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CAPSULAR ARTHROPLASTY (COLONNA'S OPERATION) FOR CONGENITAL DISLOCATION OF THE HIP

Results of 102 Operations

By

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Arthroplasty with the joint capsule as interposition material in congenital dislocation of the hip was suggested by *Codivilla* in 1900 (4). The method was adopted by *Colonna* (5) who, in 1932, reported four cases. Since then, in a number of articles, *Colonna* has given a detailed description of the technique and indications for this operation and has reported late results of some cases (6, 7, 8). He recommends operation at the age of 3 to 10 years. Few reports of this operation have appeared in the literature. *Bertrand* (1) operated on 97 patients and obtained a good result in 70 per cent of cases. *Kawamura* (12) carried out this operation in 53 cases with a poor result in 20 per cent. *Schmitt* (23) gave a detailed description of 50 hips operated on at the Balgrist Clinic, Zürich, a good result being obtained in 40 per cent of cases. In 1954 *Francillon* (10) published his experiences of a number of cases, and in 1962 *Gschwend* (11) re-examined the same series, analysing the causes of the failures. Results in small series of 19 to 26 cases have been published by *Bodart et al.* (2), *Červeňanský* (3) *Ter-Eguiasarov & Dolganova* (25) and *Petit & Caracostas* (19). Good results were reported in about threequarters of these cases. *Francillon, Bertrand* and *Petit & Caracostas* recommend shortening osteotomy of the femur in connexion with Colonna's operation in cases in which the femoral head cannot be sufficiently pulled down by traction.

Dega et al. (9) performed a one-stage procedure which is a combination of *Colonna*'s and *Zahradníček*'s (26) methods. Preoperative traction is not used, while femoral shortening osteotomy is always carried out, the antetorsion of the femur being simultaneously corrected. The

authors report good results in 121 cases of 172 followed up for 2 to 4 years after this operation.

Colonna's operation is a major surgical procedure with a high frequency of complications, as appears from the present series, too. The indications must therefore be strict, particularly since it is well known that patients with untreated luxations often remain free from pain until middle age and that the limp can be considerably improved by subtrochanteric osteotomy (13). A difference in length can be corrected by shortening osteotomy. However, to an orthopedist a luxated joint is always repugnant, and he is seriously tempted to operate in cases in which closed treatment is not possible or has failed. Although, in recent years, there has been some improvement in the early diagnosis of congenital dislocation of the hip in Finland, a number of untreated patients aged 2 to 8 years are still remitted each year to the Orthopaedic Hospital of the Invalid Foundation. Since in most cases the age of these patients precluded any question of successful closed treatment, it was decided, in 1953, to adopt Colonna's operation. During the ten-year period 1951–1961 operative reduction of about 500 hips was carried out in this hospital. Part of this series was reported by me in 1953 (16).

MATERIAL

The series comprises 92 patients treated during the period 1953–1960. Colonna's operation was carried out unilaterally in 82 cases and bilaterally in 10 cases. The number of operated hips was 102. Of the patients 73 were girls and 19 boys, the proportion being 5: 1. The nature of the deformity was as follows:

Bilateral dislocation	29
Dislocation and subluxation	17
Dislocation and dysplasia	9
Dislocation and normal	37
	92

Bilateral lesion was present in 60 per cent of cases. The annual distribution of the operations is given in Table 1.

As can be seen from the table, a larger number of operations was carried out during the period 1955–1957, while the attitude subsequently became more cautious. The age of the patients at the time of operation can be seen from Table 2.

TABLE 1
Annual distribution of operations.

Year	1953	1954	1955	1956	1957	1958	1959	1960	Total
No. of hips ..	1	12	18	38	15	7	6	5	102

TABLE 2
Age of patients at operation.

Years	1–2	2–3	3–4	4–5	5–6	6–7	7–8	17	23	Total
No. of patients	7	21	17	21	11	9	4	1	1	92

Operation was carried out at the age of 1 to 3 years in 28 cases, at the age of 3 to 8 years in 62 cases. The series also comprises two older patients.

The data concern 70 hips with previously untreated dislocation, 21 hips previously treated with plaster bandage in the abduction position and 11 hips which had undergone operative reduction. The material thus consisted of 70 primary dislocations and 32 redislocations. Most of the cases were of *McFarland*'s type III: Dislocated dysplastic hips.

INDICATIONS

In agreement with many other orthopedists, we consider that closed treatment is useless and, as a rule, contraindicated, if the patient has reached the age of three years. Between the ages of one and three years we carry out operative reduction if efforts at closed reduction have failed or if the result of the reduction is unstable. In 1956 Colonna's operation was carried out on a number of patients aged one to three years in order to gain experience of the operation at this age. The principal indication for Colonna's operation was dislocation in three- to eight-year-old patients. Unsuccessful treatment in plaster bandage or previous operative reduction with ensuing redislocation constituted secondary indications.

METHOD OF TREATMENT

Preoperative Treatment.

Colonna's operation without preoperative traction was carried out in 39 cases. Low dislocation was present in most of these cases, while 18 of the cases were redislocations following previous treatment. The operation was preceded by traction with adhesive plaster for 2 to 5

weeks in 26 cases. In 37 cases wire extension was applied, often together with a pelvic plaster bandage, for 2 to 4 weeks before operation. These were cases of high dislocation.

Preoperative *adductor tenotomy* was carried out in 33 cases.

Arthrography was carried out preoperatively in 19 cases. Earlier arthrography used to be carried out in a great many cases at this hospital (*Laurent* (16)) but latterly it has been performed in selected cases only. If, in doubtful cases, one wants to find out whether there is a dislocation or a subluxation, the condition of the limbus in the arthrogram is conclusive. It also gives a good idea of the lateral part of the acetabular roof which is not yet ossified. Contrary to *Bertrand* and *Francillon*, we have not considered it necessary to carry out routine arthrography before Colonna's operation. On the other hand, it is no doubt important to have experience of what the arthrogram looks like in different cases.

Preoperative reduction under anaesthesia was attempted in 9 cases.

Operation.

At Colonna's operation the same technique was used as in operative reduction. This method has been described in previous publications (14, 16). The skin incision is made from the spina iliaca sup. ant. curving to the lateral side of the femur about 5 cm. distally of the greater trochanter. The joint is exposed between the tensor fasciae latae and the rectus femoris muscle. If necessary, the incision is extended upwards and part of the insertion of the gluteus medius to the crista iliaca is divided. The muscular attachment to the greater trochanter is detached together with a thin plate of cartilage. The epiphyseal plate of the greater trochanter must not be injured since this may give rise to coxa valga (*Laurent* (17)). In the majority of cases the ileopsoas tendon was detached, together with a piece of the lesser trochanter, and transplanted to the lateral side of the femur to act as an inward rotator. In any case, the ileopsoas tendon often constitutes an obstacle to reduction (22). The joint capsule was mostly large enough to cover the femoral head. If this was not the case, the fascia lata and the limbus were used as additional material in a couple of cases. The acetabulum was shaped with special chisels and a pneumatic reamer. A comparatively deep and well-shaped acetabulum is important for a good result. This was not always achieved, as will be seen later. Reduction of the femoral head into the new socket sometimes proved difficult if the head

was not sufficiently pulled down by traction. In such cases there often occurred, as expected, complications in the shape of osteochondritis. Shortening osteotomy of the femur was not done. After the operation the hip in Lange's position with maximal inward rotation, was encased in a plaster bandage.

Transposition of the ileopsoas tendon to the lateral side of the femur was carried out in connexion with the operation in 81 cases. In 8 cases the tendon had already been transplanted. Transposition of the ileopsoas was thus carried out in 86 per cent of cases.

In congenital dislocation of the hip the femoral antetorsion is generally greater than normal. In agreement with many other authors, we consider that the antetorsion should be corrected when necessary. Rotation osteotomy was generally carried out two to three weeks after Colonna's operation. The osteotomy was made with Gigli's saw in the middle of the femur, the distal portion being rotated outwards until the patella was in a frontal position. The fragments were united by means of a Lane plate and four screws. After the osteotomy the hip was placed in a plaster bandage for 6 weeks. As a rule, the plate was removed one year after the operation. Correction of valgus position of the femoral neck was not carried out in the present series.

Rotation osteotomy of the femur was carried out after Colonna's operation in 57 cases and before the operation in 9 cases. The antetorsion was corrected through osteotomy in 65 per cent of cases.

In cases of bilateral Colonna's operation the interval between the operations was 3 to 8 months.

Postoperative Treatment.

The patients were kept in a plaster bandage for 6 weeks after the operation, or, if rotation osteotomy had been carried out, for 8 weeks. An extension bandage with adhesive tape was then applied for 6 or 4 weeks, respectively. For 1 to 2 weeks the patients were then given exercises, after which they were allowed to get up and walk.

COMPLICATIONS

There were no fatalities in the present series. Neither paresis nor any circulatory disturbances occurred in the operated extremity.

Infection occurred in 4 cases. In 1 of these cases osseous anchylosis occurred, while in the remaining cases there was considerably limited motility in the joint. The result in 3 cases was poor and in 1 fair.

Fracture of the acetabulum at operation occurred in 3 cases. Follow-up of these cases showed considerably limited motility in the joint; the result was poor.

Redislocation occurred in 7 cases. The cause of the redislocation was that the femoral head had not been sufficiently pulled down by the extension treatment and that the acetabulum had not been made sufficiently deep at operation. In 6 cases reoperation was carried out and in 1 case closed reduction. The result was good in 1 case, fair in 2 and poor in 4 cases.

Fibrous anchylosis occurred in 2 cases. These were the oldest patients, 17 and 23 years. The operation is not indicated for patients of this age.

Postoperative fractures occurred in 7 cases. There was fracture of the femoral diaphysis in 4 cases, supracondylar fracture of the femur in 1 case, subtrochanteric fracture in 1 case and fracture of the crus in 1 case. It is obvious that during the comparatively long period of immobilization before and after operation osteoporosis sets in, which may give rise to fractures should the patient fall. 6 of these fractures healed when treated with a plaster bandage. In 1 case fracture of the same femur occurred three times during the course of the treatment and the fracture was finally treated by medullary nailing according to *Rush*, after which it healed.

Additional Operations.

6 reoperations were carried out for redislocation, the acetabulum being made deeper and the head being replaced. To correct subluxation acetabular plasty was carried out in 3 cases after Colonna's operation. Apophyseodesis of the greater trochanter was carried out in 5 cases. By this operation we hope to prevent increasing coxa vara, resulting from osteochondritis of the femoral head (17, 20). Correction of a faulty position of the hip occurring after Colonna's operation was achieved by sub- or intertrochanteric osteotomy in 3 cases.

RESULTS

The results of both closed and operative treatment of congenital dislocation of the hip vary considerably in different series, depending on the criteria which the authors have applied in evaluating the results (16, 22, 24). There is no doubt that the same criteria should be applied in different series, since this would render results comparable. *McFarland* (18) suggests a scheme of classification which was used in

evaluating the series presented at SICOT's congress in New York in 1960. He divided the results into five groups and considered a period of observation of 5 to 6 years necessary to enable evaluation of the results. In agreement with *Scaglietti* (22), I consider a period of observation of 2 years to be, as a rule, sufficient for evaluation of the results. After 2 years a good result is seldom impaired, while a poor result never improves. *McFarland*'s scheme is no doubt called for when results of early treatment are to be judged. In cases of older patients who have undergone operation, a normal hip is seldom achieved. *McFarland*'s classification was therefore not applied when the results in the present series were evaluated. The results have been divided into four groups: good, satisfactory, fair, and poor. The criteria were as follows:

Good: Radiograms show normal or almost normal conditions in the hip. The motility is normal or satisfactory, by which is meant extension-flexion of 180 to 80°, insignificantly restricted abduction and adduction and a reduction of rotation movements to about 30°. No limp.

Satisfactory: Slight radiological changes. The head well-shaped, the acetabulum slightly dysplastic, slightly too deep or too shallow. No subluxation. Motility as in the former group. Limping, if any, is periodic and insignificant.

Fair: The head slightly flattened owing to osteochondritis. Slight dysplasia of the acetabulum, and in some cases insignificant subluxation. The motility moderately limited: Extension-flexion 180–80°, abduction and adduction 30° or more, rotation considerably reduced. Insignificant limp.

Poor: Corresponds to *McFarland*'s group 5. The hip is worse than if it had remained untreated, stiff, necrosis of the head and subluxation.

In the three first-mentioned groups the patients have no subjective symptoms. Figs. 1–5 shows hips classified according to this scheme.

With regard to previous treatment, the hips have been classified into three groups which are analysed separately.

Group I. This group consists of 70 hips which had not been treated earlier. Attempts at reduction under anaesthesia were made in 9 cases before operation. The age of the patients is seen from Table 3.

TABLE 3

Age of patients at 70 primary operations.

Years	1–2	2–3	3–4	4–5	5–6	6–7	7–8	Total
No. of hips	7	15	10	22	9	3	4	70

The results are given in Table 4.

TABLE 4

Results of 70 primary operations.

Good	Satisfactory	Fair	Poor	Total
23 (33 %)	16 (23 %)	13 (19 %)	18 (25 %)	70

If the two first groups are considered good results and the two latter poor results, the good results constitute 56 per cent and the poor 44 per cent of cases. The results in relation to the age of the patients can be seen from Table 5.

TABLE 5

Results of 70 primary operations in relation to the age of patients.

Years	1–2	2–3	3–4	4–5	5–6	6–7	7–8	Total
Good	4	5	4	6	2	1	1	23
Satisfactory	1	6	–	6	2	1	–	16
Fair	1	1	1	7	2	1	–	13
Poor	1	3	5	3	3	–	3	18
	7	15	10	22	9	3	4	70

The best results were obtained between the ages of 1 and 3 years, while between 3 and 7 years good results were obtained in a little over half the cases. The results in relation to the length of the period of observation are seen in Table 6.

TABLE 6

Results of 70 primary operations in relation to follow-up time.

Years	Good	Satisfactory	Fair	Poor	Total
2	5	1	–	2	8
3	3	1	3	4	11
4	3	1	5	3	12
5	6	11	3	3	23
6	5	2	1	5	13
7	1	–	1	1	3
	23	16	13	18	70

It appears from the table that after a period of observation of less than 5 years, the results are considerably poorer than after a longer period of observation. This does not mean that the hips have improved after 5 years but it is due to the fact that in 1956 a greater number of

patients aged 1 to 3 years was operated on and at this age the results are better.

The influence of preoperative extension treatment on the results is analysed in Table 7. Of the hips primarily operated on, 38 were cases of high dislocation and 32 of low dislocation. The majority of the hips operated on without extension treatment were cases of low dislocation, the hips which had been treated with extension with the aid of adhesive tape were high dislocations in about half and low in about half the cases, while the group which had been preoperatively treated with wire extension had, as a rule, high dislocation.

TABLE 7

The influence of preoperative traction on the results of 70 primary operations.

	Good	Satisf.	Fair	Poor	Total
No traction	7	7	4	3	21
Traction with adhesive tape ...	9	2	4	6	21
Wire traction	7	7	5	9	28
	23	16	13	18	70

TABLE 8

Results of 70 primary operations in relation to osteochondritis of the femoral head after operation.

	Good	Satisf.	Fair	Poor	Total
Osteochondritis absent	22	10	7	3	42
Osteochondritis present ..	1	6	6	15	28
	23	16	13	18	70

At first glance it appears surprising that the best results were obtained in cases in which no traction treatment preceded operation. This, however, is due to the fact that these were low dislocations, *i.e.* the prognostically most favourable cases in which the incidence of osteochondritis was lowest.

When considering the modelling of the socket at operation in relation to the results, it appeared that the best results were obtained when the socket had been made comparatively deep, while when the socket was shallow, subluxation was common and redislocation occurred in two cases.

Osteochondritis of the femoral head constituted the commonest and most serious complication. Osteochondritis results from too high a pressure upon the femoral head in the new socket. This happens in

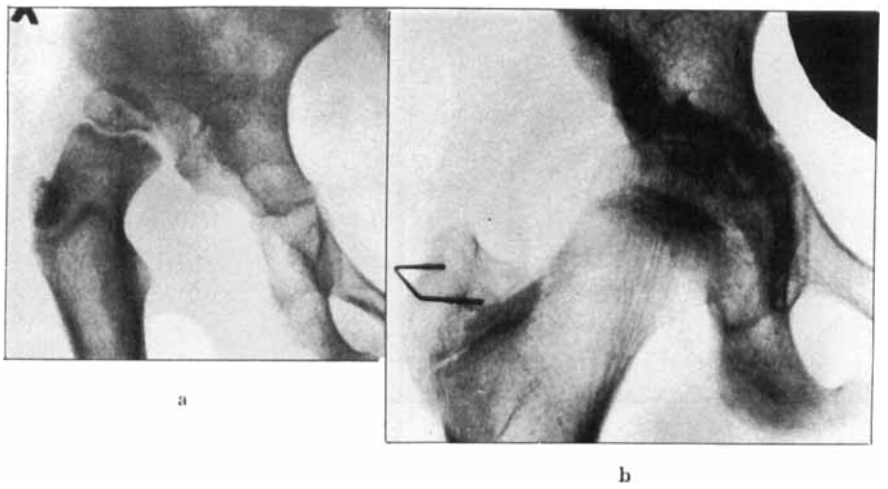

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Fig. 1.

High dislocation. Primary operation at the age of five years. Result good seven years later. The ileopsoas tendon has been attached to the greater trochanter with a staple.

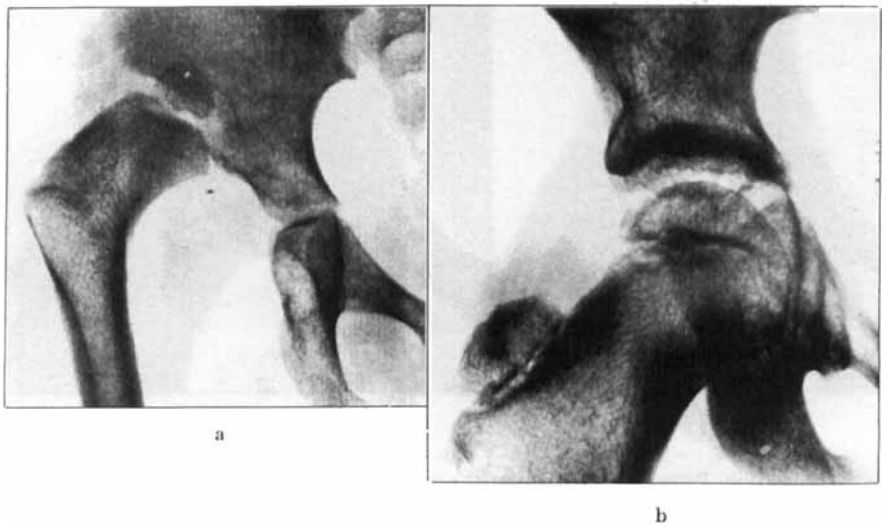

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Fig. 2.

High dislocation. Primary operation at the age of three years. Result good five years later.

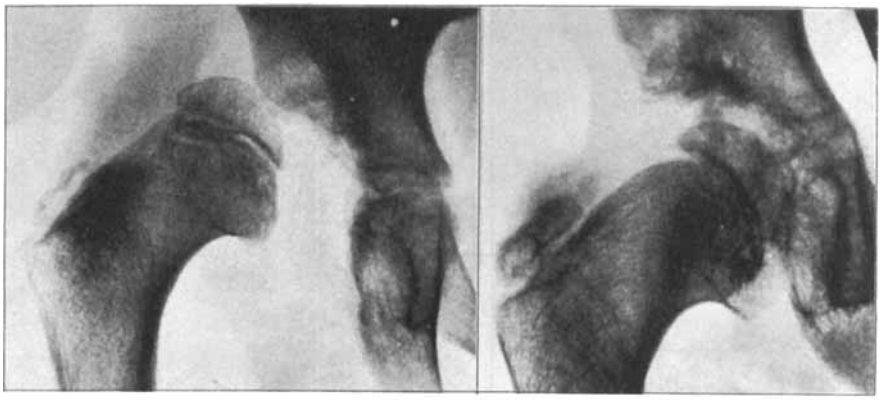

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Fig. 3.
Low dislocation. Primary operation at the age of five years. Result satisfactory two years later. Slight dysplasia, no subluxation.

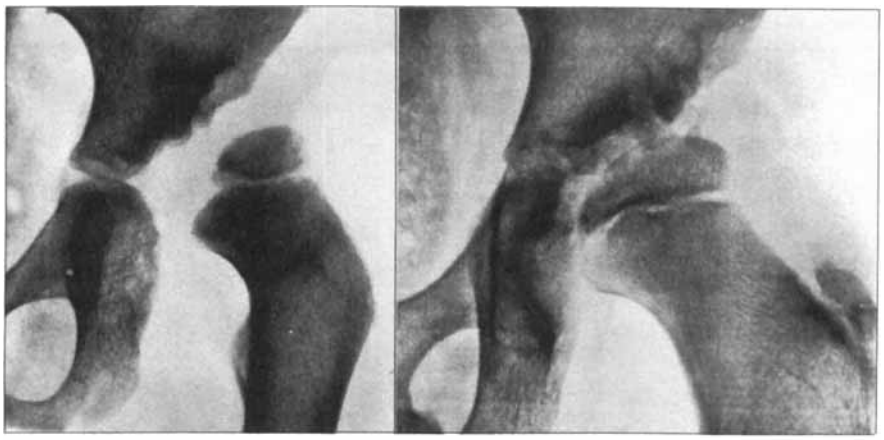

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Fig. 4.
Low dislocation. Primary operation at the age of four years. Result classified as fair three years later. Dysplasia of the acetabular roof and slight subluxation.

cases where the head has not been sufficiently pulled down by traction treatment and in which reduction has been difficult. The results of 70 primary operations in relation to the frequency of osteochondritic changes can be seen from Table 8.

Osteochondritis thus occurred in 28 (40 per cent) of 70 primarily

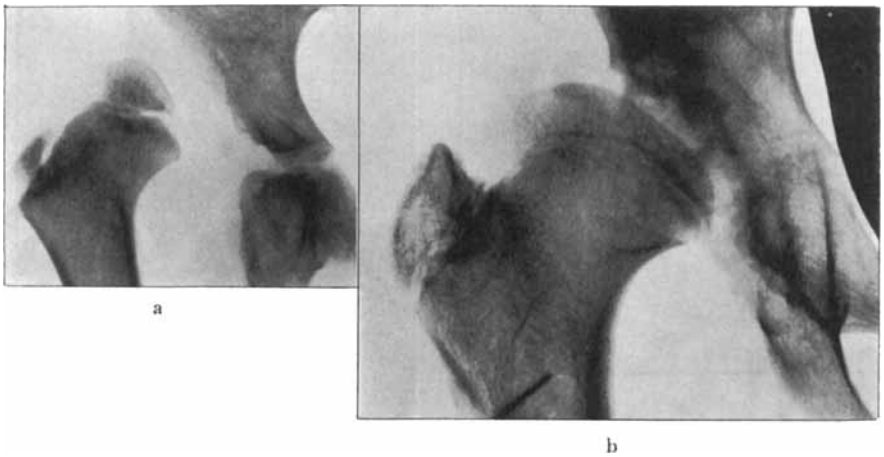

Fig. 5.
Primary operation at the age of four years. Result poor. Marked dysplasia of the acetabulum and coxa plana due to osteochondritis.

operated hips and the result was poor in about three-quarters of these cases. Figs. 1 to 5 show the result of the primary operations.

Group II. This group consists of 21 hips which had been previously treated in a plaster bandage and in which redislocation had occurred. The majority of these patients had been treated earlier at other hospitals. The duration of the abduction treatment in a plaster bandage was 4 to 12 months, 8 months on average. There were two older patients in this group, aged 17 and 23, and in these cases Colonna's operation should not have been carried out. The results in this group are seen from Table 9.

TABLE 9
Results of 21 operations due to failure of treatment in plaster cast.

Good	Satisf.	Fair	Poor	Total
3	4	4	10	21

In this group the results were good in one-third of the cases only. One factor frequently contributing to the poor results was preoperative osteochondritis, which had occurred during the earlier treatment and which in some cases had caused deformation of the femoral head. Fig. 6 shows a good operative result after previous treatment in a plaster bandage.

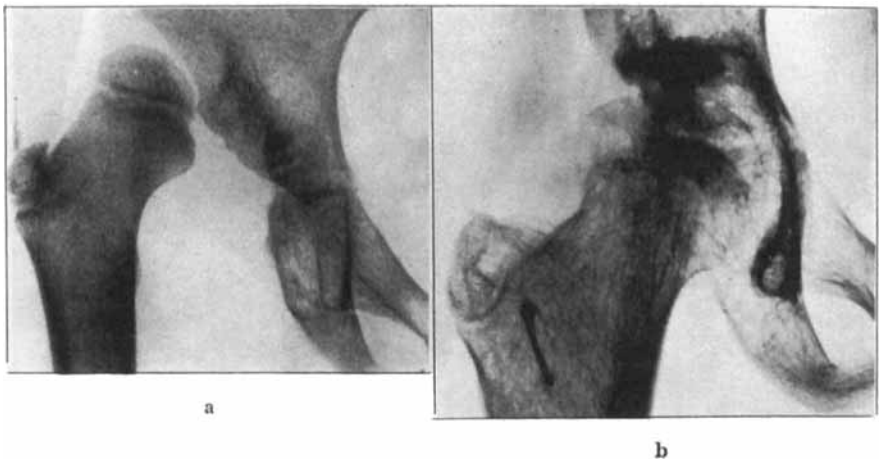

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Fig. 6.
At the age of one year this girl was treated in an abduction plaster cast for five months. Redislocation occurred and at the age of six she was admitted to this hospital for operation. Result good five years later.

Group III. This group consists of 11 hips on which operative reduction had been carried out but redislocation had subsequently taken place. The result was fair in 5 and poor in 6 hips. All patients showed signs of osteochondritis in the femoral head before Colonna's operation and a deterioration of this condition was common after operation.

Bilateral Colonna operation was carried out in 10 cases, the number of hips being 20. The result was good in 5 hips, satisfactory in 5, fair in 6 and poor in 4 hips. The results were better between the ages of 2 and 5 years but, as a rule, poor by 6 to 7 years. Fig. 7 shows a result which was classified as good.

Treatment of the *contralateral hip.* Dysplasia was present in 9 cases, but the hips, as a rule, normalized spontaneously. Subluxation occurred in 17 cases. In 3 cases operative reduction was carried out, in 2 cases acetabular plasty while 2 cases were treated conservatively with a plaster bandage. In the untreated subluxations there was, as a rule, spontaneous improvement. Of 29 patients with bilateral dislocation, 10 were operated on bilaterally according to Colonna. Of the remaining 19 hips 12 were treated with operative reduction, 1 with subtrochanteric osteotomy, 1 conservatively with a plaster bandage and 5 hips were not treated at all, mostly owing to complications in the operated hip.

A combination of the three groups provides a survey of the entire

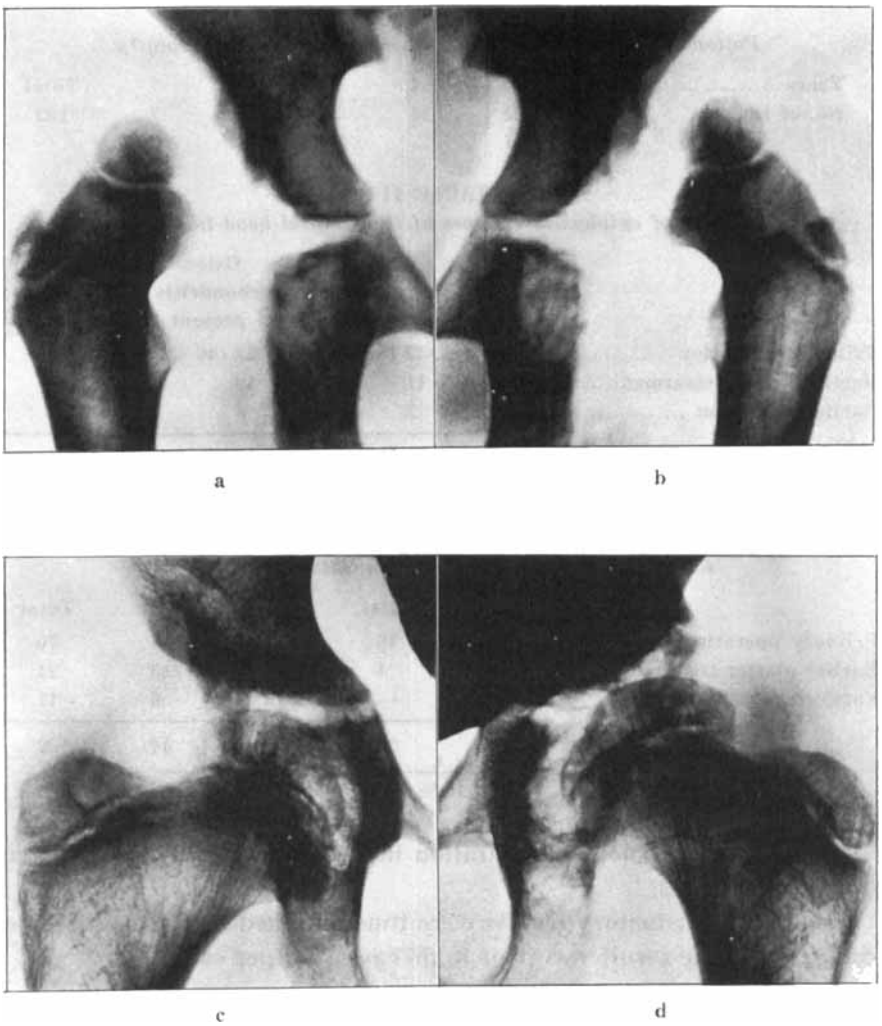

Fig. 7.
Bilateral operation at the age of four years. Result good three years later.

material, which consists of 102 hips. The period of observation for the whole series is seen from Table 10.

The period of observation exceeded 5 years in 63 cases (62 per cent) and was 2 to 4 years in 39 cases (38 per cent).

The incidence of osteochondritis in the whole series is seen in Table 11.

The incidence of osteochondritis was 45 per cent.

TABLE 10

Follow-up time for 102 hips treated by capsular arthroplasty.

Years	2	3	4	5	6	7	Total
No. of hips	12	13	14	35	21	7	102

TABLE 11

Incidence of epiphyseal changes of the femoral head in 102 hips.

	Osteo-chondritis absent	Osteo-chondritis present	Total
Primary operation	42 (60 %)	28 (40 %)	70
Earlier plaster treatment	11	10	21
Earlier operation	3	8	11
	56 (55 %)	46 (45 %)	102

TABLE 12

Results of 102 hips treated by capsular arthroplasty.

	Good	Satisf.	Fair	Poor	Total
Primary operation	23	16	13	18	70
Earlier plaster treatment	3	4	4	10	21
Earlier operation	–	–	5	6	11
	26	20	22	34	102
	45 %		55 %		

The results of Colonna's operation in the different groups are combined in Table 12.

Good and satisfactory results were thus obtained in 46 cases (45 per cent), while the result was poor in 56 cases (55 per cent).

DISCUSSION

Our results agree fairly well with those reported by *Schmitt* (23) from the Balgrist Clinic in Zürich, where he states that 40 per cent of the results were good. It is obvious as is also suggested by *Schmitt* that the criteria for the evaluation of results vary.

Colonna is well aware of the risk of complications and it is probable that if the rules he lays down in his papers are strictly adhered to, the frequency of poor results can be reduced. As appears from the foregoing, osteochondritis is the commonest complication leading to a poor result. *Colonna* maintains that if by means of preoperative extension

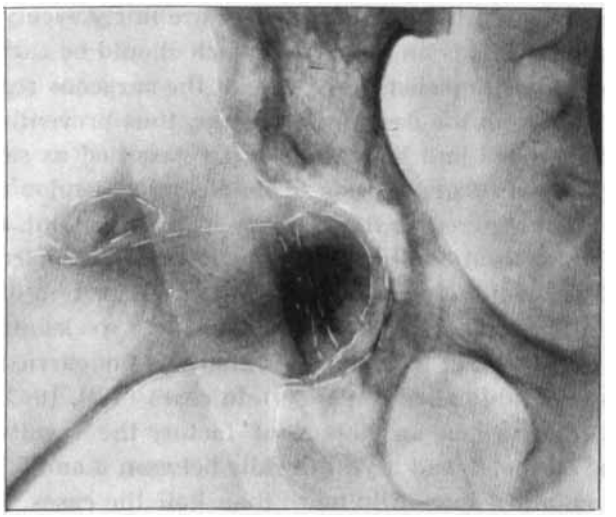

Fig. 8.
Five year old girl with high dislocation. Control roentgenogram during the operation. The femoral head is reduced into the deepened socket. The epiphyseal line is situated inside the corner of the acetabular roof. This, in my opinion, proves that the socket is sufficiently deep. The result in this case was good (Fig. 1).

treatment the femoral head has not been brought down to the level of the acetabulum, operation should be refrained from. It is possible that in such cases pressure necrosis of the head could be prevented by shortening osteotomy of the femur (1, 9, 10, 19). We have no experience of this.

The present material shows that the socket should be made comparatively deep, a fact which is also stressed by *Colonna*. There is a risk of fracture of the socket, however. This complication was responsible for the poor result in 3 of our cases. Subluxation and redislocation are common complications if the acetabulum is made too shallow. It is not always easy to calculate the depth of the socket at operation. As a routine measure we have always taken a control radiogram during the operation after reduction of the head into the new socket. But owing to the fact that the part of the head of the acetabular roof which has not yet been ossified does not appear in the radiogram, the depth cannot always be estimated correctly. I have found one useful criterion to be the relation of the epiphyseal line of the head to the lateral corner of the acetabular roof in the radiogram. In the radiogram this line should be projected just inside the corner of the acetabular roof (Fig. 8).

The operations in the present series were carried out by eight dif-

ferent orthopedists. Although the failures are fairly evenly distributed, it is obvious that this is an operation which should be carried out by a few experienced orthopedists only. One of the surgeons regularly made the socket somewhat too deep and too large, thus preventing, as a rule, necrosis of the head and his results were classified as satisfactory.

We believe that a transposition of the ileopsoas tendon to the lateral side of the femur increases the stability in the hip joint at operations for congenital dislocation of the hip. This measure was carried out in 86 per cent of cases. Rotation osteotomy for the correction of antetorsion was made in 65 per cent of cases, as a rule 2 to 3 weeks after Colonna's operation. Correction of the valgus position was not carried out but this measure is no doubt called for in certain cases (1, 9, 10, 11).

The patient's age is an important factor, the results being best between the ages of 1 and 3 years, while between 3 and 7 years a good result was obtained in a little more than half the cases. Two patients aged 17 and 23 years respectively were operated on with poor results. 8 years must be considered the upper limit for this operation, at any rate if shortening of the femur is not carried out simultaneously. Although the results of Colonna's operation between the ages of 1 and 3 years are good, we still consider that, at this age, operative reduction is to be preferred since it is a much smaller operation.

It is obvious that weight-bearing was permitted too early in the present series. No weight-bearing should be permitted for half a year following operation, and when signs of epiphyseal necrosis or dysplasia of the socket are present, weight-bearing should be avoided for still longer periods. If the motility in an operated hip is reduced, this is a sign of initial osteochondritis and the pressure on the femoral head should immediately be reduced with either an extension bandage or a Thomas' splint.

The motility in the operated hips was, as a rule, satisfactory in cases in which there were no serious complications. An extension-flexion movement of 180–80° was considered satisfactory. Rotation movements were almost always reduced.

Slight stimulation of the growth in length of the operated extremity was observed after operation in a number of cases. This did not affect the results.

Gschwend (11) analysed the poor results after Colonna's operation. He pointed out that the pressure conditions affect the results decisively. Pressure on the femoral head is the result of inadequate extension treatment, too pronounced valgus position or a too distal fixation of the

greater trochanter. He stresses the importance of wire traction and shortening osteotomy of the femur if the head is not situated low enough. Valgus position and antetorsion must be corrected. The socket must be made sufficiently deep. He further recommends postoperative extension treatment during 6 to 8 weeks and a Thomas' splint for half a year.

I entirely agree with *Gschwend* and *Colonna* that the preoperative extension treatment should be adequate, the socket must be made sufficiently deep and that weight-bearing must not be permitted too early.

If complications are prevented by adequate pre- and postoperative treatment and correct modelling of the socket, Colonna's operation will give good results.

SUMMARY

The results of 102 Colonna operations are analysed. The period of observation was 2 to 7 years. The age of the patients was 1 to 7 years and, in addition, two older patients were operated on. With the exception of attempts at reduction under anaesthesia in 9 cases, 70 hips had had no preoperative treatment. The result was good in 23 cases, satisfactory in 16, fair in 13 and poor in 18 cases. On average the result was good in 56 and poor in 44 per cent of cases. Owing to redislocation after treatment in a plaster bandage, Colonna's operation was carried out in 21 cases. A good result was obtained in one-third of these cases. This operation was carried out on 11 hips because of redislocation following operative reduction. The result was poor in these cases. The antetorsion was corrected by rotation osteotomy in 65 per cent of cases. Transposition of the ileopsoas tendon to the lateral side of the femur was carried out in 86 per cent of cases. The causes of the poor results are analysed. The commonest complication leading to a poor result was osteochondritis of the femoral head, seen in 40 per cent of cases. This was due to failure of the preoperative extension treatment to bring the femoral head to a sufficiently distal position. The socket must be made sufficiently deep, for a too shallow socket leads to subluxation or redislocation. Weight-bearing should not be permitted too early. By adequate pre- and postoperative treatment and correct modelling of the acetabulum, excellent results were obtained with Colonna's operation. The operation is therefore well worth making in cases in which, owing to the patient's age, results cannot be expected from closed or operative reduction.

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RESUME

Les résultats de 102 opérations par la méthode Colonna sont analysés. La période d'observation a été de 2 à 7 ans. Les malades étaient âgés de 1 à 7 ans, deux malades plus âgés ayant été opérés. A l'exception de tentatives de réduction sous anesthésie dans 9 cas, 70 hanches n'avaient pas été soumises à un traitement pré-opératoire. Le résultat a été bon dans 23 cas, satisfaisant dans 16, piètre dans 13 et mauvais dans 18 cas. En moyenne, le résultat a été bon dans 56 pour cent et mauvais dans 44 pour cent des cas. Par suite d'une nouvelle dislocation après un traitement par bandage plâtré, l'opération Colonna a été pratiquée dans 21 cas. Un bon résultat a été obtenu dans un tiers de ces cas. L'opération a été pratiquée sur 11 hanches par suite d'une nouvelle dislocation après une opération de réduction. Dans ce cas, le résultat a été mauvais. L'antétorsion a été corrigée par ostéotomie de rotation dans 65 pour cent des cas. Une transposition du tendon iléo-psoas du côté latéral du fémur a été pratiquée dans 86 pour cent des cas. Les causes des mauvais résultats sont analysées. La complication la plus courante menant à un mauvais résultat a été l'ostéochondrite de la tête fémorale, constatée dans 40 pour cent des cas. Elle était due au défaut d'un traitement d'extension pré-opératoire pour amener la tête fémorale dans une position suffisamment distale. L'emboîture doit être suffisamment profonde, car si elle est trop superficielle elle conduit à la subluxation ou à la rédislocation. Il ne faut pas permettre trop tôt le pórt du poids. Par un traitement pré et post-opératoire adéquat et par le modelage correctif de la cavité cotyloïde, d'excellents résultats ont été obtenus au moyen de l'opération Colonna. C'est pourquoi il vaut la peine de pratiquer cette opération dans les cas chez lesquels, en raison de l'âge du malade, on ne peut pas s'attendre à ce que la réduction fermée ou opératoire donne des résultats.

ZUSAMMENFASSUNG

Die Ergebnisse in 102 Colonna Operationen werden analysiert. Der Beobachtungszeitraum war 2 bis 7 Jahre. Das Alter der Patienten war 1 bis 7 Jahre und ausserdem wurden 2 ältere Patienten operiert. Mit Ausnahme von Einrenkungsversuchen in Narkose bei 9 Fällen, hatten 70 Hüften keinerlei Behandlung vor der Operation. Das Ergebnis war in 23 Fällen gut, in 16 zufriedenstellend, annehmbar in 13 und schlecht in 18 Fällen. Im Durchschnitt war das Resultat gut in 56 Prozent und schlecht in 44 Prozent der Fälle. Wegen Reluxation nach Behandlung

im Gipsverband wurde Colonnas Operation in 21 Fällen ausgeführt. Ein gutes Ergebnis wurde in einem Drittel der Fälle erzielt. Die Operation wurde an 11 Hüften wegen Reluxation nach blutiger Reposition vorgenommen. Das Ergebnis was schlecht in diesen Fällen. Die Antetorsion wurde mittels Rotationsosteotomie in 65 Prozent der Fälle korrigiert. Transposition der Ileopsoassehne auf die Lateralseite des Femurs wurde in 86 Prozent der Fälle ausgeführt. Die Ursachen der schlechten Ergebnisse werden analysiert. Die häufigste Komplikation, die zu schlechten Resultaten führte, war die Osteochondritis des Femurkopfes. Sie wurde in 40 Prozent der Fälle beobachtet. Dies ist dem Mangel einer präoperativen Extensionsbehandlung, die den Femurkopf in eine genügende distale Lage bringen sollte, zuzuschreiben. Die Pfanne muss genügend tief gemacht werden, da eine zu seichte Pfanne zur Subluxation oder Reluxation führt. Zeitige Belastung sollte nicht gestattet werden. Bei angemessener prä- und postoperativer Behandlung und richtiger Modellierung des Acetabulum wurden ausgezeichnete Ergebnisse mit Colonnas Operation erhalten. Es lohnt sich daher die Operation in Fällen auszuführen in denen wegen des Alters des Patienten ein Erfolg von einer unblutigen oder blutigen Reposition nicht erwartet werden kann.

REFERENCES

1. *Bertrand, P.:* Résultats de l'operation de Colonna et ses dérivées. Rev. Chir. Orthop. *41*: 203, 1955.
2. *Bodart, A., Lesure, J. & Rivot, J.:* Réduction sanglante de la luxation congénitale de la hanche par precédée de Colonna. Rev. Med. Nancy *79*: 126, 1954. (Quoted in Exc. Med. Surg. *9*: 1, 685, 1955).
3. *Červeňanský, J.:* First experiences with the capsular arthroplasty in inveterate congenital hip dislocation (czech.). Bratislava Lek. Listy *39*: 325, 1959. (Quoted in Exc. Med. Surg. *13*: II, 4808, 1959).
4. *Codivilla, A.:* Über die operative Behandlung der angeborenen Hüftverrenkung. Zschr. orthop. chir. *9*: 123, 1901.
5. *Colonna, P. C.:* Congenital dislocation of the hip in older subjects. Based on a study of sixty-six open operations. J. Bone Jt. Surg. *14*: 277, 1932.
6. *Colonna, P. C.:* Arthroplasty of the hip for congenital dislocation in children. J. Bone Jt. Surg. *29*: 711, 1947.
7. *Colonna, P. C.:* Capsular arthroplasty for congenital dislocation of the hip. J. Bone Jt. Surg. *35A*: 179, 1953.
8. *Colonna, P. C.:* Congenital dysplasia of the hip. Comptes rendus du VIII Congrès International de Chirurgie Orthopédique p. 135. Bruxelles 1961.
9. *Dega, W., Król, J. & Polakowski, L.:* Surgical treatment of congenital dislocation of the hip in children. J. Bone Jt. Surg. *41A*: 920, 1959.

10. *Francillon, M. R.:* Hüftgelenksplastik nach Colonna in der Behandlung der Luxatio coxae congenita. Zschr. Orthop. *84*: 177, 1954.
11. *Geschwend, N.:* Fehler bei der offenen Reposition kongenital luxierter Hüften nach der Methode von Codivilla-Colonna. Verh. deutsch. orthop. Gesellsch. 42 Kongr. Beilageheft zur Zschr. Orthop. 96. Stuttgart 1962. F. Enke.
12. *Kawamura, B.:* Colonna's operation for congenital hip dislocation (jap.). Orthop. Surg. (Tokyo) *10/12*: 793, 1959. (Quoted in Exc. Med. Orthop. and Traumat. 7: 22: 764, 1962).
13. *Kivilaakso, R.:* The Schanz osteotomy for irreducible dislocation of the hip. Ann. chir. gyn. Fenn., suppl. 84, 1959.
14. *Langenskiöld, F.:* Technical aspects of the operative reduction of congenital dislocation of the hip. Acta orthop. Scandinav. *20*: 8, 1950.
15. *Langenskiöld, F.:* On the transposition of the ileopsoas-muscle in operative reduction of congenital hip-dislocation. Acta orthop. Scandinav. *22*: 295, 1953.
16. *Laurent, L. E.:* Congenital dislocation of the hip. Acta chir. Scandinav. suppl. 179, 1953.
17. *Laurent, L. E.:* Growth disturbances of the proximal end of the femur in the light of animal experiments. Acta orthop. Scandinav. *28*: 255, 1959.
18. *McFarland, B.:* Congenital dislocation of the hip. Rapports présentés au VIIIe Congrès Soc. Int. Orthop. Traumat. p. 5. Bruxelles 1960.
19. *Petit, P. & Caracostas, M.:* L'arthroplastie de la hanche avec interposition capsulaire (Operation de Colonna) dans le traitment de la luxation congénitale de la hanche. Rev. Chir. Orthop. *48*: 187, 1962.
20. *Pylkkänen, P.:* Coxa vara infantum. Acta orthop. Scandinav. suppl. 58, 1960.
21. *Rohlederer, O.:* Das Torsionsproblem der Luxatio coxae und seine klinische Bedeutung. Ver. d. deutsch. orthop. Gesellsch. *36*: 277, 1947.
22. *Scaglietti, O. & Calandriello, B.:* Open reduction of congenital dislocation of the hip. J. Bone Jt. Surg. *44B*: 257, 1962.
23. *Schmitt, H. W.:* Ergebnisse der Hüftgelenksplastik nach Codivilla-Colonna bei Dysplasia luxans coxae congenita. Zschr. Orthop. *93*: 52, 1960.
24. *Severin, E.:* Congenital dislocation of the hip. Acta chir. Scandinav. suppl. 63, 1941.
25. *Ter-Eguiasarov, G. M. & Dolganova, A. A.:* Results of open reduction of congenital dislocation of the hip by the method of Colonna (russ.) Orthop. Traumat. Prosth. *8*: 23, 1961.
26. *Zahradníček, J.:* Beitrag zur Reposition der hohen angeborenen Hüftverrenkung. Arch. f. klin. Chir. *180*: 353, 1934.