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The effect of previous surgical treatment on the outcome of total hip replacement in young patients with dysplastic coxarthrosis

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Abstract

Introduction Hip dysplasia of various genesis is recognized as a common cause of coxarthrosis. Total hip replacement (THR) is the operation of choice for the patients with the final stage of the pathological process. There are different opinions on the impact of previous surgical treatment of hip dysplasia on THR. **The aim** of the study was to explore the effects of previous surgical treatment on the outcomes of THR in young patients with dysplastic and secondary coxarthrosis. **Material and methods** Surgical outcomes of 78 patients (58 females and 20 males; 91 joints) with dysplastic and secondary coxarthrosis (age 14-30 years, average age 24.3 ± 4.3 years) treated witrh THR were retrospectively reviewed. Patients were assigned to two groups. Group I (control) included 27 patients (33 joints) with dysplastic coxarthrosis primarily treated with THR. Group II (treatment group) included 51 patients (58 joints) who had previously undergone THR. **Results** Patients of group II demonstrated longer duration of surgery by 47.89 %, greater blood loss by 16.92 % and the higher complication rate by 42.1 %. **Discussion** The treatment group showed a significantly increased frequency of late complications in the form of implant instability. Patients of group II demonstrated better functional results estimated with HHS as compared to the outcomes of patients of group I. **Conclusion** Hip reconstructions performed earlier were associated with technical difficulties, aggressive THR procedure, a greater risk of late complications, but showed no significant effect on the outcomes.

Keywords: coxarthrosis, hip dysplasia, organ preservation surgery, osteotomy, total hip replacement

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INTRODUCTION

Hip dysplasia of various origin is recognized as a common cause of coxarthrosis. J. Aronson (1986) reported 76 % of secondary coxarthrosis caused by the initially distorted articular surfaces [1]. Total hip replacement (THR) is the operation of choice at the final stage of the pathological process in this cohort of patients. According to the literature, surgical intervention for dysplastic coxarthrosis is associated with greater trauma and a higher complication rate of arthroplasties performed for idiopathic coxarthrosis [2]. This is due to a loss of acetabulum bone, deformation, abnormal femoral anatomy, proximal dislocation of the femur and severe changes in the periarticular soft tissues [3, 4]. There are different opinions on the impact of previous surgical treatment of hip dysplasia on THR. Several authors report greater technical difficulties, aggressive intervention, higher complication rate and worse treatment outcomes [5, 6, 7]. Possible causes include changes in the acetabular orientation, deformity of the proximal femur and scars in the periarticular soft tissues. Other authors suggest no association between previous reconstructions and greater rate of complications and revisions [8, 9].

The objective was to explore the effects of previous surgical treatment on the outcomes of THR in young patients with dysplastic and secondary coxarthrosis.

MATERIAL AND METHODS

The work is a single-center retrospective study. An analysis of the results of surgical treatment of 78 patients (58 women and 20 men) (91 joints) with dysplastic and secondary coxarthrosis treated with total hip replacement at the National Medical Research Ilizarov Centre for Trauma and Orthopaedics between 2005 and 2020. Indications for THR included severe pain or the need to improve ambulation and daily physical activity. Inclusion criteria included stage III dysplastic coxarthrosis, developed as a result of hip dysplasia, age under 30 years. Exclusion criterion included age over 30 years. The mean age of the patients at the time of surgery was 24.3 ± 4.3 years (range, 14-30 years). There were 7.7 % patients aged under 18 years. Patients we assigned to two groups. Group I (control) included 27 patients (33

joints) with dysplastic coxarthrosis primarily treated with THR. Group II (treatment group) included 51 patients (58 joints) who had previously undergone THR. More than one hip surgery was performed for 28 cases. The groups showed no significant differences in gender and the mean age (Table 1). The patients aged under 18 years were included in group II. Severe hip pain was recorded in the patients of group I and was associated with physical activity. Preoperative Harris hip score (HHS) [10] scored 31.6 ± 1.8. The VAS pain syndrome scored 8.4 ± 0.14 [11]. Most patients used additional means of support (n = 24, 72.7 %). The relative shortening was more than 3 cm in 4 observations.

Severe pain associated with physical activity was observed in patients of group II. Preoperative HHS scored 36.5 ± 0.8. The VAS pain syndrome scored 8.30 ± 0.08. In this group, limited ROM was noted in all planes. Twenty-one patients (36.2 %) used a cane. The relative shortening measured more than 3.2 cm in 32 observations (55.2 %). Hip joints graded with the Crowe classification [12] are presented in Table 2.

More severe anatomical disorders caused by the hip displacement were observed in group II (Table 2). Patients in both groups underwent THR. For bilateral involvement, the procedures were performed at intervals of 4 to 6 months. Cementless THR was used for patients of group I. Cementless THR was performed for 49 (84.5 %) cases of group II. Hybrid fixation with cementless cup and cemented stem was used in nine patients.

Medical documentation was reviewed for technical and surgical details, postoperative care, errors and complications and mid-term treatment results. HHS and VAS were used to assess the outcomes. Statistical data processing was performed using the Attestat computer program, version 9.3.1 (certificate of registration No. 2002611109 with Rospatent). Data were presented as the mean and standard deviation. The Mann – Whitney test was used to test statistical hypotheses about differences in pairwise comparisons between the groups. The data were considered statistically significant at $p < 0.05$. The study was carried out in accordance with the ethical standards of the Declaration of Helsinki (as revised of October 2013), approved by the ethics committee (protocol No. 4 (68) of November 11, 2020). Voluntary informed consent was obtained from all patients for publication of the findings without disclosing the identity.

Table 1

Comparative characteristics of patients

		Gender		Age			
		male	female	Less than 18 years	19-30 years	mean	median
Group I	abs.	10	23	–	33	23.5 ± 3.6	24
	%	30.3	69.7	–	100		
Group II	abs.	17	41	7	51	24.2 ± 4.2	25
	%	29	70.6	12	43.2		

Table 2

Distribution of hip joints with dysplastic coxarthrosis graded with the Crowe classification

		Crowe type				Всего
		I	II	III	IV	
Group I	abs.	16	8	4	5	33
	%	48.5	24.2	12.1	15.2	100
Group II	abs.	13	24	11	10	58
	%	22.4	41.4	19.0	17.2	100

RESULTS

Anterolateral surgical approach was used in most cases. A posterior approach was used in four cases of group I (12.1 %) and in five cases in group II (8.6 %) with type IV involvement. Additional surgical interventions and complications of THR seen in 78 patients with dysplastic coxarthrosis are shown in Table 3. Acetabular plastic surgery was common for patients of group I (Fig. 1). There were more additional corrective hip surgeries in group II (Fig. 2). Shortening osteotomy was performed in one case of group I (3 %) and in four cases (6.9 %) of group II due to severely dislocated femoral head. Intraoperative complications in the groups were recorded in 4 (10.85 %) cases. They were more common for patients of group I. Intraoperative complications developed in 9.15 % (3/33) of group I and in 1.7 % (1/58) of group II.

Table 3

Surgical options and complications of THR in patients with dysplastic coxarthrosis

Description	Group I (n = 33)		Group II (n = 58)	
	abs.	%	abs.	%
Standard approach	29	88.0	53	91.4
Acetabular plastic surgery	10	30.3	10	17.2
Shortening/corrective osteotomy of the femur	1/1	6.1	4/6	17.2
Fracture of the femur	2	6.1	1	1.7
Acetabular fracture	1	3.05	0	0
Neurological disorder	1	3.05	1	1.7

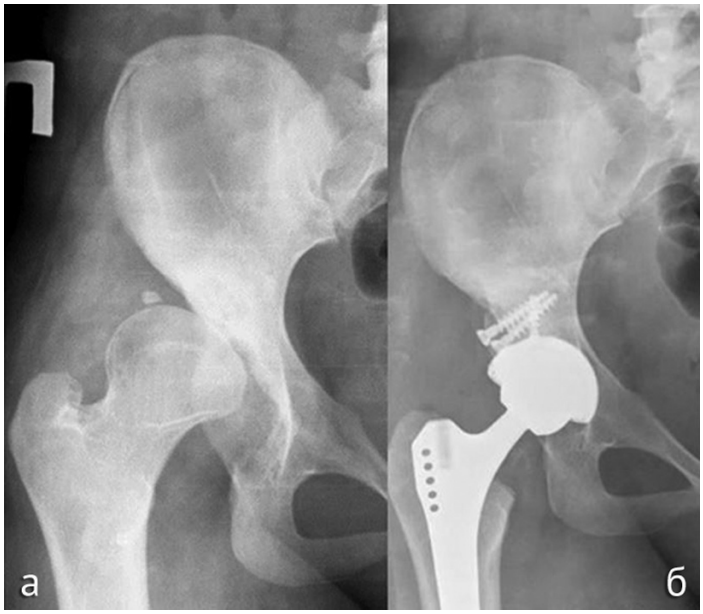

Fig. 1 AP view of the right hip joint Crowe type III in a 17-year-old patient: (a) prior to THR; (b) THR performed, acetabular roof plastic surgery, fixation with screws

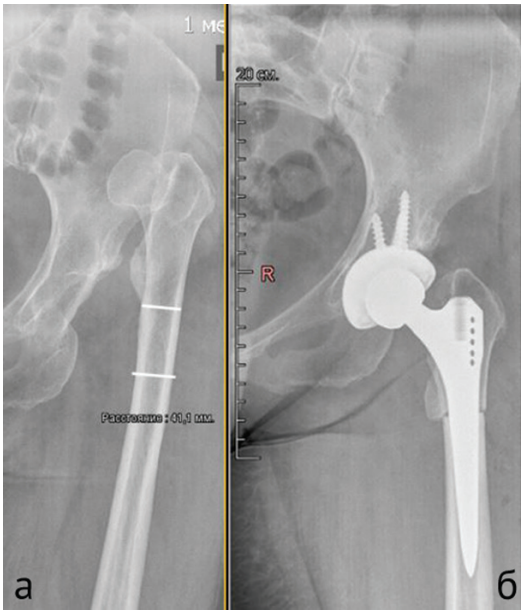

Fig. 2 AP view of the left hip joint Crowe type IV in a 29-year-old patient: (a) prior to THR; (b) THR performed, shortening subtrochanteric osteotomy of the proximal femur

The operation time was significantly longer in group II (Table 4), which was associated with severe anatomical disorders (Table 2). The operation protocols indicated a significant increase in the mean intraoperative blood loss in group II. There was a significant decrease in RBC in both groups after three postoperative days (Table 5). There was also a more pronounced decrease in hemoglobin levels. No statistically significant differences were observed in preoperative and postoperative parameters of both groups. Packed red blood cell transfusions were used postoperatively for two (6 %) patients in group I and 11 (19 %) patients in group II to treat anemia. The length of hospital stay was highly variable with the average length of stay being 30 % longer in group II as compared to group I (Table 4). HHS was used to evaluate short-term results within the period of six months. The mean HHS measured 91.4 ± 1.1 in group I and 93.6 ± 0.4 in group II. No poor outcomes were recorded. Long-term outcomes were assessed over a period of 2 to 17 years with the mean of 8.2 ± 1.7 years. The mean HHS measured 90.4 ± 1.4 with the VAS being 1.00 ± 0.06 in group I. The mean HHS measured 89.6 ± 1.3 with the VAS being 0.9 ± 0.08 in group II. Poor outcomes were observed in nine joints with implant instability diagnosed at a long term (after 4 years). Periprosthetic joint infection developed in one case of group II. A recurrent dislocation was seen in one patient of group I. Implant instability was associated with trauma in two cases of group II. Aseptic instability of the femoral component was diagnosed in five cases. The frequency of late complications and poor outcomes was higher in patients of group II (Table 6). There was no difference in the proportion of good and excellent results in the groups.

Table 4

Comparative characteristics of the groups

Description		Group I (n = 33)	Group II (n = 58)	Mann – Whitney U test
Duration of surgery, min.	mean	78.3 ± 4.3 (35-170)	115.8 ± 5.7 (35-275)	U = 574.5; p < 0.05
	median	70	105	
Duration of inpatient treatment, days	mean	17 ± 1.1 (9-42)	21.9 ± 1.3 (9-74)	U = 732.5; p = 0.05
	median	14	18	
Blood loss, mL	mean	413.6 ± 19.3 (200-1300)	483.6 ± 22.1 (100-1200)	U = 756.5; p < 0.05
	median	350	400	

Note: differences being significant at $p \leq 0.05$.

Table 5

Dynamics in RBC measured in 78 patients with dysplastic coxarthrosis

Description		Group I	Group II	Mann – Whitney U test
RBC, 10^{12}/л	pre-op	4.6 ± 0.1	4.4 ± 0.06	U = 790.5; p > 0.05
	post-op	3.5 ± 0.1	3.4 ± 0.06	U = 770; p > 0.05
HGB, г/л	pre-op	130.9 ± 3.6	129.2 ± 1.8	U = 747; p = 0.05
	post-op	103.2 ± 3.3	102.1 ± 1.7	U = 840.5; p > 0.05
HCT, %	pre-op	39.5 ± 0.7	37.8 ± 0.58	U = 774; p > 0.05
	post-op	32.44 ± 0.9	29.8 ± 0.6	U = 742.5; p > 0.05

Note: differences being significant at $p \leq 0.05$.

Table 6

HHS measured in 78 patients (91 joints) at a long term

Outcome	Group I		Group II	
	abs.	%	abs.	%
Excellent	26	78.8	42	72.4
Good	2	6.1	9	15.5
Fair	3	9.0	1	1.7
Poor	2	6.1	6	10.4
Total	33	100	58	100

DISCUSSION

THR performed for patients with dysplastic coxarthrosis is associated with technical difficulties due to affected articular surface anatomy, lack of bone tissue, shortened periarticular muscles and hip dislocation. This increases the risk of intraoperative and postoperative complications and worsens the treatment outcome in comparison with arthroplasty performed for primary coxarthrosis [13, 14, 15, 16]. V. Sakellariou (2014) reported inferior clinical and functional outcomes in patients with dysplastic coxarthrosis treated with THA as compared with those in patients with primary hip osteoarthritis [17]. This form of hip osteoarthritis can be caused by a congenital pathology or an articular disease of childhood treated either conservatively or surgically. The treatment seeks to restore articular relationships, stabilize the hip joint, improve the limb function and prevent early arthritis.

There are different opinions on the effect of previous pediatric and adolescent hip surgeries on subsequent arthroplasty. Several authors report greater technical difficulties, aggressive intervention, higher complication rate and inferior treatment outcomes [18]. Possible causes include changes in the acetabular orientation, deformation of the proximal femur and scars in the periarticular soft tissues [19, 20].

Prolonged operative time and substantial postoperative blood loss were reported in patients who had previously undergone interventions on the articular components [21, 22]. Patients could be at higher risk for intraoperative fractures of the articular components [2, 14]. Ferguson G.M. (1994) reported 23 % cases of intraoperative complications [23]. N. Boos (1997) reported a high level (8.1 %) of late infectious complications in patients who had undergone a previous hip surgery [7]. WH Rijnen reported the adverse event encountered in 12.5 % of the cases [24]. Previous pelvic osteotomy could suggest a greater risk of implant loosening with the incidence ranging between 7 and 23 % [2, 24]. C.L. Peters (2001) reported a greater dysfunction in young patients who underwent THA after a failed innominate osteotomy

evaluated with the HHS [25]. According to the opposite opinion, previous reconstructive operations on articular components were not associated with higher complication rate, revision interventions and inferior outcomes of arth roplasty [8, 9, 26, 27, 28, 29]. Supporters of the opinion suggested an increase in the operating time and technical complexity of the procedure in this cohort of patients.

The cohort of patients included young individuals aged under 30. Arthritis progressing after reconstructive operations in the third decade of life could be associated with an inadequate volume and inconsistent surgical option, and technical surgical errors. Repeated surgical interventions had a role and added to the inherent anatomy and functionality of the joint. Medical records indicated greater technical complexity and morbidity related to THR patients of the treatment group as compared to the controls. There were concerns of increased operating room time, increased blood loss, and extended patient length of stay at the hospital. The frequency of intraoperative complications was nearly identical in the comparison groups. Standard approach was used in the majority of cases. A greater proportion of hip surgeries was performed in the treatment group. Acetabular plastic surgery was common for the comparison group.

Higher rate of late complications in the form of implant instability was observed in the treatment group. The proportion of good functional results measured with the HHS was higher in patients of group II as compared with the outcomes of group I. To a certain extent, the data obtained contradict to the findings observed by C.L. Peters who reported a significant deterioration in the clinical outcomes after a previous pelvic osteotomy in THR patients with similar radiological parameters [25].

This work has limitations due to a small number of patients in the treatment and control groups, short follow-up periods, which does not allow an objective assessment of the survival rate of the THR in the cohort of patients.

CONCLUSION

Previous hip reconstruction procedures increase the technical complexity and aggressiveness of subsequent THR contributing to a greater risk of late complications and having no significant impact on the outcomes.

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Teplenkiy M.P. – conceptualization, methodology, writing – reviewing and editing, control, project management.
Kaminsky A.V. – formal analysis.
Fozilov Dzh.T. – data collection, preparation of work for publication, writing – initial draft.