

Original Paper

Long-term Evaluation of Primary Syndactyly Treatment in Children, Using a Flatt Modified Technique

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REZUMAT

Evaluarea rezultatelor tratamentului sindactiliei primare la copii, utilizând pentru reconstrucția spațiilor interdigitale o variantă modificată a tehnicii descrise de Flatt

Obiective: Evaluarea rezultatelor tehnicii descrise de Flatt și modificată de Upton în tratamentul sindactiliei primare la copii.

Materiale și metode: Au fost evaluați 24 de pacienți cu 72 de spații interdigitale operate (atât la mâini cât și la picioare) pentru sindactilie primară între 2002-2013 în Clinica de Chirurgie Plastică și Arsuri a Spitalului Clinic pentru Copiii „Grigore Alexandrescu”. Toate spațiile interdigitale au fost reconstruite de către același operator principal, aplicând aceleași indicații operatorii și tehnică chirurgicală. Postoperator au fost urmărite și documentate: apariția infecției, necroza lambourilor, integrarea grefelor, recidiva sindactiliei, contractura în flexie, devierea de ax, aspectul cicatricilor, sensibilitatea și mobilitatea degetelor .

Rezultate: La niciunul dintre pacienți nu s-a constatat postoperator infecția , necroza lambourilor sau pierderea grefelor tegumentare. Recurența sindactiliei a fost înregistrată pentru 15 dintre cele 72 de spații reconstruite.

Concluzii: Tehnica descrisă de Upton pentru tratamentul sindactiliei poate fi utilizată cu succes atât în tratamentul sindactiliei membrelor superioare cât și a celor inferioare, asociind o rată scăzută a complicațiilor. Ea poate fi utilizată și în revizia recidivelor sindactiliei, fără a mai necesita utilizarea grefelor tegumentare.

Cuvinte cheie: sindactilie primară, tratament, grefe tegumentare, reconstrucția comisurii, complicații

ABSTRACT

Objectives: The aim of the present study was to evaluate the results of web reconstruction in children with primary syndactyly, using the technique of Flatt modified by Upton for syndactyly release.

Materials and methods: We reviewed 72 webs in 27 hands and 21 feet in 24 patients, operated for primary

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syndactyly, during the period of 2002-2013 in the Plastic Surgery and Burns Department of “Grigore Alexandrescu” Clinical Emergency Hospital for Children. All the webs were corrected by the same surgeon, using the same indication, timing and technique. Skin grafts becoming loose, flap necrosis, development of local infection, web creep, flexion contracture, finger deviation, scars, sensitivity and function were assessed clinically and documented.

Results: There were no cases of loose skin graft or flap necrosis, and none of the patients developed local infection due to the surgery. Web creep was seen in 15 of the 72 released webs.

Conclusion: The technique described by Upton for syndactyly release can be successfully applied both in the treatment of syndactyly of hands and feet. The incidence of complications is low. Revisional surgery for web creep can be performed using the same technique, without the use of skin grafts.

Key words: primary syndactyly, treatment, skin grafts, commissure reconstruction, complications

INTRODUCTION

Syndactyly is one of the two most common congenital hand abnormalities, the other being polydactyly (1, 2, 3). It occurs in about 1: 2,500 live births, more commonly in males, and is most often seen in the third web space (2, 4). The condition has a strong familial tendency and is bilateral in half of the cases (4, 2, 5). Inheritance is thought to be autosomal dominant with variable penetrance and expressivity, which may explain the male predominance (6).

Unlike secondary syndactyly, which occurs due to abnormal fusion of initially individualized fingers, primary syndactyly mainly occurs due to the failure of differentiation between adjacent digits, caused by the absence of apoptosis in the interdigital mesenchyme during the seventh and eighth weeks of gestation (7, 8). Syndactyly may occur as an isolated event or it may be linked to other anomalies in the body, being known as syndromic syndactyly (7).

The treatment of syndactyly is by surgery. Numerous techniques have been described over the years, but several principles have been generally accepted: commissural reconstruction, finger separation using a zigzag incision and skin grafting of the residual skin defects (2, 4, 9). When multiple digits are involved, both sides of a single finger shouldn't be simultaneously released, but rather the procedures should combine so that the number of surgeries and anaesthetics is minimized. (2, 8).

The aim of the present study was to evaluate the results of web reconstruction in children with syndactyly, treated in the Plastic Surgery and Burns Department of “Grigore Alexandrescu” Clinical Emergency Hospital for Children between 2002 and

2013, using the technique of Flatt modified by Upton for commissural reconstruction.

MATERIALS AND METHODS

We reviewed 72 webs in 27 hands and 21 feet in 24 patients, operated for primary syndactyly during the period of 2002-2013 in the Plastic Surgery and Burns Department of “Grigore Alexandrescu” Clinical Emergency Hospital for Children. All the webs have been corrected by the same surgeon, using the same indication, timing and technique. Syndactyly of the first web of the hand was not included in the study (for this type of syndactyly release, the four-flaps Z-plasty technique has been used).

11 of the patients describe positive family history of syndactyly, and 6 of them associate congenital disorders (congenital cataracts, hypospadias, renal fusion, epilepsy).

Age at the time of first surgery varied from four months to seventeen years. 13 of the patients were boys and 11 girls.

Of these patients, 5 had only feet syndactyly, 9 of them only hand syndactyly, and 10 of them had both upper limbs and lower limbs affected. Hand syndactyly was simple- incomplete for 16 webs, simple – complete for 13 webs, and complex for 16 webs. Seven hands had only one web involved, seven had two webs affected, and eight had three webs with syndactyly. Foot syndactyly affected 27 webs.

Development of web creep, flexion contracture, finger deviation, scars, sensitivity and function were assessed clinically and documented. Web creep was objectively and serially assessed using the volar base

Table 1. Peculiarities of the studied group

Particularities	Numbers
Patients/ webs	24/72
Male / female	13/11
Age at first syndactyly release surgery (months)	4- 205
Hands/ foot syndactyly (webs)	45 / 27
Complete/ incomplete (webs)	30 / 42
Simple/complex syndactyly (webs)	42/ 30
Follow-up period (months)	18- 147
Patients with/ without other congenital disorders	6 / 18

of the web as a baseline. Scar quality was assessed using Vancouver Scar Scale. (10)

Follow-up period ranged from 18 to 147 months, with a median of 58 months.

Surgical technique

The surgery is performed under general anaesthesia and tourniquet control.

For commissural reconstruction the technique of Flatt modified by Upton (1990) has been used in all patients. A rectangular flap was designed over the dorsum of the hand, starting proximally at the level of the metacarpal heads and extending distally up to two thirds of the way from the metacarpal head to the PIP joint. On the palmar side a triangular flap is developed and is inserted through a longitudinal incision made at the central tip of the rectangular flap. (1)

Beyond the flaps used in commissure reconstruction, the fingers are separated using zigzag incisions. The palmar flaps are based opposite the dorsal flaps (mirror images) to allow interdigitation. This orientation minimizes the tendency for formation of a flexion scar contracture and maximizes coverage potential. Separation of the digits requires division or excision of the fascial interconnections between the digits, with care taken to identify and preserve the individual neurovascular bundles, as well as to ensure adequate venous drainage of the commissure. The commissure flap is sutured first to assess placement and configuration of the web space. Subsequently, the interdigitating flaps are brought together while avoiding excessive tension. (5)

The bare areas on both lateral sides are covered with skin grafts. All the skin grafts were full – thickness and were harvested from the distal wrist crease or groin area. (Fig. 1,2,3,4,5,6,7,8)



Figure 1. Simple complete hand syndactyly - before surgery



Figure 2. Simple complete hand syndactyly - before surgery

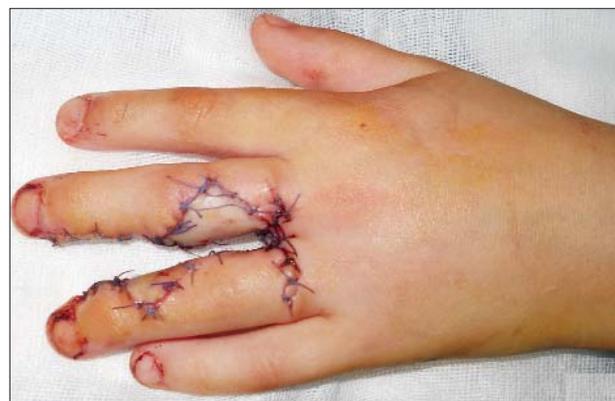


Figure 3. Simple complete hand syndactyly - after surgery



Figure 4. Simple complete hand syndactyly - after surgery



Figure 5. Simple complete foot syndactyly - before surgery



Figure 6. Simple complete foot syndactyly - before surgery



Figure 7. Simple complete foot syndactyly - after second web reconstruction



Figure 8. Simple complete foot syndactyly - 3 weeks after second web release

The postoperative dressing must apply compression across the skin grafts and protect the separated digits, but care must be taken not to apply strong compressing. The fingertip is kept visible at all times to check the vascularity. The compression dressing is removed at one week after surgery and a light dressing is applied until two weeks postoperatively (1).

For the adjacent side a delay of 6 months is proposed before separating the second side (2). Usually the patients are discharged after two days.

After reconstruction, patients should be examined periodically until they have achieved skeletal maturity, because late complications such as web creep can occur (6).

RESULTS

47 webs needed skin grafts to cover the area resulting from the release of digits, and 25 did not need skin grafts. Hair growth has been found on three webs and hyperpigmentation in two webs, all grafted with skin from the groin. None of the webs

grafted with skin from the distal wrist crease developed hyperpigmentation or hair growth.

Of the 24 operated patients, there were no cases of skin grafts becoming loose or flap necrosis, and none of the patients developed local infection due to the surgery.

In relation to the duration of the surgical procedure, it ranged from 20 to 90 minutes, with a general mean of 47 minutes. There was no significant difference between hand and foot length of syndactyly release surgery. There was a difference in duration of surgery between simple cases (34 minutes) and complex cases (71 minutes).

Web creep was seen in 12 of the 48 webs operated before 1 year of age, while from the 24 webs operated later, only 3 developed web creep. Most of the patients operated in the first year of life had complex or complicated syndactyly, which means that the difference in the incidence of late complications correlates not only with the timing of surgery, but also with the complexity of this congenital anomaly. Only seven of the web creep cases required surgery. The revisional surgery was performed using the same Flatt modified technique, without the need to use skin grafts.

Scar quality evaluation revealed a height

Table 2. Need for skin graft

Type of syndactyly	Number of webs released using skin graft	Number of webs released without skin graft
Simple	22	20
Complex	25	5
Web creep	0	15

Table 3. Hand syndactyly release complications

Complications	Number of involved webs
Loose skin graft	0
Flap necrosis	0
Local infection	0
Flection contracture	0
Web creep	15
Hyperpigmentation	2
Hair growth	3
Total	20

below 2 mm in 70 of the 72 spaces, normal or supple pliability in 68 of the 72 webs. There was no evidence of flection contracture. All patients had good fingertip sensation.

DISCUSSION

The goal of the syndactyly release is to create a functional hand, with almost normal fingers and normal shaped commissures, without deformity or contracture, using the fewest surgical procedures while minimizing complications (1).

To this purpose many techniques for web reconstruction have been described during the past four decades. These techniques can be divided into methods that use skin grafts and those that do not. The methods that manage to avoid the use of skin grafts are mostly applied in the release of incomplete syndactylies, although some authors also evocate their use in the treatment of complete and even complex syndactylies (7, 11, 12, 13). In contrast, the techniques that require skin grafting may be used with good results in the treatment of all types of syndactyly, regardless of the cause, the complexity and location. Use of skin grafts to cover the bare areas allows tension-free suture and prevents flap ischemia and necrosis, enabling primary wound healing and preventing scar contracture.

In our series none of the patients developed flap necrosis, loose skin grafts, flexion contracture or local infection due to the surgery. Web creep development was observed in 20% of the released webs, and it was correlated not only with the small age of patients at the time of surgery, but also with the complexity of this congenital anomaly. Revisional surgery was required in less than half of the recurrences, and it was performed using the same technique, without the use of skin grafts.

The reporting of different rates of complications

after applying the same surgical techniques by different surgeons suggest that patients' particularities (the complexity of the malformation, age at time of surgery, other pathologies associated) and the conditions for undertaking the surgery are decisive factors on the patient's postoperative evolution.

To achieve good results from syndactyly release it is not enough that the main surgeon be well acquainted with the anatomy of the hand. To minimize the rate of complications, this type of surgery should be performed in a plastic surgery department of a hospital for children, by a surgical team experienced in treating child syndactyly, using appropriate surgical instruments and loupe magnification.

Timing of the operation is a matter of discussion. Older publications proposed delaying surgery until the patient is 5 or 6 years old, while more recent authors recommend surgery before the age of 2 years (1, 9). Considering that the functional pattern of the hand is established in the first year of life and that psychological stress is lower at this age, most patients hospitalized for hand syndactyly in our department are submitted to surgery before the age of one year.

In relation to the duration of the surgery, it was observed that the complex cases of syndactyly required operations almost two times longer than for simple cases, possibly because of the greater level of difficulty in correcting the malformations, younger age of the patients at first surgery and the frequent use of skin grafts in these patients.

Average duration of surgery, shorter than in other similar studies, could be explained by the fact that all patients included in the study were operated on by the same surgical team, with great experience in the treatment of syndactyly.

Frequent association of syndactyly with other congenital disorders (in our study 25% of the cases), some of them with the indication of treatment before the syndactyly release, is the reason why these patients require careful assessment and investigation at birth.

The mean length of follow-up was 58 months, which is a reasonable period considering the maturing time for scars and the literature consulted. (12,14,15)

CONCLUSIONS

The technique described by Upton for syndactyly release is safe, reproducible, with good functional and

cosmetic results.

It can be successfully applied both in the treatment of syndactyly of hands (except the first web) and feet, regardless of the syndactyly complexity.

The incidence of complications is low. Revisional surgery for web creep can be performed using the same technique, without the use of skin grafts.

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REFERENCES

1. Kojima T., Congenital Disorders : Syndactyly, Richard A. Berger ed., Hand Surgery, Lippincott Williams & Wilkins, 2004
2. Enescu D. , Malformatii congenitale ale membrului superior, in Tratat de chirurgie, vol VI, Ed. Academiei Romane, Bucuresti , 2008, 242-251
3. Stan V. , Malformatii congenitale ale mainii, Antohi N., Chirurgia Plastica si reconstructiva a membrului superior, Vol 1, Tipografia Romana Libera, 2001, 182- 187
4. Choi M. , Congenital hand abnormalities, Grabb and Smith's Plastic Surgery, 6th edition, Lippincott Williams & Wilkins, Philadelphia, 2007, 856-863
5. Kay S. P., Deformities of the Hands and Fingers, Green DP, Operative hand surgery, New York, Churchill Livingstone, 1999, 1303-1312
6. Jordan D., Hindocha S., Dhital M., The Epidemiology, Genetics and future Management of Syndactyly, The Open Orthop. J, 2012, 6, 14-27
7. Niranjana N. S. Azad S.M. , Fleming A. N. M., Long-term results o primary syndactyly correction by the trilobed flap technique, J Hand Surg (Br), 2005; 58:14-21
8. Light T. R. , Congenital Anomalies : Syndactyly, Polydactyly and Cleft Hand, Peimer ed., Surgery of the hand and upper extremity, , 2112-2132
9. De Smet L., Van Ransbeeck H., Deneef G., Syndactyly release: results of the Flatt Technique, Acta. Orthop. Belg. , 1998; 64 (3):301-305
10. Fearmonti R., Bond J., Erdmann D., A Review of Scar Scales and Scar Measuring Devices / Open access Journal of Plastic Surgery. Accessed at www.eplasty.com on 21 June 2013
11. Bulic K. Long-term aesthetic outcome of fingertip reconstruction in complete syndactyly release, J Hand Surg (Eur), 2013; 38 (3): 281-287
12. Sharma K.R. , Tuli P., Makkar A., End-of-Skin Grafts in Syndactyly Release: Description of a New Flap for Web Space Resurfacing and Primary Closure of Finger Defects, HAND, 2009; 4: 29-34
13. Lapid O., Sagi A. Three- square-flip-flap reconstruction for post burn syndactyly, British Journal of Plastic Surgery, 2005, (58): 826-829
14. Lumeta BD., Kitzinger HB, Beck H. Long-term outcomes of web creep, scar quality, and function after simple syndactyly surgical treatment, J Hand Surg Am., 2010, 35 (8) : 1323-1329
15. Cortez M. Fernandes J. V. J., Ferreira R. , surgical resultados from treating children with syndactyly through the collective effort system at „SOS Hand Recife” between 2005 and 2009, Rev. Bras. Ortop. , 2014; 49 (4): 396-400