








Pediatric Finger Replantations: Retrospective Evaluation of 31 Cases

Pediatric Parmak Replantasyonları: 31 Olgunun Retrospektif Değerlendirilmesi

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Abstract

Aim: Traumatic amputations are rarely seen in the pediatric population and indicate absolute replantation most of the time. The aim of this study was to evaluate the epidemiology, complication, and success of replantation surgery in pediatric patients.

Material and Methods: We retrospectively evaluated 31 patients younger than 18 years old who underwent finger replantation surgery for traumatic amputation in our clinic between January 2015 and January 2019.

Results: The age of the 31 patients was between 2 and 17 years (mean: 10.5). Twenty-five patients were male and six were female. Six patients had amputation of more than one finger, and 38 fingers were replanted. Twenty-two of 38 fingers (57.8%) were successfully replanted, and 16 fingers (42.1%) were closed as stump.

Conclusion: Every effort should be made to maintain the size of the limb in order to prevent probable psychosocial and functional deficits in the future; even though the size of the limb in the pediatric population is generally small and the fact that the injuries are usually distal and crushed.

Key words: Pediatric finger replantation; amputation; anastomosis

Öz

Amaç: Travmatik amputasyonlar çocukluk çağında nadir görülmektedir ve çoğu zaman mutlak replantasyon gerektirmektedir. Bu çalışmada 18 yaş altında travmatik amputasyon sonrası replantasyon uygulanan hastaların epidemiyoloji, komplikasyon ve replantasyon başarısının değerlendirilmesi amaçlanmıştır.

Gereç ve Yöntemler: Bu çalışmada Ocak 2015 ile Ocak 2019 tarihleri arasında travmatik amputasyon sebebiyle parmak replantasyonu uygulanan 18 yaşından küçük 31 hasta retrospektif olarak incelenmiştir.

Bulgular: Otuzbir hastanın yaşı iki ile 17 arasında idi (ortalama: 10,5). Yirmibeş hasta erkek, altı hasta kadın idi. Altı hastada birden fazla parmakta amputasyon meydana gelmiştir ve 38 parmak replante edilmiştir. Otuzsekiz parmağın 22'si (%57,8) başarılı bir şekilde replante edilirken, 16 parmakta (%42,1) güdük kapatılmıştır.

Sonuç: Pediatik dönemde uzuv boyutunun küçük olması, yaralanmaların genellikle distal seviyeden ve ezilme şeklinde olması replantasyon başarısının önündeki en büyük engeller olmasına rağmen; psikososyal ve fonksiyonel defisitleri önlemesi amacıyla uzuv boyutunun devamlılığı için her türlü çaba gösterilmez.

Anahtar Sözcükler: Pediatik parmak replantasyonları; amputasyon; anastomoz

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Introduction

Traumatic amputations are seen less in the pediatric population than in adults (1). In young children, finger amputation is often caused by a crush or avulsion due to squeezing between objects such as bicycle chains and doors (2). In older children, it is seen as a result of heavy machinery, motor vehicle and firearm accidents (3).

Traumatic pediatric amputations indicate absolute replantation regardless of the level of finger, except for life-threatening comorbidities and multilevel injuries. The most important reason for this indication is the rapid recovery compared to adults and the prevention of future psychosocial and functional deficiencies.

The aim of this study was to evaluate the epidemiology, complications and success of replantation in patients undergoing replantation surgery before the age of 18 years.

Materials and Methods

This study included 31 patients younger than 18 years old who underwent finger replantation surgery for traumatic amputation between January 2015 and January 2019. Patients were evaluated retrospectively for age, gender, amputation type, side, region and level, anastomosis number of arteries and veins, postoperative complications and replantation outcome (Table 1). The life-threatening comorbid factors that prevented replantation in the emergency department were excluded. All patients were operated under general anesthesia. After irrigating the amputate and the stump with isotonic, unhealthy soft tissue and bone were debrided, the arteries and veins were marked with 8/0 nylon sutures under the microscope. After bone fixation with Kirschner (K) wire; flexor tendon, digital artery, digital nerve, extensor tendon, and dorsal vein were repaired and skin was sutured. Vessels and nerves were repaired with 9/0 or 10/0 Ethilon (Ethicon, Johnson & Johnson, USA) nylon sutures. Tendons were repaired, with a modified Kessler method with 4/0 prolene and a running epitendinous suture with 6/0 prolene. In distal amputations, dorsal vein and central artery anastomoses were performed. A peroperative nail was taken in patients when any dorsal vein was not found. In postoperative follow-up, hand elevation, intravenous (IV) 30 mg / kg, 3x1 cefazolin sodium, 5 mg / kg IV paracetamol 3x1 were administered. IV 0.5 mg/kg dextran 40 treatment was started and the dose was reduced within five days. In patients with venous congestion, the nail bed was treated with heparin gas or leech therapy. If hemoglobin value falls below 10 mg/dl, 10 mg/kg erythrocyte suspension was given after completion of the treatment, the patients were discharged and followed-up. In the postoperative first month, the K-wires were withdrawn and the physical therapy protocol was started.

Ethics committee application was received from "University of Health Sciences, Turkey Sisli Hamidiye

Etfal Training and Research Hospital Health Practice and Research Center Clinical Research Ethics Committee with 2019/2253 decision number.

Results

The age of the 31 patients was between two and 17 years (mean: 10.5). Twenty five patients were male and six were female. A crush injury was found in 29 patients (93.5%) and sharp type injury was found in three patients (7.8%). In the etiology, 18 patients had door slams, nine had bicycle chain injuries, two had traffic accidents and two patients had firearm accidents. Seventeen patients had injury at right hand, 13 patients injury at had left hand and one patient had injury at both hands. Six patients had amputation of more than one finger, and 38 fingers were replanted. Amputations were seen most commonly in the middle finger (n=14), small finger (n = 10), ring finger (n = 6), index finger (n = 6), and thumb (n = 4), respectively. Distal interphalangeal (Dip) joint (Figure 1,2) in 15 fingers (39.4%), distal phalanx (Dp) in nine fingers (23.6%), middle phalanx (Mp) in six fingers (15.7%) (Figure 3), proximal phalanx in (Pp) four fingers (10.5%) and proximal interphalangeal (Pip) in three fingers (7.8%) joint level amputation was detected. Anastomosis was performed with one artery in 25 fingers, double artery in seven fingers, vein graft in six fingers. A double vein anastomosis was performed in six fingers, single vein anastomosis in 19 fingers. Vein anastomosis was not performed in 13 fingers since the veins could not be found in those fingers. Replantation surgery was unsuccessful due to arterial failure in 10 fingers. Venous congestion was seen in 20 fingers, and replantation failed in five (25%) of them. There were no arterial insufficiency and venous congestion in eight fingers. 22 of 38 fingers (57.8%) were successfully replanted, and 16 fingers (42.1%) were closed as stump. The duration of hospitalization for patients was between 3 days and 12 days (mean: 9.2 days).

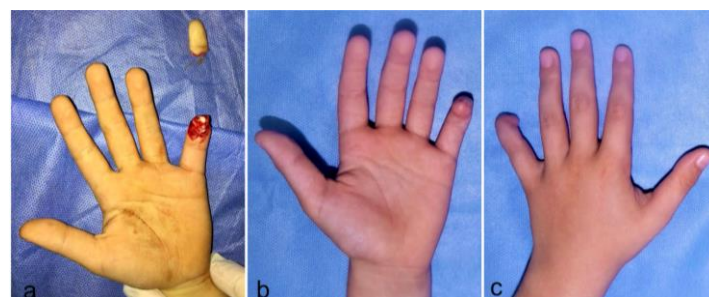


Figure 1: Case 12; preoperative (a) and postoperative images (b,c) of the patient who underwent replantation surgery after crush injury at the left hand fifth finger distal interphalangeal joint level.

Table 1. Demographic data and replantation results of patients.

Patient No	Age	Gender	Amputation mechanism	Side	Finger	Level	Artery	Vein	Complication	Result
1	11	M	Crush	L	3	Dip	1	-	AI	Fail
2	13	M	Avulsion	L	3	Pp	VG	2	AI	Fail
3	11	M	Crush	R	1	Pp	1	1	VC	Success
4	12	M	Crush	L	5	Mp	2	2	-	Success
5	11	M	Avulsion	L	1	Dip	1	-	AI	Fail
6	5	M	Crush	L	4	Mp	VG	2	VC	Success
7	8	F	Avulsion	R	5	Pp	VG	1	VC	Fail
8	13	M	Crush	L	3	Dip	1	-	VC	Success
9	10	M	Sharp	L	3	Dip	1	1	VC	Success
					4	Dip	1	1	VC	Success
10	16	M	Avulsion	R	2	Dip	1	1	-	Success
11	16	M	Avulsion	L	3	Dip	1	1	VC	Success
					4	Dip	1	1	-	Success
12	7	M	Crush	L	5	Dip	1	-	VC	Success
13	17	M	Avulsion	L	1	Dp	1	1	VC	Fail
14	11	F	Avulsion	L	5	Dp	1	-	VC	Fail
15	10	M	Crush	L	2	Mp	1	1	-	Success
					3	Mp	2	2	VC	Success
16	3	F	Crush	R	3	Dp	1	-	VC	Fail
17	10	F	Avulsion	R	2	Dip	1	1	AI	Fail
18	17	M	Crush	R	2	Pip	VG	1	-	Success
19	10	M	Avulsion	R	3	Dip	2	1	AI	Fail
20	16	M	Crush	R	3	Dip	1	1	VC	Success
21	12	M	Avulsion	R	5	Pp	VG	2	VC	Success
22	10	M	Crush	R	4	Dip	1	-	VC	Fail
23	14	M	Crush	R	3	Dip	1	1	AI	Fail
				L	4	Dip	2	1	VC	Success
					3	Dp	1	1	VC	Success
					4	Dp	1	-	AI	Fail
24	12	M	Crush	R	5	Dp	1	1	VC	Success
25	2	M	Sharp	R	5	Dp	1	-	VC	Success
26	3	F	Crush	R	1	Mp	VG	-	AI	Fail
27	7	M	Avulsion	R	2	Dp	1	-	VC	Success
28	13	M	Crush	L	2	Pp	2	2	-	Success
					3	Pp	2	1	VC	Fail
29	10	M	Crush	R	5	Mp	2	1	AI	Fail
30	8	M	Sharp	L	3	Dp	1	-	VC	Success

Description: M; Male, F; Female, R; Right, L; Left, Dip; Distal interphalangeal joint, Dp; Distal phalanx, Mp; Middle phalanx, Pip; Proximal interphalangeal joint, Pp; Proximal phalanx, Mp; Metacarpalpalangeal joint, VG; Vein grafts, AI; arterial insufficiency, VC; Venous congestion

Discussion

Amputation is most common in the distal phalanx at childhood period (4). The most important reason for this is that the fingers are trapped between objects. In this study, 18 patients had amputation as a result of a trapping in a door and this situation was the most common etiological factor. Besides, the distal amputation rate was found to be 63.1%. Nine of these are Dp and 15 are amputations from the Dip joint level. In addition, approximately 94% of the cases were crush injury.

In children, 10% of finger injuries can be replanted (5). Pediatric amputations usually occur as crush injury. In addition, small vessel diameters, the difficulty of

dissection and the absence of replantable vessels are the major impediment to successful replantation. Despite these, successful replantation surgeries of 58% to 98% have been reported in children with the development of microsurgical techniques (6-8).

Lafosse et al. reported that the success rate for children under 6 years of age was 47% (9). Baker et al. evaluated 41 finger replantations in newborns and young children and found the replantation success and patient weight was directly proportional (10). In this series of 31 patients, the rate of successful replantation was 57.8%, and the mean age of the patients was 10.5 years. These data indicate that the success of replantation decreased with the decrease in patient age and limb size.

Factors determining the success of replantation surgery include the general condition of the patient, the transport conditions of the limb, ischemia time, type of injury, surgical technique and postoperative follow-up. Even though non-surgical conditions are optimized, it is more difficult to work in smaller vessels, especially in childhood.



Figure 2: Case 20; preoperative (a) and postoperative (b) images of the patient who underwent replantation surgery after crush injury at the right hand third finger distal interphalangeal joint level.



Figure 3: Case 28; preoperative (a), and postoperative images (b,c) of the patient who underwent replantation surgery after crush injury, left hand third and fourth finger proximal interphalangeal joint level.

Appearance of faster vasospasm complicates surgery. Besides, difficulty in finding dorsal veins in distal amputations decreases success rates.

Although one artery and one vein are sufficient for the perfusion of amputate, the success rate increases as the number of venous anastomoses increases (10, 11). In this series, double vein anastomosis was performed in six patients. Single vein anastomosis was performed in 19 patients. In 13 fingers, anastomosis could not be performed since the vein could not be found. Venous congestion was observed in 20 fingers postoperatively and quarter of them were lost.

The limitations of this study were the small number of cases and that it was a single-center retrospective study.

In conclusion, small size of the limb in the pediatric population and the fact that the injuries are usually distal and crushed are the biggest impediment to the success of replantation surgery. Nevertheless, every

effort should be made to maintain the size of the limb in order to prevent psychosocial and functional deficits in the future.

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