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Surgical Management of Camptodactyly

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A B S T R A C T

Camptodactyly is a congenital deformity characterized by a flexed posture in the proximal interphalangeal joint. It is generally found in the little finger and may or may not include the other fingers. It is painless and nontraumatic [1]. It affects approximately 1% of the population. It is bilateral in around two thirds of the patients, although the degree of contracture is usually not symmetrical [2]. The deformity generally increases during growth spurts, especially during the periods of rapid growth from one to four years and from 10 to 14 years of age [3]. The primary cause of this deformity is still a matter for discussion and there is no consensus in the worldwide literature. Although some cases occur sporadically, there is often an autosomal inheritance pattern present. The metacarpophalangeal and distal interphalangeal joints are unaffected, although they may develop compensatory deformities [4]. The purpose of this study is to assess the clinical result of surgical treatment in management of camptadoctyly and to evaluate the results by clinical assessment. This retrospective study was carried out on fifteen patients. These patients with flexion deformity were admitted in Upper Limb and Reconstructive Microsurgery Unite in Assiut University Hospital and were managed by surgical treatment. Age ranges from 2to 15 year, the mean age intervention was 9.8 years. There were 9 males and 6 females as males 60% to 40% females, there were 4 cases with positive family history and 11 case with negative family history. And 4 cases with excellent result, 4 cases good ,7 cases with fair ,17 cases with poor result. From this study the best time to operative at age between (1.5-2.5) years. Also need more family knowledge about camptodactyly to start treatment early.

Keywords: Common deformity, surgical treatment, flexor digitorum superficial is tenotomy.

1.0 Introduction

Interphalangeal joint. It is generally found in the little finger and may or may not include the other fingers. It is painless and nontraumatic[1]. It affects approximately 1% of the population. It is bilateral in around two-thirds of the patients, although the degree of contracture is usually not symme trical[2]. The deformity generally increases during growth spurts, especially during periods of rapid growth from one to four years and from 10 to 14 years of age[3]. The primary cause of this deformity is still a matter for discussion and there is no consensus in the worldwide literature. Although some cases occur sporadically, there is often an autosomal inheritance pattern present. The metacarpophalangeal and distal interphalangeal joints are unaffected, although they may develop compensatory deformities [4]. According to Siegert JJ camptodactyly ca be divided into simple and complex types from a clinical point of view. The simple type consists of flexed contracture of the proximal interphalangeal joint.

In complex camptodactyly, there are other associated deformities such as syndactyly or a combination of clinodactyly and camptodactyly [5] . The purpose of this study is to assess the clinical result of surgical treatment in the management of camptodactyly and to evaluate the results by clinical assessment. Glicenstein was classified camptodactyly into:Primary: when it appears in the first years of life. It affects both sexes in the same proportions and evolves with skeletal growth. It may also appear close to adolescence, with clear predominance in females. It is frequently bilateral. It is restricted to the little finger and progresses rapidly during the growth spurt.

Secondary: associated with syndromes and other malformations and normally involves more than one finger. The most frequent associations are radial club hand, oculodentodigital syndrome, Marfan syndrome and arthrogryposis[6]. In 1994, Benson classified camptodactyly as follows: Type I: This is the commonest form and it becomes evident during childhood. It generally affects the little finger alone. It affects boys and girls equally. Type II: Camptodactyly of adolescence, which occurs predominantly in females. Clinically, it resembles type I. It develops between the ages of seven and eleven years, starting subtly and evolving gradually and progressively. It affects girls more than boys. This type of camptodactyly generally does not improve spontaneously and may evolve to severe flexed deformity.

Type III: This is present from the time of birth. It usually affects several fingers. It is constantly bilateral, with accentuated fixed forms. It is associated with a variety of syndromes and other deformities[7]. The degree of involvement between the hands is often asymmetrical.

In a general manner, the classifications have the aim of grouping different cases of camptodactyly and from this, to establish a treatment protocol. Several forms of treatment for camptodactyly have already been proposed. Many published studies have emphasized conservative treatment, while others have described surgical procedures. Incomplete extension is better tolerated than deficient flexion. Early mobilization should be instituted in order to promote the restoration of flexion[7]. The problem with this deformity is that several forms of presentation exist, which means that there is no single model for effective treatment. The family should be advised that the treatment is long and that follow-up throughout the skeletal growth period is necessary; moreover, after partial or total correction, relapses may occur. Many studies have demonstrated success through conservative treatment consisting of use of braces and stretching exercises[6].

Surgical treatment is reserved for specific cases and in cases of failure of conservative treatment[8].

Camptodactyly is difficult to treat and even more difficult to consistently achieve successful results. The different preoperative findings among outcome reports after surgical reconstruction of camptodactyly. The most noteworthy differences concerned the presence or absence of a fixed PIP joint flexion deformity and the amount of active extension of the PIP joint when the metacarpophalangeal joint is positioned in flexion.

2.0 Materials and Methods

This retrospective study was carried out on fifteen patient . These patients with flexion deformity were admitted in Upper Limb and Reconstructive Microsurgery Unite in Assiut University Hospital and were managed by surgical treatment.

Inclusion criteria:

1- Deformity greater than 50°.

2- Symptomatic.

3-Failure of conservative treatment.

4-Progressive contracture.

5-Bilaterally&more than one digit.

6-Hardness.

Exclusion criteria:

1- Recurrent cases.

2- Associated with vascular disease e.g Raynads.

3- Post-traumatic.

Methods of evaluation:

1-History taking:-

Personal history including Name, Age, Sex, Occupation, Address, phone number, hand dominance and Special habits

2- Clinical evaluation:

Metacarpophalangeal and interphalangeal joint motion and measuring the degree of flexion deformity.

3-Radiological evaluation:

of the affected hand x-ray (Anteroposterior and Lateral view).

4- Operative Documentation:

The operative approach, technique of the operation, the modality of management, and intra-operative complication.

Ethical consideration:

The study was approved by the Ethical Committee of the Faculty of Medicine at Assiut University. Informed consent with risk explanation will be obtained from each patient's family. Every patient's family will be free to refuse participation in the study without affecting the service or the clinical management. They will be free to ask any questions about the study. Demographics of the study group

Age:

It ranges from 2to 15year old an average age 9.8+6.2.

Sex:

There were 9 males and 6 females 60% males to 40% females.

Family history:

There were Positive in 4 patients and negative in 11 patients as 26.7% positive to 73.3% negative family history.

Table 1 shows the distribution of hand dominance, age at 1st operation, side and treated digits. With (86.7%) of patients have right Dominance, with the mean age of the first operation being 8.5 years and (66.7%) in the unilateral side with treated (50.0%) of digits right and (50.0%)left digits

Table 1: Distribution of hand dominance, age at operation, side and treated digits.

Item	No.	%
Dominance		
Right	13	86.7
Left	2	13.3
Age at operation		
Range	0.83 - 19	
Mean+SD	8.5+5.7	
Side		
Unilateral	10	66.7
Bilateral	5	33.3
Treated digits (n=32)		
Right	16	50.0
Left	16	50.0

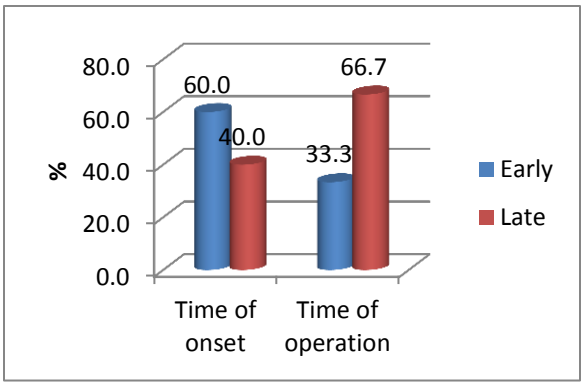


Fig (1):Distribution of time of onset and operation.

Operative Technique:

Position: Surgery was carried out while the patient was lying supine.

Anesthesia: All surgeries were carried out under general anesthesia.

Tourniquet was applied in all cases.

Approach:

The PIP joint was approached by using a palmar or mid-lateral incision, depending on the magnitude of the contracture and the status of the skin. A palmar longitudinal approach with Z-plasty lengthening is used for a mild to moderate flexion contracture.

A full-thickness skin graft is selected for a severe PIP joint contracture. The incision is extended into the palm in a zigzag fashion for complete exploration of the digit. The proximal extent of the dissection ends at the transverse carpal ligament. Skin shortage within the palm is not an issue, and Z-plasty lengthening is not required. Flexible camptodactyly without a fixed flexion can be approached with a mid-lateral incision over the digit combined with a zigzag incision in the palm.

Deeper Dissection:

After the skin incision, any abnormal fascia and linear fibrous bands are released during exposure of the deeper structures. Additional release of the flexor tendon sheath, the flexor digitorum superficialis tendon, the checkrein ligaments, the collateral ligaments, and the palmar plate may be necessary to obtain sufficient extension.

The digit is explored for anomalous structures, with specific examination of the intrinsic muscles and flexor digitorum superficialis. Any anomalous origin or insertion of the lumbrical or interosseous muscles is resected .

Traction is applied to the tendon in a proximal and distal direction to assess its excursion and insertion.

Deficient proximal excursion with concomitant inability to flex the PIP joint indicates abnormalities of insertion. This requires release of the flexor digitorum superficialis tendon through a third annular pulley window. After release and reconstruction the skin is closed and Kirschner wire fixation to hold the metacarpophalangeal joints in 70 degrees of flexion, and the interphalangeal joints straight.

Postoperative Care:

Immediate post-operative care:

All patients were tested for capillary circulation before leaving the operating room after recovery. All patients were fitted in splint after the surgery. Movement restriction for all patient had camptodactyly surgery for three weeks. Intra venous antibiotics were given for 24 hours then oral antibiotics continued for seven days. 2nd day of surgery plain X-ray is done. Patients were discharged from hospital after 2-4 days. The first visit of the patient to the outpatient clinic was 7-10 days after discharge, Three weeks after surgery, the Kirschner wire, cast and the sutures are removed. A thermoplastic splint is fabricated with the wrist in neutral, the metacarpophalangeal joints in 70 degrees of flexion, and the interphalangeal joints straight.

The distal interphalangeal joint is splinted to concentrate the flexor digitorum profundus action on proximal interphalangeal joint flexion. During week 6, the patient may engage in some light resistive strengthening. During weeks 7 and 8, more resistance may be added to the strengthening program

3.0 Results

The data were tested for normality using the Anderson-Darling test and for homogeneity variances prior to further statistical analysis. Categorical variables were described by number and percent (N, %), where continuous variables described by range, mean and standard deviation (range, Mean, SD). Chi-square test and fisher exact test used to compare between categorical variables where compare between continuous variables by Student t-test and ANOVA. A two-tailed $p < 0.05$was considered statistically significant. All analyses were performed with the IBM SPSS 21.0 software.

Analyzed the result using the method of Sierget et al7.,from the mayo clinic:

Excellent: full Correction of extension, with less than 15° loss of flexion of the interphalangeal joint. **Good:** Correction with loss of up to 20° of extension and gain of extension of the interphalangeal join >40° with loss of flexion <30° . Fair: Correction with loss of extension of up to 40° and gain of extension of the interphalangeal joint >20°, with loss of flexion <45°.

Poor: Correction with gain of extension of the interphalangeal joint <20°, with range of motion <40°.

Table 2 shows descriptive of preoperative lack of extension and operative procedure. With (46.87%) have FDS tenotomy, temporary k-wire, (31.25%) have FDS tenotomy, volar Capsule release, skin z-plasty, temporary k-wire, (12.5%) have FDS tenotomy (wrist level)+Temporary k-wire. As regard about operative findings there were (59.37%) of patients Tight FDS, Capsule &neurovascular bundle and (25.0%) of patients were Tight fascial bands.

Table 2:Descriptive of preoperative lack of extension ,operative procedure and Operative findings.

Preoperative Lack Of extension (n=32)		
Range	60 - 95	
Mean ± SD	76.9+10.0	
Item	No.	%
operative procedure		
FDS tenotomy, temporary k-wire	15	46.87
Transfer of anomalous lumbrical insertion to wing tendon, skin z-plasty	3	9.37
FDS tenotomy, volar Capsule release, skin z-plasty, temporary k-wire	10	31.25
FDS tenotomy (wrist level)+Temporary k-wire	4	12.5
Operative findings		
Abnormal lumbrical insertion	3	9.37
Small FDS	2	6.25
Tight fascial bands	8	25
Tight FDS , Capsule &neurovascular bundle	19	59.37

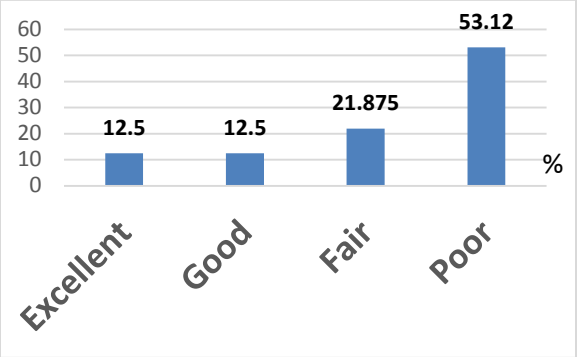


Fig (2) shows distribution of grade with (53.12%) of cases in poor, 21.87% in fair grade with 12.5% in excellent and good grade.

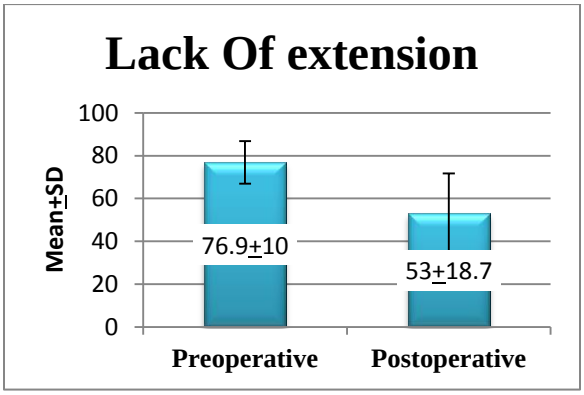


Fig (3): Comparison between preoperative and postoperative lack of extension

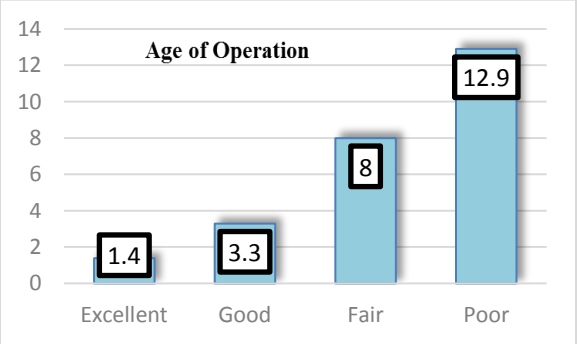
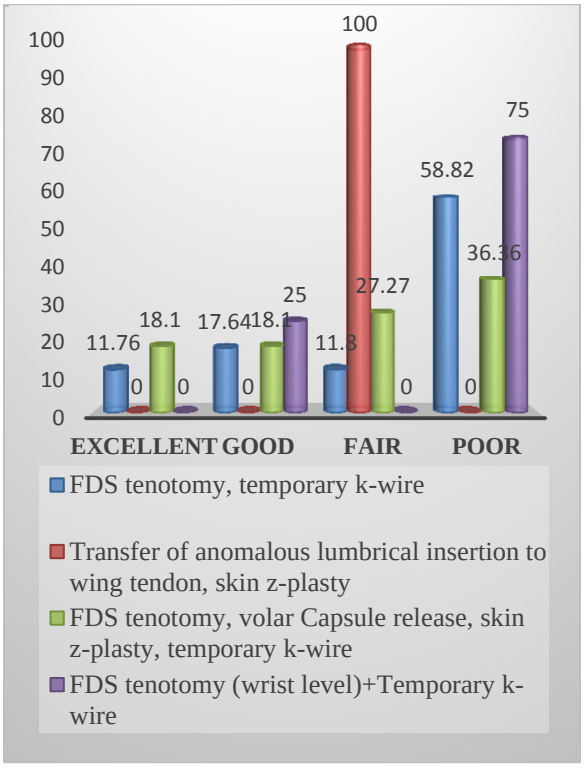


Fig (4): Comparison between grades according to age at operation.



*Statistically significant difference ($p<0.05$)

Fig (5): Comparison between grades according to operative procedure

With highly significance difference between grades and operative procedure there were 17.64% of cases in good grade and 11.76% of cases in excellent grade, 11.8% in grade fair and 58.82% in poor grade with FDS tenotomy, temporary k-wire operation but with another procedure which is FDS tenotomy, volar Capsule release, skin z-plasty, temporary k-wire there were 18.1% of cases in good grade and 18.1% of cases in excellent grade, 27.27% in grade fair and 36.36% in poor grade

4.0 Discussion

Camptodactyly' (Greek for bent finger) is a relatively rare condition which constitutes 5% of congenital hand anamolies. Most of the cases are sporadic, and have bilateral involvement [9]. It is most commonly seen in little finger with contractures ranging from 20 to 100 degrees. Although functional impairment is minimal, Its appearance prompts visit to a surgeon. Camptodactyly may occur separately or together with other signs characterizing a large number of syndromes. It is considered as a 'marker sign' that should invite physician's attention to the possibility of occurrence of associated malformations[10]. Camptodactyly may occur as an isolated deformity as well as a part of many well-characterized hereditary syndromes.

Isolated type can be sporadic or can have an autosomal dominant trait with variable penetrance and expressivity

[11]. The gene for this deformity has not been identified as well as any specific gene locus and gene has not been reported for Kirner's deformity[12]. In present study the mean age of study group were 9.8 years. This agree with Mehmet ERDURAN1 who reported the deformity usually becomes obvious between the ages of eight and fourteen years [12] . In present study there were negative family history (73.3%) in study group. This agrees with Malik S, Schott J who reported and agree with this study [11]. The family history revealed that there were no any relatives having this deformity but there were 2 people having camptodactyly in various degrees in father's family. In present study there were (66.7%) of study group were unilateral side. This agree with Glicelctein J who reported camptodactyly to be usually unilateral [8], Of 27 cases seen by the author in general neurology outpatient clinics over a 5 year. period most referred for reasons other than finger deformity and 20 cases had bilateral changes, albeit asymmetric in some. But Lamers reported that Camptodactyly was more often bilateral, often asymmetric, than unilateral [10] . In present study there were (60.0%) of cases were early onset. This agrees with Mehmet Taşar who reported It is characterized by early-onset camptodactyly [13]. In present study there (46.87%) of patients at operative were done flexor digitorum superficialis tenotomy, temporary K-wire. This agrees with Col R Ravishanker who reported Early detection and insertion of the K-wires corrected the subluxation and the deformity [14]. Following active and passive physiotherapy good function returned in the finger. In present study about distribution of grade there were 12.5% of cases in excellent grade, 12.5% of cases in good grade, 21.87% in grade fair and 53.12% in poor grade. Compared with Saulo Fontes who reported some difference of result [15]. In present study the preoperative angle were 76.9 but postoperative were 53.0 with significance difference. This agree with Siegert JJ who reported treatment [16]. Many studies have demonstrated success through conservative treatment consisting of use of braces and stretching exercises [2]. For younger children, the brace should include the hand and the wrist. This brace is initially used during the maximum period of acceptance, with intervals for stretching exercises guided by therapists, until the deformity has been corrected [17]. The importance of the

parents with regard to correctly performing the exercises should not be underestimated, because aggressive stretching could cause pain and tissue damage[13]. At a later stage, to avoid recurrence, the brace is used for shorter periods during the day. However nighttime use

ismaintained until the end of the skeletal growth period [13].

5.0 Conclusion

Over time, some cases evolved to present some loss of the gain that had previously been achieved, which emphasizes the need for continual follow-up monitoring, with systematic use of braces, until the final phase of skeletal growth has been reached best time to interfere at age between (1.5- 2.5)years.

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