

Evaluation of Use Full Thickness and Split Thickness Skin Graft in Management of Congenital Hand Syndactyly

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الخلاصة:

يعتبر ارتفاق اصابع اليد من اكثر انواع تشوهات اليد الولادية حدوثا, وعلاجه يتطلب بحث مستمر في اكتشاف الطرق التي تؤدي الى تحسين وظيفة اليد. اشتملت هذه الدراسة على معالجة (16) مريضا مصابا بارتفاق اصابع اليد الولادي في مستشفى الجراحات التخصصية ومستشفى الواسطي في الفترة ما بين كانون الثاني 2004 – اذار 2005. وقد تم تقييم حالة المرضى قبل التداخل الجراحي عن طريق اخذ المعلومات الوافية والفحص السريري لليد وكذلك الفحص الشعاعي لضمان اختيار الطرق المثلى للعلاج. بعد فتح الالتصاقات جراحيا ,تم وضع ترقيع جلدي ذو السمك الكامل او ترقيع جلدي ذو السمك الجزئي على المناطق غير المغطاة بالسدة, كذلك تم الطلب من المرضى استعمال مسند خاص بعد العملية. لقد كانت هناك بعض المضاعفات بعد التداخل الجراحي اهمها تغيير لون الترقيع الجلدي عند استعمال الترقيع الجلدي كامل السمك, وعدم قدرة الاصابع على الانبساط الكامل عند استعمال ترقيع جلدي ذو السمك الجزئي. من خلال هذه النتائج نستطيع ان نستنتج انه بالامكان استعمال كلا الترقيعيين في معالجة ارتفاق اليد الولادي معطيا نتاج جيدة بالنسبة لوظيفة اليد بالرغم من وجود عدد من المضاعفات في كلا النوعين.

Absract

Background :

Hand syndactyly is the commonest type of congenital hand anomalies and its management is a real challenge to the surgeon and stimulate continous search for newer concepts and methods for restoration of function .

Aim of the study :

The objective of this study is to evaluate the use of full thickness and split thickness skin graft in reconstruction of congenital hand syndactyly and to compare between complications that occur in using these grafts and identify the proper ways of avoiding these complications.

Patients and methods:

The study involved 16 patients presented to the department of plastic and reconstructive surgery in the hospital of surgical specialties and Al-Wasity hospital. The patients were evaluated preoperatively by talking full history and examination of the hand systematically ,plain radiographic studies were performed and all patients were adviced to use web elastic splint postoperatively and the patients were followed up by regular visits following surgery.

Results :

3rd web space was the commonest space involved by syndactyly and hyperpigmentation was the most frequent complication reported when using F.T.G. although it was reported in some cases of S.T.G. Shrinking of skin graft and extension lag were more frequently seen when using S.T.G. while web creeping occur commonly when using F.T.G. Other compications like rotational ,derivation deformaties and morbidity of scar at donor and recipient sites were reported.

Conclusion :

Using F.T.G. and S.T.G. in reconstruction of syndactyly give acceptable functional results although both types have their own disadvantages.

Introduction

Congenital defects of the hand present cosmetic and functional problems and often the first exceeded the second(1).

The dynamic forces of growth and differential development are often greater than the surgeon's capacity to modify them(1). Any plan of reconstruction of the congenitally deformed upper limb must be directed toward the capacity of the patient to adopt the benefits of surgery, unrestricted functional growth and acceptable appearance (2). Deformities of the hand are often only part of the problem, other congenital lesions may exist, but not yet apparent(3,4,5). Syndactyly by definition is a failure of differentiation in which the fingers fail to separate into individual appendages. Syndactyly is usually bilateral in 50% of patients (6,7), and males are affected as twice as frequently females. It is the commonest congenital hand deformity (1/3 of all congenital hand anomalies with prevalence 7 per 10000 live birth in England (8)). The 3rd web space is most commonly affected followed by 4th, 2nd and 1st web space (9).

Development defects could be the result of delay or prevention of normal necrotic process(13,14). Cell death in limb formation during embryological development is an important process that regulate the cessation of various tissues at vital time and location(10,11,12).

Almost all combinations of abnormal anatomy can be present in syndactyly(15). Skin is invariably deficient.

Classification:

Based on the severity of the anomaly, syndactyly can be classified into simple type in which the webbed

fingers joined only by soft tissue and complex type in which these fingers joined by bones or cartilage union, when in side to side fusion at the distal phalanges called acrosyndactyly. Also can be classified into complete type, the involved digits are united as far as the finger tip and incomplete type, in which the union is only partial and does not extend to the finger tip. There is also special entity called complicated type syndactyly when the fused fingers have one joint and neurovascular bundle.

Management :

Most patients with syndactyly benefit from surgical release except in those with complex type in whom the conjoined fingers together are functional but individually hypoplastic, separation of the conjoined fingers may make the two individualized digit nonfunctional, because only one set of tendons and one neurovascular pedicle may be present. Timing of surgery is variable, however the more complex type, the release is earlier to prevent malrotation, angulation that develop from differential growth rates of the involved fingers. In complex type we prefer release of border digits in approximately 6 months age (i.e. thumb, little fingers) (6).

Surgical technique:

The surgical division is individually tailored based on complexity and location of syndactyly. General release is accomplished by creating local palmar-dorsal triangular interdigitating flaps to resurface interdigital space (19,20,21)

Flaps inset 45 degree inclination in the dorsal to volar orientation with dorsal edge ending at the mid-length of proximal phalanx. If fingernail is

involved, it is divided longitudinally. We osteotomize and cover the bony unions with local flaps for stable coverage (22). Applying either full thickness skin graft or split thickness skin graft to area that remain uncovered by the flaps. Separation of the involved digits using volar and dorsal zig-zag approach. For minor incomplete syndactyly, various techniques such as double opposing z-plasties or 4-flaps z-plasty may not require skin graft (19).

Despite appearing relatively straight forward, syndactyly release is complex operation requiring well skill. However if properly performed, the rate of complications is low, and the results are extremely gratifying for the patient in terms of improving hand functionally and provide normal appearing hands and fingers.

Complications:

The complications encountered in syndactyly surgery can be divided into:

1. Early complications: these complications occur in early post operative period including finger ischemia that is occur when there is damage to neurovascular bundles at both sides of the digits and also flap necrosis when there is tension during suturing of the flaps. skin graft loss which usually occur due to haematoma and infection.
2. Late complications: recurrence of syndactyly, contractures, rotation and deviation deformity of fingers in addition to hyperpigmentation and hair growth that occur commonly in using full thickness skin graft.

Patient and Methods

Sixteen patients with congenital syndactyly presented to the department

of plastic surgery of surgical specialities hospital and AL-Wasity hospital between January, 2004 to March, 2005.

Patients were studied clinically and evaluated according to: age, sex, hand dexterity, history of similar congenital anomalies in the family, prenatal conditions, maternal age and degree of relationship between parents, associated anomalies such as CHD

, cleft lip and palate..etc .

The hands were examined systematically to evaluate the number of digits present, the number and the level of the web space involvement, the length of the finger, and appearance of fingernail. Passively movement of the fingers was evaluated to determine bony union and differential movement.

Fusion of the fingernail is often associated with bony union, and broad fingernail also may indicate a hidden polydactyly (17). Since the result of syndactyly correction can be negatively influenced by the presence of other hand deformities (22), complex form of syndactyly and syndactyly associated with deformities like brachydactyly and other deformities were excluded from this study.

Beside the hands, cranium, face, torso and lower extremities were examined for any deformities. Plain radiographic studies were performed to reveal the number of digits, number of metacarpals, number of phalanges, the presence of complex cross union, delta phalanges.

Operative measures :

1. Anesthesia: all surgeries were done under general anesthesia with pneumatic tourniquet.

2. Surgical techniques: the release was accomplished by creating local palmar-dorsal triangular flaps to resurface

interdigital space. Separation of the involved digits using a volar and dorsal zigzag approach. We used full thickness skin graft (FTG) to resurface the raw area in eight cases and the graft was taken from the groin ,and we used split thickness skin graft (STG) to resurface raw area in eight cases too, where the graft was taking from the thigh .

Post-operative measures:

The hand elevated for at least three days after surgery , the wound inspected 24-48 hrs post-operatively using light sedation ,any haematoma under the skin graft is evacuated any tension in the flaps should be released .The next dressing was changed eight days post-operatively ,revisiting every week for two visits.

We used web elastic splint beginning 3 weeks post-operatively and the patients were seen monthly .

On follow up we assessed:-

- 1)Maximal active flexion and extension of the operated fingers.
- 2)The angle of maximal active spreading of the fingers was also measured.
- 3)Web creep and thicking was evaluated as preposed by Withy et al (2001)(22,29).

Web creep 0 : normal and soft web.

1: No web creep ,but thicking of the web due to scarring.

2: Creep of the web to one-third of the distance betwwen the base of the web and PIP joint crease.

3: Creep of the web to two-third of the distance between the base of the web and PIP joint crease .

4:Creep of the web to the PIP crease.

4)Rotation and deviation deformity.

5)Instability and shrinkage of the skin graft .

6)Graft hyperpigmentation and hair growth.

7)Scar quality of recipient sites.

8)Scar quality of donar site.

Results

The total number of patients involved in this study was 16 patients . 10 patients were male (62%) and 6 patients were female (39%) with male to female ratio 1.6:1 .

Age presentation ranged from 6 months to 20 years ,most patients presented below 4 years.

1.Associated anomalies : 7 patients (42%) have other associated anomalies as shown in table 1

Associated anomalies	Number	Percent(%)
Syndactyly of feet	2	12
Polydactyly of hand	2	12
CHD	1	6
Cleft foot	1	6
Club foot	1	6
Total	7	42

Table(1)=associated congenital anomalies

2.Dominant hand involvement :more than half of the patients were bilateral hand involement, 9 patients(56%), as shown in table 2

Table (2)=Dominant hand involvement with syndactyly

Hand involement	Number	%
Bilateral	9	56
Right	5	31

Left	2	13
Total	16	100

- 3. Six patients (38%) had family history of similar congenital anomalies.
- 4. Two patients (12%) had family history of other congenital anomalies.
- 5. Maternal age above 35 years was recorded in 1 patient (6%) from total number of patients.
- 6. One patient was born premature (6%).
- 7. Marriage between relative was found in 8 patients (50%).

8. Possible associated environmental factors had been detected in 3 cases, maternal rubella recorded in 1 case (6%), drug ingestion 1 case (6%), while one patient's mother was diabetic on insulin (6%).

9. Web space involvement: The 3rd web space is involved by syndactyly more frequently than other web spaces, while 1st web involved less than others.

Table 3=web space involvement

Web space number	Number	%
1 st	3	10
2 nd	4	13
3 rd	15	50
4 th	8	27
Total	30	100

10. Type of syndactyly: In 30 web space syndactyly, 20 cases were simple complete (66%) while 10 cases were simple incomplete (34%), as shown in table 4.

Table 4= Type of syndactyly

Type of syndactyly	Number	%
Simple complete	20	66
simple incomplete	10	34
Total	30	100

11. X-ray finding: In all patients we notice normal number of digits, normal number of metacarpals, normal joint counters. All were simple, so no bony fusion.

need regrafting (12%). No graft loss in using S.T.G.

b. Flap necrosis: no flap necrosis was reported.

12. Early post-operative complications:
 a. Skin graft loss: one case complicated by graft loss in which we use F.T.G. and

13. Late complications as shown in table (5) and table (6)

Table (5) late complications of syndactyly surgery following using S.T.G.

Complications	Number	%
Web creep	0	0
Flexion lag	0	0
Extension lag	3	37
Rotation deformity	2	25
Deviation deformity	1	12

Colour (hyperpigmentation)	2	25
Shrinking and instability	3	37
Scar at donar morbidity	0	0
Scar at recipient morbidity	1	12

Table (6) late complications of syndactyly surgery following using F.T.G.

Complications	Number	%
Web creep	2	25
Flexion lag	0	0
Extension lag	2	25
Rotation deformity	1	12
Deviation deformity	2	25
Colour (hyperpigmentation)	6	75
Shrinking and instability	0	0
Scar at donar morbidity	1	12
Scar at recipient morbidity	1	12

Discussion

Syndactyly is the commonest cingenital hand anomalies (2), although other studies were done by IVY and Kallen (24,25) proposed that polydactyly is the commonest .

In our study there is male predominance with a ratio of 1.6:1 .Most of patients presented with bilateral hand syndactyly and this go with IVY (7) who stated that bilateral hand deformities is frequently seen. 3rd web space is commonly involved and this goes with Goldberg 1985(4) and Lister et al 1993(6) who stated that syndactyly commonly occurs betwenn middle and ring fingers.

We found many associated congenital anomalies like CHD ,club foot ..etc.We also found positive family history of similar anomalies (syndactyly) in 38% of cases and other congenital hand anomalies in 12%.

The age of the mother doesnt seen to have bearing on upper extremities defect except in Downs syndrome as stated by KilgroreE.S. 1084n (16), in our study only one mother was above 35 years .Syndactyly may present as part of

syndromes (4,5,6) and recognition of these sydromes directly influence the surgical care of the hand anomaly. In our series the maternal exposure to radiation ,infection and drugs was positive in 18% of cases this goes with BoyesJ.H. 1974(7) ,who stated that both enviromental and genetic factors can lead to congenital defects.The timing of our surgical intervention was usually timed at 2 to 3 years of age when the syndaictyly was central ,while at 6 to 9 months of age when the syndactyly affect the thumb or little fingers.

Using high power magnification loups with pneumatic tourniquite is essential when operating on the delicate tissue of the child .In our repair we use zig-zag incision between webbed fingers dorsaly and volarly baccuse longitudinal incision may lead to linear contracture .In our study there was no neurovascular bundle injury ,this was due to proper identification of this bundle during surgery .

The commissure was created by local palmar-dorsal traingular interdigitint flaps to resurface the interdigital space .

In syndactyly, the skin is always deficient and additional skin is usually needed (6), so we applied skin graft (either F.T.G. taking from groin or S.T.G. taking from thigh) to raw area that remained after setting of local flaps. In our study only one patient developed F.T.G. loss due to infection and the patient had regrafting procedure.

The movement of the web was less when S.T.G. than F.T.G. where the angle between two adjacent spreading fingers covered by S.T.G. has an average of 20 degree, while in using F.T.G. the angle was 23 degree, this clinically not significant as a decrease of 3 degree is not likely to cause any more functional problems. We also found more shrinking and instability of graft when using S.T.G. this may be the cause of decreased movement of the web, these results go with studies proposed by J.Deunk et al 2003(23). In our study we detected more extension lag in using S.T.G., this goes with J.Deunk et al 2003(23), while flexion lag was not detected.

Rotational deformities of the fingers were more detected in using S.T.G. while deviation deformities were more common in using F.T.G. these results go with studies proposed by Deunk et al 2003(23).

Web creeping was more detected in using F.T.G. in opposite to other studies that found more creeping in using S.T.G. (Brown, 1977)(26), (Percival and Stykes, 1989)(27), (Toledo and Ger, 1979)(28), Dentiger M. et al 1989(30). However, we don't have satisfactory explanation for this clinical difference.

We advise all patients to use elastic web splint starting three weeks post-operatively and we notice web creeping occurred in most of the uncooperative

patients those who did not use this splint. Hyperpigmentation was found in 75% of cases treated by F.T.G. leading to dissatisfaction in large number of patients, while 25% of patients treated by S.T.G. developed hyperpigmentation, so it is unavoidable to develop hyperpigmentation when we take F.T.G. from the groin, but there is a chance to overcome this complication by taking F.T.G. from the arm that may lead to wide scar as stated by J.Deunk et al (2003)(23), while we found only one patient developed wide and raised scar at groin. Perhaps we can decrease the chance of developing hyperpigmentation using S.T.G. by taking the graft from planter arch of the foot which provides better colour and texture as stated by (Pensler, 1988), but we could not apply this technique in our patients because most patients or their parents refused taking graft from the sole of the foot. Other donor sites had been proposed by other authors as Paret Al. 1999(31) who was taking F.T.G. from ulnar side of the wrist and some authors proposed techniques without using skin graft as Elerot, 1996(32), Greuse and Ossen, 2001(33).

Conclusion

1. Syndactyly commonly occur in male and 3rd web space is commonly involved.
2. Shrinking and instability of the graft occur frequently in S.T.G. leading to limitation in movement of the web with more extension lag.
3. More web creeping in using F.T.G. that may need reoperation and the incidence was decreased when we used web elastic splint.

4. Hyperpigmentation of the graft is nearly always seen in patients treated by F.T.G. that taking from groin region.

5. Using F.T.G. and S.T.G. in reconstruction of syndactyly give acceptable functional results although both types have their own disadvantages.

Recommendations

1. We advise to use F.T.G. in reconstruction of syndactyly although it has some disadvantages like web creep.

2. We recommend to use elastic web splint to decrease the risk of web creeping.

3. We can use S.T.G. that is easily harvested, good take and less risk of web creeping and hyperpigmentation.

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