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Late Results after Surgical Treatment of Thumb Duplication

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Abstract **Purpose** : The purpose of this work is to define the optimal surgical management of thumb duplication and suggest techniques that will improve the results of treatment.

Materials and methods : The results of surgical treatment were assessed for 69 cases of thumb duplication.

Subjective evaluation was done by asking patients and/or their parents to give an opinion on both the functional as well as the cosmetic results. Objective assessment of the thumb duplication was based on the criteria of JCY Cheng et al.(1984). Statistical significance was defined as a p value<0.05.

Results : Subjective assessment of functional outcome was much better after reconstructive procedures(97.1% satisfied), than after simple ablation(79.4% satisfied), $p<0.05$. Subjective assessment of appearance revealed : 82.9% satisfied after reconstruction, 58.8% satisfied after simple ablation, $p<0.05$. The results of objective assessment were also better in the group of patients after reconstructive procedures, $p<0.01$. The smallest number of complications was observed in Wassel types II and IV, but the results were not significant. Significant differences between groups were observed only for joint instability, which was more common in Wassel type III, $p<0.05$. Complications were more common in the group of patients after simple ablation, comparing with reconstruction, $p<0.01$.

Conclusions : 1. Late results in treatment of the thumb duplication are superior after reconstruction compared with simple ablation. Both subjective assessment of function(97.1% and 79.4%, $p<0.05$) and cosmesis(82.9% and 58.8%, $p<0.05$) were better after reconstruction. When the cosmetic result was assessed as unsatisfactory, the functional result was most often also assessed as unsatisfactory($p<0.01$).

2. Late objective results in treatment of the thumb duplication were superior after reconstruction compared with simple ablation($p<0.05$).

3. Late deformity occured more often after simple ablation, comparing with the reconstruction($p<0.01$), and the odds ratio was 7.89.

4. The most common complication after treatment of the thumb duplication($p<0.05$) was joint instability in treatment of Wassel type III pathology. Different complications were found in other types of pathology, but the results were not significant.

Key words : Congenital deformities, Thumb duplications, Surgical treatment, Complications

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Introduction

Thumb duplication is one of the most common congenital hand anomalies. The goal of surgery is to create a five-digit hand, and to form the new thumb with maximal function and appearance. Various surgical methods are applied to treat thumb duplication. The rate of complications and residual deformities is quite high, and very often secondary procedures are needed. For the long time old and primitive methods of treatment were performed in Lithuania, and the results of treatment were unsatisfactory.

The PURPOSE of this work is to define the optimal surgical management of thumb duplication and suggest techniques that will improve the results of treatment.

Tasks

1. Evaluate the late subjective and objective results of treatment of thumb duplications. The influence of different surgical methods, from simple ablation to reconstructive operations, will be evaluated as will the influence of the type of pathology.

2. Determine the late complications, and correlate the type and incidence of complications with the type of thumb duplication and the type of surgery.

Materials and methods

84 cases were treated in the period from 1979 to 2003 in Vilnius University Children's Hospital and Vilnius University Emergency Hospital. Thumb duplication was divided into the 7 types, according to HD Wassel (1969)[14]. In order to compare the results of the surgical treatment, we divided the patients with thumb duplication into the groups : 34 patients to whom the accessory thumb was simply ablated (1979-1991) and 35 patients to whom reconstructive procedures were performed (1992-2003). The average age of patients treated before 1991, was 4 years 3 months (range, 8 months to 16 years) at the time of surgery, while those operated after 1992 was 2 years 2 months (range, 5 months to 12 years 9 months). Younger patients were treated after 1992 due to improved operative technique. The results of surgical treatment were assessed for 69 cases of thumb duplication. Late results were evaluated between 3 months and 13 years after surgery.

Subjective evaluation was done by asking patients and/or their parents to give an opinion on both the functional as well as the cosmetic results. Objective assessment of the thumb duplication was based on the criteria of JCY Cheng et al. (1984)[1] and included segment alignment, joint stability and mobility, first web space, comparison with opposite hand, pulp and nail condition, residual prominence at excision site, opposition and pinch of the residual or reconstructed thumb were assessed. The objective results were classified as "good", "fair"and "poor".

Statistical significance was defined as a p value < 0.05. We also used Odds ratios-commonly used in epidemiological studies to describe the likely harm an exposure might cause[12].

Results

The results of subjective assessment are listed in Tables 1 and 2.

Subjective assessment of functional outcome was much better after reconstructive procedures (97.1% satisfied), than after simple abla-

Table 1. Results of subjective assessment after simple ablation

Wassel type	No. of cases	Satisfied with function	Dissatisfied with function	Satisfied with appearance	Dissatisfied with appearance
I	3	0	3	0	3
II	8	8	0	7	1
III	6	5	1	3	3
IV	14	11	3	8	6
V	0	0	0	0	0
VI	0	0	0	0	0
VII	3	3	0	2	1
Total	34	27	7	20	14
%	100	79.4	20.6	58.8	41.2

Table 2. Results of subjective assessment after reconstructive procedures

Wassel type	No. of cases	Satisfied with function	Dissatisfied with function	Satisfied with appearance	Dissatisfied with appearance
I	1	1	0	1	0
II	15	15	0	14	1
III	3	3	0	1	2
IV	10	10	0	9	1
V	1	0	1	0	1
VI	2	2	0	2	0
VII	3	3	0	2	1
Total	35	34	1	29	6
%	100	97.1	2.9	82.9	17.1

Table 3. Results of subjective functional and subjective appearance result

Appearance result	Functional result Satisfied		Functional result Dissatisfied		Total	
	No. of cases	%	No. of cases	%	No. of cases	%
Satisfied	49	80.3	0	0	49	71.0
Dissatisfied	12	19.7	8	100.0	20	29.0
Total	61	100.0	8	100.0	69	100.0

Table 4. Results of objective assessment after simple ablation and reconstructive procedures

Result	Type of surgery Simple ablation		Type of surgery Reconstruction		Total	
	No. of cases	%	No. of cases	%	No. of cases	%
Good	6	17.6	22	62.9	28	40.6
Fair	20	58.8	11	31.4	31	44.9
Poor	8	23.5	2	5.7	10	14.5
Total	34	100.0	35	100.0	69	100.0

Table 5. Type of pathology by Wassel and cases with late deformities after surgical treatment

Wassel type	No. of cases	No. of cases with late deformities	%
I	4	3	75
II	23	11	47.8
III	9	7	77.8
IV	24	14	58.3
V	1	1	100
VI	2	1	50
VII	6	4	66.7
Total	69	41	59.4

Table 6. Type of surgery and number of cases with late deformities

Type of surgery	No. of cases	No. of cases with late deformities	%
Simple ablation	34	28	82.3
Bilhaut Cloquet procedure	8	6	75.0
Ablation + CL repair	16	3	18.7
Ablation + CL repair + osteotomy	8	4	50.0
Ablation + CL + tendon transfer	2	0	0
On top plasty	1	0	0
Total	69	41	59.4

CL collateral ligament

tion (79.4% satisfied), $p<0.05$. Subjective assessment of appearance revealed: 82.9% satisfied after reconstruction, 58.8% satisfied after simple ablation, $p<0.05$.

We also assessed how subjective functional results depends on the subjective appearance

Table 7. Complication and type of pathology by Wassel

Complication/Wassel type	I N=4	II N=23	III N=9	IV N=24	V N=1	VI N=2	VII N=6	Total N=69
Angulation	3	6	4	9	1	0	2	25
Z deformity	0	2	2	5	0	0	1	10
Instability	3	6	6	7	0	0	3	25
Loss of mobility	2	6	5	5	1	1	2	22
Narrow thumb web	0	0	0	2	0	0	1	3
Residual prominence	2	6	4	4	0	0	1	17
Nail deformity	0	4	0	1	1	1	1	8
Loss of opposition	0	2	1	1	1	1	0	6
Pulp atrophy	1	6	3	8	1	1	3	23
Total	11	38	25	42	5	4	14	139

result (Table 3).

When the cosmetic result is assessed as unsatisfactory, the functional result is most often also assessed as unsatisfactory ($p<0.01$).

The results of objective assessment were based on the criteria of JCY Cheng et al (Table 4).

The results of objective assessment were better in the group of patients after reconstructive procedures, $p<0.01$. The comparison of results in both groups showed that there were statistically better results after duplicated thumb reconstruction, $p<0.02$, statistically worse results after simple ablation, $p<0.05$, while the difference of fair results was not statistically significant.

We also evaluated how fair and poor results (late deformities) depended on the type of thumb duplication (Table 5).

The smallest numbers of cases with fair and poor results (late deformities) were observed in Wassel II and IV, but the difference between groups was not statistically significant.

We analyzed how late deformities depended on the types of surgery (Table 6).

Late deformities were statistically more often after simple ablation, comparing with the reconstruction, $p<0.01$, and the odds ratio is 7.89 (OR=7.89 PI(2.58-24.13)). We compared the rate of late deformities among different types of surgery. Late deformities were statistically more often after simple ablation, comparing with ablation+CL repair, $p<0.01$, OR=20.2, PI(4.3-93.8), also comparing with ablation+CL repair+osteotomy, $p<0.05$, OR=4.6, PI(1.01-24.12), with ablation+CL repair+tendon transfer, $p<0.05$, OR was not assessed. Late deformities were statistically more often after Bilhaut-Cloquet procedure, comparing with ablation+CL repair, $p<0.05$, OR=13.0, PI(1.7-99.4).

139 different complications were determined among assessed 69 cases (Table 7).

For Wassel type I type the angulation and instability were the most common, for Wassel type II-different complications : angulation, instability, loss of mobility, pulp atrophy and other, for Wassel type III-also different : angulation, instability, loss of mobility, for Wassel type IV-angulation, instability and pulp atrophy, for Wassel types V, VI, VII-also different complications. Statistically significant difference was observed only for the joint instability in treatment of Wassel type III pathology, $p<0.05$.

Discussion

No classification for thumb duplication was used in our clinics before 1991, and only one type of surgery-simple ablation of one of the thumbs-was performed, in all cases, by our data, a radial thumb. This type of surgery in most cases is not proper, and it can, probably, be used in cases when one of the thumbs is significantly distant from the other, and is called a "floating thumb"[2)13)]. After either subjective or objective assessement the results of threatment were considerably worse in the simple ablation group as a compared with the group in which reconstruction was performed ($p<0.05$). After simple ablation, in 23.6% of cases the results after objective assessment were poor, while 5.7% after reconstruction, and fair results correspondingly 58.8% and 31.4%. By our data, when the cosmetic result was assessed as unsatisfactory, the functional result was most often also assessed as unsatisfactory ($p<0.01$).

The most common complications after surgical treatment were angulation (observed in 25 cases), joint instability (25 cases), loss of mobility (22 cases), pulp atrophy (23 cases). The complication was determined when the objective result of the criteria was assessed as fair or poor. This is one reason why the rate of complications in our work is so high. Another reason, of course, is the big percent of cases treated by simple ablation.

From 1992 Wassel's classification has been used in our clinics for thumb duplication, and more different types of surgery after evalutation of anatomical type of deformity have been used to restore anatomy and function ; also, the patients at the time of surgery were younger.

In most cases, except one, we performed radial thumb ablation with collateral ligament reconstruction, using a ligament-periosteal flap that provides sufficient ligament tissue to stabilize the joint (30 cases)[8)]. In 9 of these cases phalangeal or metacarpal osteotomy was done. Osteotomy was performed when deviation of the phalanx was more than 8 degrees after both joint surfaces were congruently aligned. In 3 cases additionally to the collateral ligament repair we performed a transfer and reinsertion of the abductor pollicis brevis muscle and extensor tendon of the removed finger. Although ablation with collateral ligament repair is much better than simple abaltion in restoring segmental alignment, joint stability and mobility, in 26.9% of cases the results of objective assessment were fair and poor. In 5 cases of them secondary procedures were performed because of malalignment and redundant soft tissue.

In 9 cases for all Wassel types we performed the Bilhaut-Cloquet procedure. Only in Wassel type I and II were the results good and the most common residual problemd were nail deformity and loss of joint mobility. We agree with thoses authors who state that the Bilhaut-Cloquet procedure is a useful method in those cases in which both thumbs are symmetrically hyploplastic[3)11)], in Wassel type I, II, rather type III, IV[10)].

In our series, there were more late deformities-59.4% (Table 5)-compared with other reports, where complications and late deformities were observed in 20-49% of all cases[7)9)10)]. This could be explained by the fact that a larger proportion of our cases were treated by simple ablation of the supernumerary thumb (49.3% of cases) and Bilhaut-Cloquet proce-

dure(11.6% of cases), and the results after theses methods of treatment were the worst (82.3% ir 75.0%, respectively, Table 6). In these two groups of cases the rate of late deformities was the highest($p<0.05$). According to the authors, there were unacceptable residual deformities in more than half of cases after simple ablation and for all cases after Bilhaut-Cloquet procedure[13]. In our series, simple ablation was performed only before 1991, this method is not used any more at our department ; lately we have been performing the Bilhaut-Cloquet procedure extremely rarely.

Some authors report that the greatest number of complications occur in Wassel type IV pathology[4][5], others-that in Wassel III, V, VI and VII(11). In our series the smallest number of complications was in Wassel types II and IV, but the difference between groups was not statistically significant(Table 5).

According to the literature data, the most common problems after surgical treatment is angulation in the MP and IP joints, where 2/3 of these deformities are due to the instability of the collateral ligaments(10). Angulation in the MP and IP joints in the same thumb is called Z deformity, which we observed in 14.5% of the assessed cases just after simple ablation of the supernumerary digit. In our series the most common complication was joint instability, which we observed in 6.2% of all assesed cases, and was statstically significant in treatment of Wassel type III pathology ($p<0.05$). Such a big rate of instability, again, we explain by the big percent of assessed cases, treated by simple ablation. After simple ablation of the supernumerary digit without restoration of the collateral ligament, the stability of the joint is lost. Angulation was also common complication, more often observed after ablation+CL repair+osteotomy, because when the angulation before surgery was not well-marked, it was difficult to determine the exact angle of osteotomy.

The less common complications were loss of joint mobility and pulp atrophy.

Risk factors for late deformities after surgical treatment of thumb duplication are Wassel type IV, Z deformity before operation, when both thumbs are radially deviated through the interphalangeal joint[4], also "pollex abductus", when FPL tendon abnormally inserts int EPL tendon through an abberant radial slip of the tendon[6]. We support this opinion, though in our series the smallest number of complications was in Wassel type IV. We explain this fact by the good surgical technique and rehabilitation after surgery.

To prevent complications, it is very important to evaluate the type of pathology, and to choses the proper surgical procedure, taking into consideration the groups of risk.

Conclusions

1) Late results in treatment of the thumb duplication are superior after reconstruction compared with simple ablation. Both subjective assessment of function(97.1% and 79.4%, $p<0.05$) and cosmesis(82.9% and 58.8%, $p<0.05$) were better after reconstruction. When the cosmetic result was assessed as unsatisfactory, the functional result was most often also assessed as unsatisfactory($p<0.01$).

2) Late objective results in treatment of the thumb duplication were superior after reconstruction compared with simple ablation($p<0.05$).

3) Late deformity occured more often after

simple ablation, comparing with the reconstruction ($p<0.01$), and the odds ratio was 7.89.

4) The most common complication after treatment of the thumb duplication ($p<0.05$) was joint instability in treatment of Wassel type III pathology. Different complications were found in other types of pathology, but the results were not significant.

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