

Spaghetti Wrist: A follow-up review of 22 cases

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Objective: To retrospectively document the surgical outcome in this small group of patients in terms of functional recovery, opposition, deformity, tendon function, sensations, intrinsic muscles recovery and to compare results with the literature.

Methodology: The initial study-population consisted of 22 patients with complete records analyzed retrospectively and an evaluation was made from the records. Motor recovery and sensory recovery had been reassessed in an outpatient setting, on average 6.9 years (range 1 – 12) years after the operation. All had been operated by the same surgeon within 30 hours of injury using a pneumatic tourniquet and without an operating microscope. Follow up active/passive assisted exercises were used in all.

Results: Most patients had returned to their normal

life without any handicap within one year of injury. Excellent and good finger flexion was achieved in 91% cases. Opposition was regained in 95%, intrinsic function good or excellent in 79% only and sensory recovery (two-point tactile discrimination) was in 62% only. Very few showed any disabling deformity and only one case needed openadhenolysis.

Conclusion: Spaghetti wrist injury can be managed in most trauma care orthopedic units without using specialized microsurgical care. Most patients return to their original jobs with good functional recovery, opposition, deformity, tendon function, sensations, intrinsic muscles recovery.

Keywords: Spaghetti wrist, functional recovery, sensory recovery.

INTRODUCTION

Wrist and proximal to wrist lacerations are frequently seen in orthopedic practice. Most of the muscles in this area are tendinous and fairly superficial. Any sharp object that runs across this area not only cuts the skin open but also lacerates the underlying muscles, vessels and nerves. The wounds maybe deceptively very deep and smaller on the surface hiding the colossal damage underneath. A wound when explored is usually full of cut flexor tendons and nerve ending looking like a heap of spaghetti noodles.

Repairs after exploration under anesthesia are generally done at the earliest. Some may necessitate vascular repair as well. Puckett and Mayer in 1985 made a historical contribution and suggested to include all cases with at least 3 cut structures including at least one nerve (Ulnar/Median) and one major vessel (Radial/Ulnar).¹⁻⁴ Most authors share the perception that it is a very severe injury yet most well known studies have shown very good recovery of their cases.^{1,3,5-8} However, recoveries are successful but due to technical limitations, mistakes during operations leading to functionally compromised hand function, traumatic neuromata, stiffness, clawing deformity, loss/alteration in sensation and motor function in fingers can occur.¹

Though there is a difference of opinion but most agree to include all cases with a volar forearm laceration in the

area between distal wrist crease to the flexor musculotendinous junction (12 tendons, 2 major nerves and 2 major vessels) and the work of Wang et al in this matter is of value.⁸ Inability to correctly identify the structures and incorrect stitching of the same may also compromise results.¹ Inadequate (the dilemma falling between protection of new suture lines versus wish to begin rehabilitation and early movements) physiotherapy may further reduce the success rate.^{1,3,5} The need to document our results scientifically lies in the wish to audit our current practice and review it if needed. Because of scarcity of these cases we cannot plan a prospective study at present.

METHODOLOGY

In all 27 cases were retrieved but only 22 fulfilled the criteria for inclusion. All those with detailed record of the injury, surgical notes and complete follow up data were included. Those with incomplete final assessment at 1-year post operatively were contacted to obtain a uniform assessment to be included in the final analysis. All patients had been operated within first 30 hours of injury with extension of wound when required, primary repair of cut structures in layers and plaster splintage after wound closure. The back slab had been retained in some form (sometime only as extension blocker) for approximately 6 weeks.

Active and assisted physiotherapy had been continued to at least 12 weeks after surgery. All cases had received intravenous antibiotic (ceftriaxone) starting immediately after admission and ending at the time of discharge. General anesthesia and pneumatic tourniquet were used in all. The tendinous repair was done with 3 or 4 zero unabsorbable monofilament (Prolene®) as Modified Kessler 2 strand core suture method.⁸ Some were overrun with finer monofilament 4/5 epitendinous repair. Nerves were repaired with 5/6 zero monofilament suture in interrupted stitches (without use of operating microscope).⁸ No vessel repair case has been included in the study. Some pure muscular or musculotendinous repairs were done with braided absorbable 3 or 4 zero sutures (Vicryl®) while a few purely muscular cuts (unstitchable) were left just apposed in the wound for secondary healing.

No cases with gaps and nerve grafting have been included along with those reporting more than three days after injury. All those with preexisting deformities, fractures in the same arm and poor compliance in the follow up period were excluded.

Statistical Analysis: The data were analyzed using of SPSS version 21.

RESULTS

Records (in all 27 cases had been operated) of those 22 showing a complete record complying to Puckett and Mayer (1985) assessment criteria were included.^{1,4,5} As all cases had already been operated long before this formal analysis was made the ability to collect or recall a lot of information especially use of renowned

functional/psychological tools like Quick DASH/IES-R could not be applied to all uniformly.^{2,3}

Of the 22 patients included average age was 27.88 (range 13 – 47 years), male were 13 (61.90%) and 8 (38.10%) were female (Table 1). Only seven were not manual workers (house wives were included in manual workers!) while the majority were skilled or semiskilled manual workers. Medical records (duration 1 – 12 years) were mostly adequate enough to retrieve five major information required by the study namely Tendon Function, Thumb Opposition, Function of Intrinsic Muscles, presence of Deformities, alterations in Sensations of Median and Ulnar Nerves.

Most had been injured with a clear mechanism e.g., Knife or glass edges. All cases had one or both of the major nerves severed at the time of injury along with other structures. In all, 11 Median Nerve, 3 Ulnar Nerve lacerations were noted apart from the 3 cases where both the nerves were found to be cut. Most of the cut muscles recovered well and regained more than MRC grade 4 power (average). Eight cases had lacerated radial or ulnar vessels (Table 2). None was repaired and all were ligated. No Sural Nerve interposition grafting was need in any of the cases.⁸

Intrinsic muscle function was judged as ability to adduct or abduct fingers and a positive Froment's sign (13 – 61.92% excellent, 7 – 33.33% good, 1 – 4.76% fair). Clawing of fingers was taken as positive for having a residual deformity. Two-point tactile discrimination was used as a surrogate of a well recovered sensory function (8 – 38.09% Median Nerves and 11 – 52.38% Ulnar Nerves showed partial recovery) (Table 3). Only one patient needed redo surgery for adhenolysis and wrist

Table 1: Demographic Facts.

Parameter	Age	Sex	Profession	Duration (Years)	Mode of Injury	Size of Wound	Distance from Wrist Crease	Laterality
Ave	27.66	M = 13	HW 3	6.90	GLASS 7	8.90	6.43	
Max	47	F = 8	LAB 5	12	RTI 7	17	12	R = 16 (72.72%)
Min	13		STD 6	1	ASLT 2	1	2	L = 6 (27.27%)
			SK LAB 6		KNIFE 3			
			BUSS 1		FALL 1			
					FAI 1			

(Legend: HW-House wife, LAB: Laborer, STD-Student, SK LAB-Skilled Laborer, BUSS: Business, RTI-Road Traffic Injury, ASLT-Assault, FAI-Fair Arm Injury, R-Right, L-Left)

Table 2: Structures Injured and Muscle power regained.

Structure	PL	FCR	FCU	FDS1	FDS2	FDS3	FDS4	FPL	FDP1	FDP2	FDP3	FDP4	MN	UN	RA	UA
Cut	19	18	13	15	20	19	12	10	13	13	10	7	14	7	5	3
%age	90.48	85.71	61.90	71.43	95.24	90.48	57.14	47.62	61.90	61.90	47.62	33.33	66.67	33.33	23.81	14.29
MP Ave	–	4.57	4.67	4.76	4.61	4.42	4.33	4.42	4.62	4.67	4.57	4.57	–	–	–	–
Max	–	5	5	5	5	5	5	5	5	5	5	5	–	–	–	–
Min	–	4	4	4	4	4	3	3	3	3	3	3	–	–	–	–

(Legend: PL-Palmaris Longus, FCR-Flexor Carpi Radialis, FCU-Flexor Carpi Ulnaris, FDS-Flexor Digitorum Superficialis I-IV, FPL- Flexor Pollicis Longus, FDP- Flexor Digitorum Profundis, MN-Median Nerve, UN- Ulnar Nerve, RA- Radial Artery, UA- Ulnar Artery, MP AVE= Muscle Power Average)

Table 3: Functional results at last follow up.

Result	Tendon Function		Opposition		Intrinsic Muscles		Deformities		Sensations	Median N	Ulnar N
Excellent	85% to full ROM/finger flexion to 1.0 cm or less from DPC	13 (61.88%)	Tip of the thumb moves freely over the other four fingers		Finger Abd/Add + Froment's sign -				TPD \leq 10 mm		
Good	70–84% total normal ROM/2.0 cm from the DPC	6 (28.56%)	Tip of the thumb touches only tips of fingers		Finger Abd/Add+ Froment's sign+	17 (80.95%)	Major clawing + ape hand +	1 (4.76%)	TPD 10 – 20 mm	13 (61.88%)	10 (47.62%)
Fair	59% total normal ROM		Tip of the thumb cannot reach the tip of fingers		Finger Abd/Add+ Froment's sign+	3 (14.28%)	Minor Either clawing or ape hand +	5 (23.08%)	TPD \geq 20 mm Light touch + Pinprick+		
Poor	Fixed Contractures or adhesions		2 (9.52%)			No finger Abd/Add Froment's Sign+	1 (4.76%)	None	15 (71.42%)		8 (38.09%)

(Legend: ROM-range of motion, DPC-distal palmer crease, Abd/Add-Abduction/Adduction, TPD-Two Point Discrimination)

movement restriction. No gross infections or osteodystrophy was noted. Due to repeated and careful counselling most, patients complied well with the prescribed rehabilitation program.

DISCUSSION

Most of our cases were from working class except a few and most could not afford private and a dedicated physiotherapy service. Most authors have reported majority of the patients to have recovered well after surgical repair of these injuries.^{1,4-8} Although initial recovery of function was over shadowed by post-operative stiffness especially in the first 12 weeks but with gradual use of the hand in daily activities most

patients regained very good hand function. Though the recovery was slow and marred by changing range of motion of the interphalangeal joints or wrist or altered pain sensation of the fingers supplied by the injured nerve. These changes were expected and thence were managed with good physiotherapeutic measures, analgesics, and splints.

A few patients did show need for nerve conduction studies and electromyography, but it was not a uniformly applied practice. Some patients did need short term use of pregabalin and anti-depressant e.g. nortriptyline or a selective serotonin reuptake inhibitor for a few months. Mid of the linear lie of the wound was taken as the distance from the crease. We did not note

Table 4: Comparison of results.

Studies	Year	Age (Mean)	Number of Patients	Follow-up Period (Mean) Months	Flexion Action (%)		Opposition (%)		Intrinsic (%)		Sensation (%)	
					E+G	F+P	E+G	F+P	E+G	F+P	E+G	F+P
Chin et al	1988-1996	29	60	20	100	0	-	-	58	42	53	47
Hudson and De Jager	1981-1990	28.7	60	49	68	32	-	-	-	-	40	60
Kabak et al	1990-1995	N/A	21	76	100	0	-	-	-	-	-	-
Noaman	1997-2005	17.1	42	12 – 96	97	3	95	5	95	5	97	3
Yazdanshenas et al	2009-2012	28.3	153	20	91	9	92	8	79	21	48	52
Present study	2010-2022	27.6	22	82	90	10	95	5	95	5	62	38

(Legend: E = Excellent/no deformity, G = Good/minor deformity, F = Fair, P = Poor) (Adopted from Yazdanshenas et al)⁵

any proclivity of the wound for ulnar or radial side of the forearm when a smaller number of structures were cut as did Gloria et al.⁷

Our group of patients had age and sex characteristic as other comparative studies published recently (Table 4).⁷ Although most of the patients had been operated at the earliest and not beyond 30 hours after receipt in the hospital by a general orthopedic surgeon in an average operating time of 155 minutes (90 – 210) (Table 2). Our surgical technique was standard as in most studies we have cited where the surgeons were not dedicated hand surgeons nor was any microsurgical intervention used neither was WALANT used at any stage.^{1,3,5,7,8,9}

Our post-operative care was similar in practice except for the fact that the physiotherapy care was provided in most cases by the surgeon himself, while in other studies where physiotherapist provided early passive assisted range of motion for flexion with active extension of fingers was used. Various authors have differed in minor details but almost similar (mostly claim to have achieved excellent to good) results have been achieved. Our results have been of equal magnitude (Table 4).⁷ Most of our patients had shown regain of very good finger flexion (a surrogate of tendon excursion) like other comparable work.⁷

Grip strength has been good in most of our cases (Table 3). When we look at thumb function only ability to move the thumb across bases of the fingers or tip pinch with the thumb was noted and no record had been

maintained of the pinch strength.⁷ Although Median and Ulnar nerves have been shown to gain adequate tensile strength in cadavers after simple repair an extension blocking splint was still retained for approximately 6 weeks.¹²

Sensory recovery has been rather mediocre as far as two-point tactile discrimination is concerned, which documents less than ideal recovery but most of our cases showed very well preserved protective sensory supply of the fingers (Table 3). Our study does not show any case who needed to be re operated in early post-operative period and we did not administer Tacrolimus to any of these patients to prevent tendon scarring.⁶

Ours is a very small number of cases spread over about ten years' time. The data of such old nature in itself makes its validity weak if not maintained in good quality e.g. scales like DASH score and IES-R to see the psychological effects of the study cannot be applied uniformly any more if a prospective study design is not used.^{2,3,13} Our hospital is a private setup and does not receive medicolegal cases like assault, attempted suicide or self-inflicted wounds. This may have made our data less representative of the whole society as shown in most foreign and local studies.^{1,7,8,10,11} Being a very small number of patients our observations cannot be presumed to be of as great a value as shown in larger studies but it can be safely presumed that no specialized hand surgical unit is required in the early care of such cases.

CONCLUSION

Although ours is a very small retrospective collection of data, the results achieved so far are promising. It can be concluded safely that repairs of nerve and tendon injuries proximal to wrist can lead to good results when a careful technique is used and a close follow-up is maintained post operatively.

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