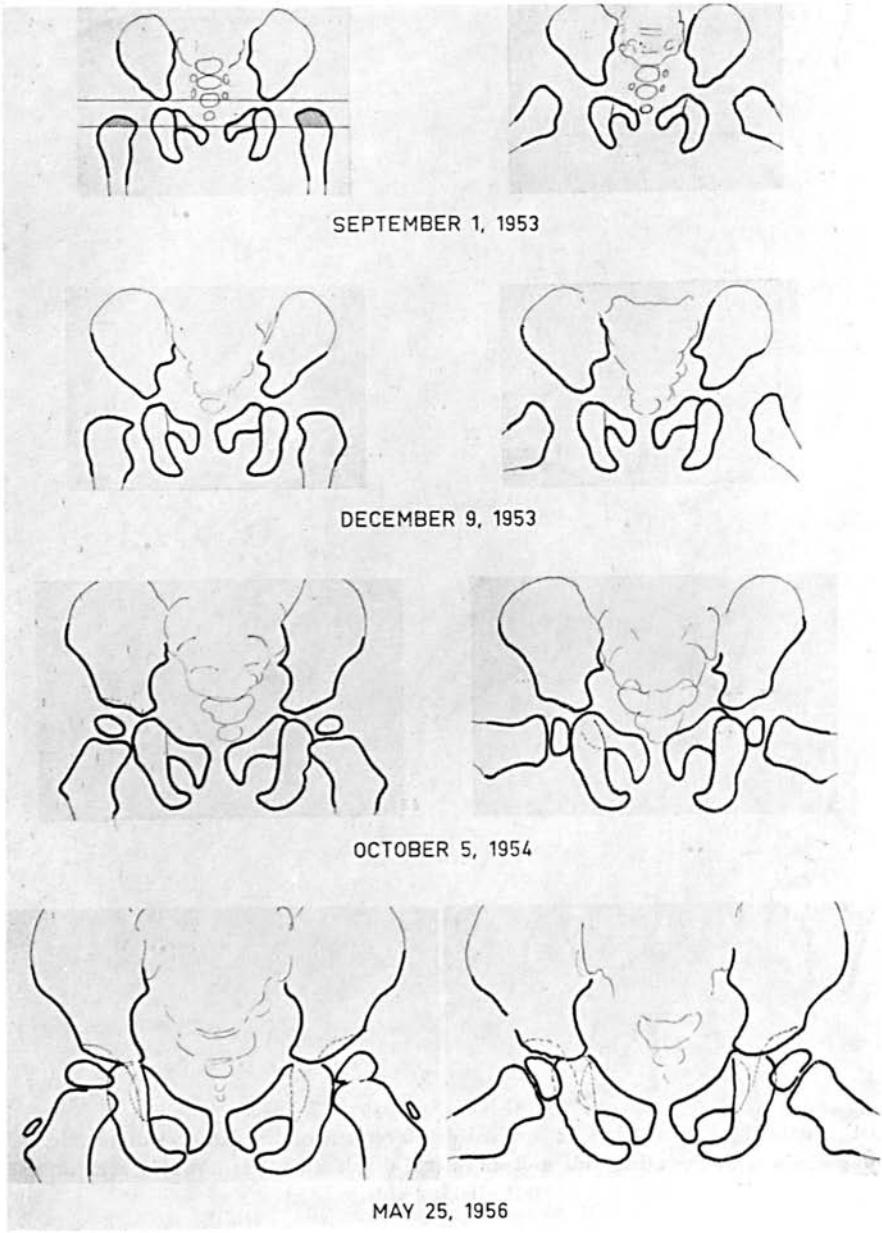


Fig. 6.
Case 5. Girl, O-N, born August 29, 1953.

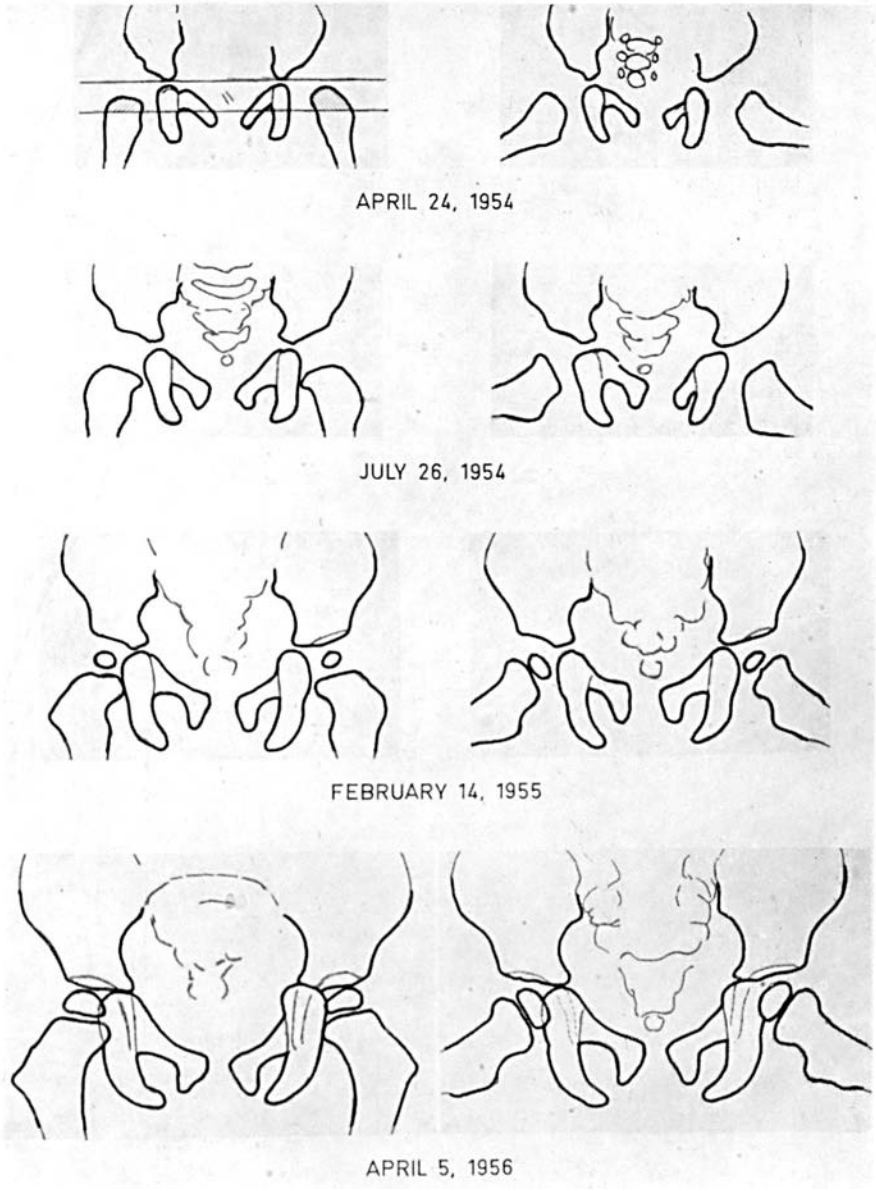


Fig. 7.
Case 6, G-Ö, born April 22, 1954.

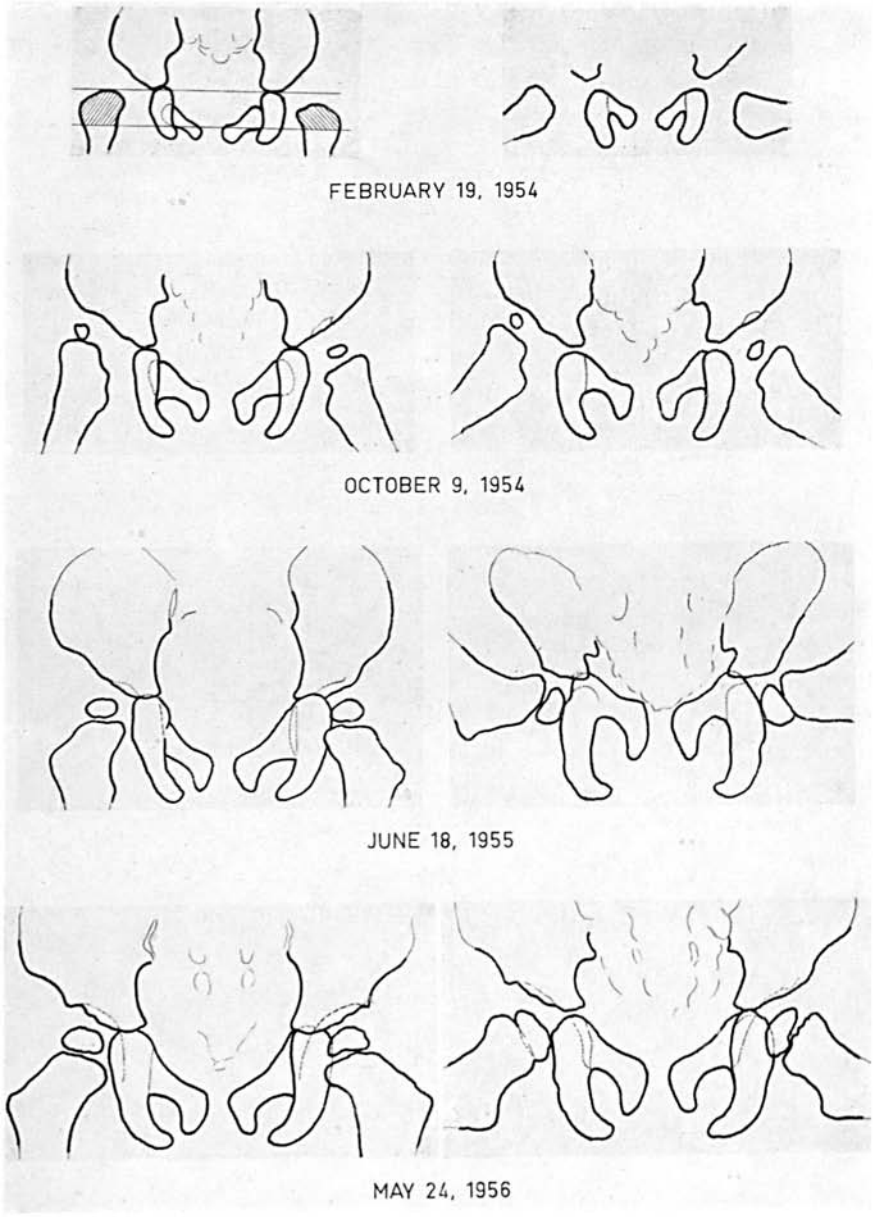
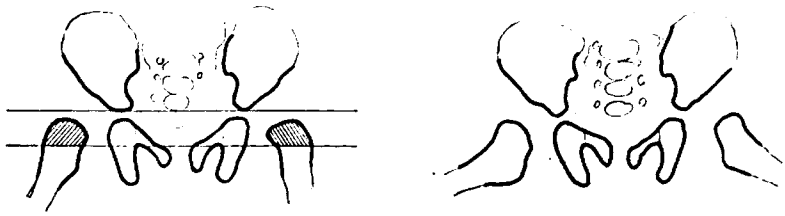


Fig. 8.
Case 7. Girl, Å-N, born February 16, 1954.

Fig. 9.
Case 8. Girl, J-N, born June 24, 1955. →



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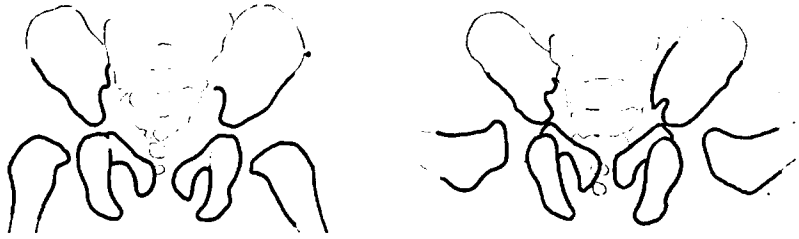

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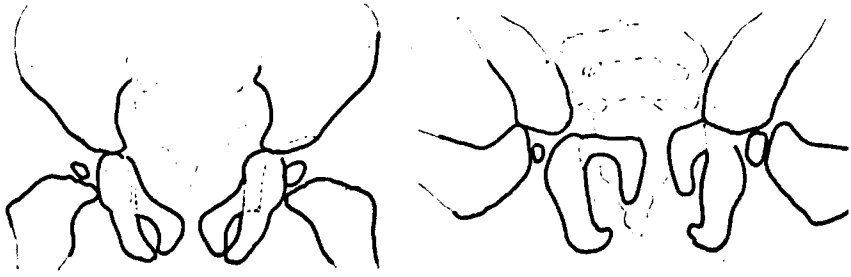


MAY 26, 1956

The study of the X-ray pictures which I pursued in connexion with this comparison showed a still better correspondence between the X-ray picture and the clicking. This shows that the major sign betraying a luxation is the upward displacement of the upper end of the femur. Only one of the clicking hips (case 4) revealed no obvious upward displacement of the femoral diaphysis. On the other hand by comparison with the other side a very clear lateral displacement of the upper end of the femur was present. The upward displacement of the upper femoral end emerges very plainly if a line is drawn through the upper edge of the symphysis parallel with a line through the Y cartilage. On the control cases this line runs through or just above the upper edge of the femoral diaphysis. When the femur is displaced upward this breaks off a larger or smaller piece of the upper end of the femoral diaphysis. The control cases were chosen from 8 newborn girls weighing from 3000–4000 grams at birth (Fig. 1).

The shape of the acetabulum is rather more difficult to judge in the newborn infant, but the control cases seem indeed to show a roof with a more transverse direction than in the luxation cases (Fig. 1). One of the control cases showed a slight upward displacement of the femoral end and a somewhat sloping acetabular roof on both sides. X-ray check of this case 6 months later still shows a sloping roof. It is indeed not improbable that a subluxation position may develop in this case later on. The case will be given continued checking.

In judging the dislocation *Hilgenreiner*'s method of measurement may also be used. It appears from this that the distance, called h by *Hilgenreiner,* between the y-line and the upper edge of the femoral diaphysis does not exceed 5.5 mm in any of the cases judged to have definite upward dislocation. A more detailed analysis of the X-rays is outside the scope of this work. They will be discussed in a future investigation.

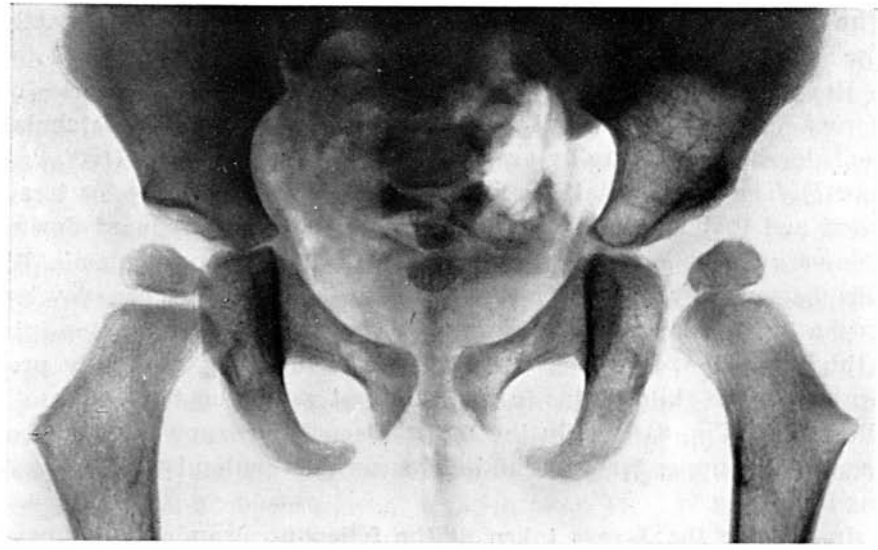
Undoubtedly it is of extreme importance that a clinically suspected hip luxation can be roentgenologically confirmed and in my cases this was possible. A roentgenological examination ought not to be omitted in a single case. However it should also be pointed out that the Ortolani click can hardly be anything else but what we call the reduction click, when we reduce hip joint luxations in older children. The difference is only that the reduction occurs so much more easily in the newborn infant both because no muscular resistance must be overcome and because the dislocation is generally less serious than in the older child.

The feeling when the joint head slips into the acetabulum is exactly the same in both cases.

How the hip joints have developed will be seen from the series of X-rays (Figs. 2–9). Several X-ray pictures show that the acetabular roof develops considerably even during the first 6 months (figs. 2, 4 and 7). This means that it is important to utilise this time for treatment and that it is essential that the joint is in fact reduced during this period. *Ortolani* states his early treatment to be prophylactic. By this he probably means that an untreated subluxation can develop into a luxation and that an untreated low luxation may develop into a high luxation. The risk of such a development is especially present when the child begins to walk and put weight on the leg. Case 7 illustrates (Fig. 8) plainly the fact that continued upward displacement of the upper femoral end may occur even without weight-carrying by the leg.

In judging the X-rays taken at the follow-up examination I have used the term normal in the majority of cases. This may indeed seem bold or perhaps completely unjustified particularly as the observation period is short. I consider that this evaluation holds good however. The future course will show if I have erred. I do hope not. Those X-ray pictures, which were not regarded as normal, are shown in Fig. 10.

Various types of abduction cushions (*Putti, Ortolani, Frejka*) or abduction splints and plates (*Hilgenreiner, Palmén*) have been suggested for the early treatment of the hip joint luxation whether it is begun immediately after birth or later. A more and more evident complication of the reduced hip joint luxation is an aseptic necrosis with secondary deformation of the joint head. The cause is considered to be a traumatisation of the joint head connected with the treatment. In itself the risk of incurring this complication is probably much less if the reduction is performed during the first months of life than if it happens later, for the reduction is so much easier with the infant child. The risk itself increases if during the treatment the joint head is allowed to slip out and into the joint cavity every time the child is attended to and is much more than if the joint head is permitted to remain in the acetabulum. It seems to me that a more effective method of fixation than those stated above is required therefore. This is said also from the point of view that one's aim should be to see that the joint head remains in its reduced position and that this condition should be achieved as soon as possible. In the clinic we have constructed a new type of splint which proved effective (Fig. 11) in the two



a

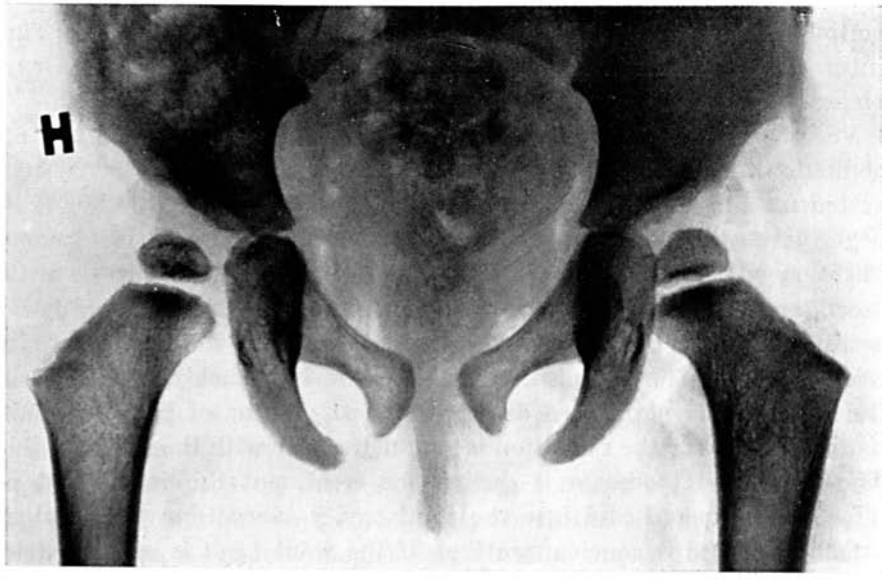


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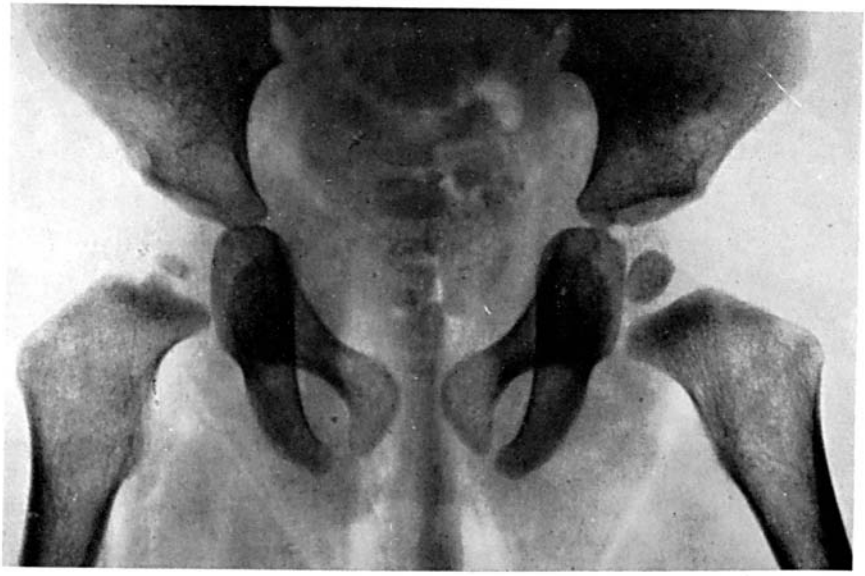
Fig. 10.



c

Fig. 10.

a, b, c. X-ray pictures of the hips, which were not regarded as quite normal at the follow-up examination (Cases 5, 7, 8).

cases we have employed it (these cases are still under treatment). This is cut from a 1.5 mm thick sheet of aluminium, according to the baby size required and lacquered with celluloid. It can easily be bent and shaped, it is washable and therefore hygienic. A cotton stocking or other form of padding is passed over the lower thighs and over this again is drawn a plaster or rybb or shield. The pad can be changed without removing the splint from the child. If required the frame can easily be taken away and replaced again with the child in the abdominal position as the picture shows.

An important question is to what extent the Ortolani symptom is reliable. According to our experience in Malmö it is highly reliable. Since 1953 not a single case of congenital luxation has appeared at the clinic for treatment apart from those reported here and since there is in Malmö a careful, well organised and continuous check on babies then any missed cases amongst newborn infacts ought to have been discovered and referred to the orthopaedic clinic for treatment. It is probable that a number of subluxations escaped discovery since such cases presumably have not produced any clicking, but this is another question.

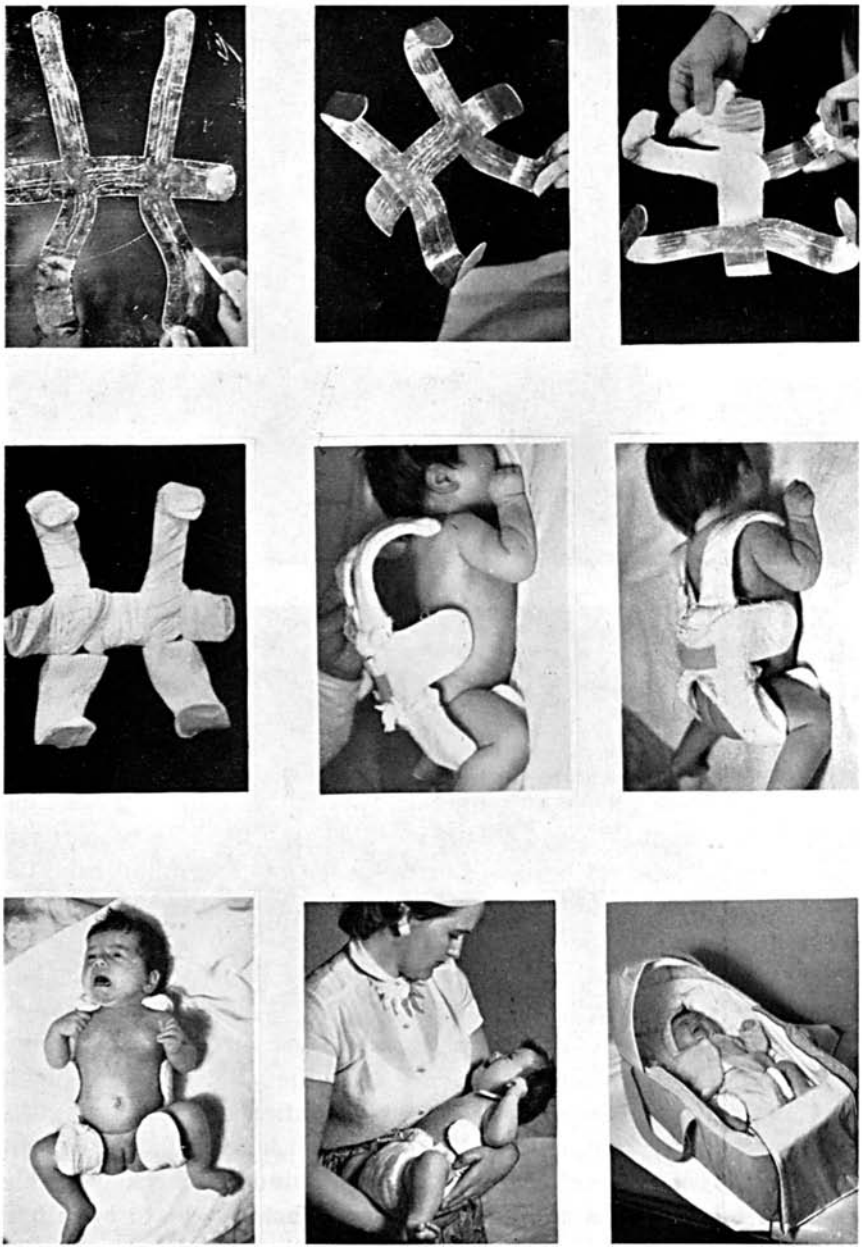


Fig. 11.

The splint is cut from a plate of aluminium, 1.5 mm. thick, and painted with celluloid-aceton solution. It is easily formed after the baby's body. The cover can be changed and the splint be cleaned without being taken off.

CONCLUSION

1. The Ortolani-click seems to be quite adequate as a means of discovering luxation or fairly advanced subluxation in newborns. Since early diagnostic examinations were introduced in Malmö, not a single case of dislocation of the hip joint has been discovered at a later stage.

2. All available roentgenograms but one show a considerable upward dislocation of the femur. The differing roentgenograms show a distinct lateral dislocation of the upper end of the femur and a somewhat shallow acetabulum on the clicking side. There seems thus to be no doubt that luxation or subluxation (possibly preluxation) was present in all the instance. The statement often found in the literature, viz., that roentgenograms of the hip joint of newborns have no diagnostic value was not borne out by my series of cases.

3. The acetabular roof shows a considerable development during the first six months of life. Reduction and effective fixation in abduction position even during these first months must therefore be of utmost importance for a "normal" development of the hip joint.

4. Ambulatory treatment with abduction pillow or abduction plate is not always sufficiant. A frame constructed by me seems to be more convenient.

5. Follow-up examinations show 14 roentgenologically normal or almost normal joints and only one case of slight subluxation.

6. The tracing of the cases is a matter of organisation and can only be accomplished with the aid of co-operating pedatricians in the obstetric wards.

7. The treatment should be supervised and controlled by trained orthopedic surgeons, since these are best able to judge the development of the condition during the course of treatment.

SUMMARY

Since 1952 clicks (ad mod. Ortolani) have been observed in 14 hip joints out of eight newborn girl children. In all cases the X-ray investigation revealed a dislocation upward and/or laterally of the upper end of the femur. Treatment was commenced immediately. Six children were given ambulatory treatment by keeping the legs in the abduction position by means of a cushion or plate. It was necessary to admit two children to the orthopedic clinic for a period of plaster treatment. The follow-up examination shows roentgenologically nor-

mal or almost normal hip joints with the exception of one joint which reveals a slight subluxation.

The cases reported show that it is of great—perhaps decisive—importance that the treatment should be started immediately after birth.

An aluminium splint is described which is used for two children treated very recently.

In the city of Malmö (approx. 200,000 inhabitants) since 1952 almost all newborn infants have been examined by pediatricians for Ortolani click amongst other things. By this means all the new cases of hip joint luxation seem to have been discovered.

Early diagnosis and early treatment presuppose cooperation between pediatricians in the maternity department, radiologists and orthopedic surgeons. Achieving this is a problem of organisation. The treatment should be guided and supervised by the orthopedic surgeon since he has the best qualifications for judging the development of the condition during the course of the treatment.

RESUME

Depuis 1952, on a observé (ad mod. Ortolani) un cliquetis dans 14 articulations de la hanche chez huit nouveaux-nés, tous des filles. Dans tous les cas l'examen aux Rayons X révéla une dislocation vers le haut et/ou latérale de l'extrémité supérieure du fémur. Le traitement fut entrepris immédiatement. Six bébés furent soignés ambulatoirement par la fixation des os en position d'abduction au moyen d'un coussin ou d'une plaque. Il fut nécessaire d'hospitaliser deux enfants dans une Clinique orthopédique pour une période de traitement dans le plâtre.

Les examens complémentaires ont montré des articulations de la hanche radiologiquement normales ou pratiquement normales à l'exception d'une seule dans laquelle il y avait une légère subluxation.

Les cas rapportés montrent qu'il est tres important, et peut-être décisif, d'entreprendre le traitement immédiatement après la naissance.

Il est donné la description d'une plaque en aluminium qui a été utilisée pour deux des enfants soumis récemment au traitement.

Pour pouvoir poser un diagnostic très rapidement et entreprendre un traitement à la phase précoce, il est nécessaire qu'il y ait une collaboration entre les pédiâtres de la Maternité, les radiologistes et les chirurgiens orthopédistes. C'est là une question d'organisation. Le traitement doit être guidé par le chirurgien orthopédiste, qui est le mieux

qualifié pour juger du développement de l'état de l'enfant au cours du traitement.

ZUSAMMENFASSUNG

Seit 1952 wurden bei acht neugeborenen Mädchen in insgesamt 14 Hüftgelenken das von Ortolani beschriebene Knacken gefunden. In allen Fällen zeigte die Röntgenuntersuchungen eine Luxation des oberen Femuren des nach aufwärts und/oder nach lateral. Mit der Behandlung wurde sofort begonnen. Sechs Kinder wurden ambulatorisch mittels Fixation der Beine in Abduktion mit Hilfe von Polstern oder Platten behandelt. Zwei Kinder mussten in die orthopedische Klinik aufgenommen und mit Gipsverband behandelt werden. Die Nachuntersuchung erwies röntgenologisch normale oder fast normale Hüften, mit Ausnahme von einem Gelenk, das eine leichte Subluxation zeigte.

Diese Fälle erweisen, dass es von grosser – vielleicht entscheidender – Wichtigkeit ist mit der Behandlung sofort nach der Geburt zu beginnen.

Eine Aluminiumschiene wird beschrieben, die an den beiden zuletzt behandelten iKndern verwendet wurde.

Früherkennung und Behandlung voraussetzen Zusammenarbeit von Kinderarzt an geburtshilflichen Abteilungen, Röntgenologen und orthopedischen Chirurg. Dies ist eine Aufgabe der Organisation. Die Behandlung sollte vom orthopädischen Chirurg geleitet und beaufsichtigt werden, da er die besten Voraussetzungen für die Beurteilung der Entwicklung des Zustandes im Laufe der Behandlung hat.

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