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Approaches to Distal Upper-Extremity Trauma

A Comparison of Plastic, Orthopedic, and Hand Surgeons in Academic Practice

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Background: Hand trauma call duties at university medical centers are traditionally split among plastic surgeons and orthopedic surgeons, frequently without additional fellowship training in hand and upper-extremity surgery. Differences in operative approach between these groups have never been specifically described. The University Health Consortium—Association of American Medical Colleges Faculty Practice Solutions Center database contains comprehensive, factual, billing and coding data from 90 academic medical centers in the United States and can be used to characterize the practice patterns of various academic surgical specialties.

Objective: To characterize and compare the clinical experience of academic plastic, orthopedic, and hand surgeons in addressing traumatic distal upper extremity injuries (using the Faculty Practice Solutions Center data set).

Methods: Annual data for CPT defined procedures related to traumatic injuries of the nail bed, finger, hand, wrist, and forearm performed by plastic, orthopedic, and hand surgeons during calendar years 2010 to 2013 were included in the study.

Results: From 2010 to 2013, the experience of fellowship-trained hand surgeons in treating traumatic distal upper extremity injuries was consistently greater than that of plastic surgeons and general orthopedic surgeons across all categories. Injuries of the nail bed were repaired more frequently by plastic surgeons than orthopedic surgeons (average 1.3 annual procedures per surgeon for plastic surgeons compared with 0.3 for orthopedic surgeons). Fractures and dislocations involving the phalanx and metacarpal were repaired equally by both groups, with plastic surgeons using predominantly percutaneous (38%) or open methods (45% of repairs), and orthopedic surgeons using mostly closed reduction (59% of repairs), splinting, and casting. Fractures and dislocations involving the carpal bones, radius, and ulna were more frequently repaired by orthopedic surgeons (average 23.2 procedures versus 2.6 for plastic surgeons), whereas tendon repairs in all segments were performed more frequently by plastic surgeons (average 13.7 procedures versus 2.5 for orthopedic surgeons). Replantation and repair of neurovascular injuries were exceedingly rare (less than 1 occurrence) in all groups for all years and are not specifically reported in Table 1. Similarly, incision and drainage procedures and decompressive fasciotomies of the distal upper extremity were uncommonly performed and also not included (Table 1 displays the mean annual procedures per surgeon by grouped CPT coded procedures, with overall averages displayed to the right. Figure 1 displays the proportions of intra-articular and extra-articular bony hand injuries treated by closed, open, and percutaneous methods by each specialty).

Conclusions: A large degree of variation exists in the treatment of distal upper extremity injuries, based on specialty service. Hand surgeons, not surprisingly, have the most robust clinical experience, whereas plastic surgeons and orthopedic surgeons each display varying strengths and weaknesses, perhaps a consequence of their respective training.

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Hand trauma call duties at university medical centers are traditionally split among plastic surgeons and orthopedic surgeons, frequently without additional fellowship training in hand and upper-extremity surgery. Fellowship-trained hand surgeons, who typically share backgrounds in plastic, orthopedic, or occasionally general surgery, also participate. Differences in operative approach among these groups have never been specifically described.

In a recent survey, fellowship-trained hand surgeons from orthopedic and plastic surgery backgrounds reported differences in the composition of their clinical practices, perhaps a reflection of clinical exposure during residency.[1] Without fellowship training, plastic and orthopedic surgeons who treat hand trauma, may be at a disadvantage when addressing certain injuries.

OBJECTIVE

The objective of this article is to analyze practice patterns of general plastic surgeons, general orthopedic surgeons, and hand surgeons addressing distal upper extremity injuries in academic medical centers, using the Faculty Practice Solutions Center (FPSC) database. The University Health Consortium—Association of American Medical Colleges maintains the FPSC database which contains de facto coding and billing data from 90 academic medical centers, encompassing all procedures performed at these facilities for all payer types in both inpatient and outpatient settings by individual specialty. Previously, the FPSC database has been used to characterize practice patterns of various surgical specialties.[2–4]

METHODS

Annual data for CPT defined procedures that address distal upper extremity trauma performed by university plastic, orthopedic, and hand surgeons during calendar years 2007 to 2013 were included in the study. No specific designation of prior specialty training in plastics, orthopedics, or general surgery is given for hand surgeons in the database. However, based on a recent survey of the American Association for Hand Surgery, and American Society for Surgery of the Hand, most respondents from academic practices were from orthopedic backgrounds (63% orthopedics, 47% plastics).[1]The FPSC database values are reported as the average annual procedures per surgeon (pps).

RESULTS

From 2010 to 2013, the total experience of hand surgeons in treating traumatic distal upper extremity injuries was greater than that of their general plastic surgery and orthopedic surgery counterparts, across all categories for all years. Table 1 displays the mean annual pps by grouped CPT coded procedures, with overall averages displayed to the right.

A comparison of plastic surgeons to orthopedic surgeons shows slight predominance of plastic surgeons performing nailed repairs, albeit in relatively low volume, ranging from 0.8 to 2.0 pps annually for plastic surgeons and 0.1 to 0.6 for orthopedic surgeons.

TABLE 1. Distal Upper Extremity Injury Repairs: Mean Annual Procedures per Surgeon

Procedure	2010			2011			2012			2013			Annual Average		
	P	O	H	P	O	H	P	O	H	P	O	H	P	O	H
Nailbed Repair	**0.8**	**0.6**	**3.0**	**2.0**	**0.5**	**3.3**	**1.3**	**0.1**	**3.5**	**1.0**	**0.1**	**2.4**	**1.3**	**0.3**	**3.0**
Hand Fracture (Shaft, EA)	**8.8**	**5.5**	**66.7**	**9.7**	**8.1**	**62.4**	**12.1**	**8.9**	**67.0**	**9.5**	**16.6**	**61.5**	**10.0**	**9.8**	**64.4**
Phalaynx	4.7	2.7	33.0	5.5	4.7	31.5	6.4	4.2	34.2	4.9	10.9	28.7	5.4	5.6	31.9
Closed	0.7	1.7	15.3	1.3	3.2	13.5	1.5	2.9	17.4	1.9	7.0	13.7	1.3	3.7	15.0
Percutanous	1.8	0.3	9.9	1.7	0.6	7.9	2.2	0.8	8.8	1.1	1.8	7.8	1.7	0.9	8.6
Open	2.3	0.7	7.8	2.5	0.9	10.1	2.6	0.5	8.1	2.0	2.1	7.1	2.3	1.0	8.3
Metacarpal	4.1	2.8	33.6	4.2	3.4	30.9	5.7	4.7	32.8	4.5	5.6	32.8	4.6	4.1	32.5
Closed	0.5	2.1	18.1	0.5	1.8	14.5	1.0	2.7	16.7	0.5	4.6	16.7	0.6	2.8	16.5
Percutanous	1.4	0.2	5.6	1.2	0.8	6.7	1.9	0.8	5.8	1.1	0.3	5.8	1.4	0.5	6.0
Open	2.1	0.5	10.0	2.5	0.8	9.8	2.8	1.1	10.2	3.0	0.7	10.2	2.6	0.8	10.1
Hand Dislocation/ Joint Fracture (IA)	**3.8**	**1.4**	**28.4**	**4.5**	**1.4**	**25.4**	**4.4**	**1.8**	**23.8**	**3.5**	**3.3**	**22.5**	**4.0**	**2.0**	**25.0**
IP/ MP	3.1	1.0	21.0	3.5	0.9	18.1	3.3	1.5	17.3	2.3	2.8	16.0	3.1	1.6	18.1
Closed	0.2	0.2	2.3	0.4	0.2	2.3	0.4	0.2	2.1	0.2	0.6	1.8	0.3	0.3	2.1
Percutanous	1.7	0.4	10.1	2.2	0.5	7.8	1.9	0.8	8.5	1.2	1.1	7.9	1.7	0.7	8.6
Open	1.2	0.5	8.6	0.9	0.2	8.0	1.0	0.6	6.8	0.9	1.1	6.2	1.0	0.6	7.4
Carpometacarpal	0.8	0.4	7.4	1.0	0.5	7.3	1.1	0.3	6.5	1.1	0.5	6.5	1.0	0.4	6.9
Closed	0.0	0.0	0.4	0.1	0.1	0.5	0.2	0.1	0.4	0.1	0.1	0.4	0.1	0.1	0.4
Percutanous	0.4	0.1	4.0	0.5	0.3	3.7	0.4	0.1	3.5	0.5	0.1	3.5	0.5	0.1	3.7
Open	0.4	0.2	3.1	0.3	0.1	3.1	0.5	0.2	2.6	0.6	0.2	2.6	0.4	0.2	2.8
Wrist Fracture/Dislocation	**2.1**	**13.0**	**57.2**	**1.7**	**20.1**	**56.8**	**3.0**	**18.1**	**62.7**	**3.0**	**21.0**	**62.7**	**2.4**	**18.1**	**59.9**
Intracarpal	0.6	1.2	12.4	0.4	1.4	10.6	0.9	0.8	12.2	0.8	1.6	12.2	0.7	1.3	11.8
Closed	0.1	0.9	3.9	0.0	0.6	3.0	0.3	0.5	4.4	0.1	1.4	4.4	0.1	0.8	3.9
Open	0.4	0.3	8.5	0.4	0.8	7.7	0.6	0.3	7.7	0.6	0.2	7.7	0.5	0.4	7.9
Distal Radius/Ulna (RC, UC)	1.5	11.8	44.9	1.2	18.7	46.2	2.1	17.3	50.5	2.2	19.4	50.5	1.8	16.8	48.0
Closed	0.3	7.3	18.8	0.3	10.8	16.4	0.3	10.8	24.3	0.3	13.2	24.3	0.3	10.5	20.9
Percutanous	0.4	1.7	9.0	0.3	3.5	10.6	0.6	2.6	9.5	0.9	2.4	9.5	0.6	2.6	9.6
Open	0.9	2.7	17.1	0.6	4.4	19.2	1.1	4.0	16.8	1.0	3.8	16.8	0.9	3.8	17.5
Forearm Shaft Fracture (Radius/Ulna)	**0.3**	**5.2**	**7.0**	**0.1**	**5.1**	**7.5**	**0.4**	**5.0**	**7.8**	**0.2**	**5.1**	**7.8**	**0.2**	**5.1**	**7.5**
Closed	0.1	2.8	1.3	0.1	3.0	2.1	0.1	2.8	2.7	0.0	3.3	2.7	0.1	3.0	2.2
Open	0.2	2.4	5.7	0.0	2.1	5.4	0.3	2.2	5.1	0.2	1.7	5.1	0.2	2.1	5.3
Tendon Repair	**13.4**	**3.0**	**56.2**	**12.0**	**2.0**	**54.2**	**14.9**	**3.0**	**59.3**	**14.4**	**1.8**	**59.3**	**13.7**	**2.5**	**57.2**
Hand	8.8	1.6	38.3	8.6	1.4	37.3	9.8	2.0	38.6	8.4	1.5	38.6	8.9	1.6	38.2
Flexor	4.9	0.9	19.2	5.0	0.8	19.5	5.3	0.9	20.5	4.5	0.6	20.5	4.9	0.8	19.9
Extensor	3.9	0.7	19.0	3.5	0.6	17.8	4.5	1.1	18.1	3.9	0.9	18.1	4.0	0.8	18.2
Forearm/ Wrist	4.6	1.4	17.9	3.5	0.6	16.9	5.1	1.0	20.7	6.0	0.3	20.7	4.8	0.8	19.1
Flexor	3.6	0.8	11.3	2.6	0.2	11.5	3.7	0.7	11.8	4.1	0.1	11.8	3.5	0.4	11.6
Extensor	1.0	0.7	6.6	0.8	0.4	5.4	1.4	0.4	9.0	1.9	0.2	9.0	1.3	0.4	7.5
Casting/Splinting	**5.3**	**13.8**	**123.0**	**3.8**	**21.2**	**129.9**	**3.7**	**19.7**	**109.2**	**1.4**	**19.1**	**109.2**	**3.5**	**18.5**	**117.8**
Casts	3.0	10.5	93.7	2.1	17.8	94.2	2.2	15.8	71.6	1.0	15.1	71.6	2.1	14.8	82.8
Forearm-Finger	2.9	9.3	80.2	1.4	15.3	85.0	1.8	14.5	64.1	0.7	12.3	64.1	1.7	12.9	73.3
Forearm-Hand	0.1	1.2	13.5	0.7	2.5	9.2	0.4	1.3	7.5	0.4	2.7	7.5	0.4	1.9	9.4
Splints	2.2	3.3	29.3	1.6	3.4	35.7	1.5	3.9	37.7	0.4	4.0	37.7	1.4	3.7	35.1
Forearm-Hand	1.7	1.6	19.9	1.5	2.2	22.8	1.1	3.4	30.2	0.3	3.8	30.2	1.1	2.8	25.8
Finger	0.5	1.7	9.4	0.1	1.1	12.9	0.4	0.5	7.4	0.1	0.3	7.4	0.3	0.9	9.3

[EA= Extraarticular. IA=Intraarticular, IP=Interphalangeal, MP= Metacarpophalangeal, CM=Carpometacarpal, IC=Intercarpal, RC= Radiocarpal, UC=Ulnocarpal]

P, plastic surgeons; O, orthopedic surgeons; H, hand surgeons.

Extra-articular bony hand fractures, involving the phalanx and/or metacarpals, were treated roughly equally by orthopedic and plastic surgeons, with an average of 9.8 and 10.0 annual pps, respectively.

Intra-articular joint fractures and dislocations of the hand involving the phalanx and/or metacarpal were treated more frequently by plastic surgeons, averaging 4.0 pps compared with orthopedic surgeons, averaging 2.0 pps. The frequency of joint repairs overall was less than that of extra-articular injuries of the hand for all groups.

An important distinction in the treatment of hand injuries both extra-articular and intra-articular is the method used by the various groups. Figure 1 displays the proportions of bony hand injuries treated by closed, open, and percutaneous methods by each specialty Orthopedic surgeons preferred closed reduction treatment of these injuries roughly 2:1 over other methods, whereas plastic surgeons used closed methods only 17% of the time. Hand surgeons and orthopedic surgeons demonstrate a preference for closed reduction of extra-articular, phalangeal, and metacarpal injuries, whereas all 3 groups preferred open or percutaneous interventions for intra-articular joint injuries of the hand (Fig. 1).

Wrist fractures and dislocations including intracarpal, radiocarpal, ulnocarpal, and distal radius/ulnar injuries were repaired infrequently by plastic surgeons, averaging 2.4 pps. Intracarpal injuries were also infrequently repaired by orthopedic surgeons (average, 1.3 pps), whereas injuries of the radiocarpal, ulnocarpal, and distal radius/ulna were repaired more frequently by orthopedic surgeons compared with plastic surgeons (16.8 vs 1.8 pps, respectively).

Orthopedic surgeons also demonstrated greater experience treating midshaft fractures of the radius and ulna, averaging 5.1 annual pps,

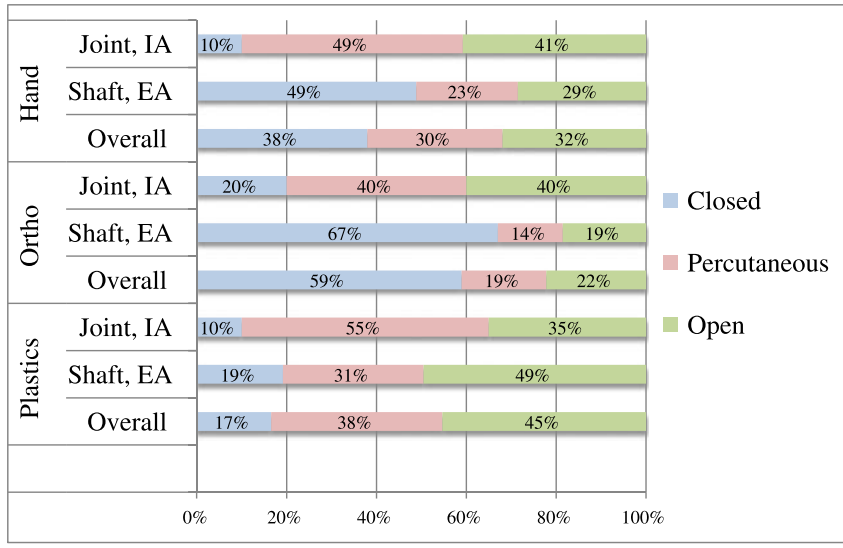

FIGURE 1. Treatment of hand fractures and dislocations (extra-articular and intra-articular).

compared with 0.2 pps for plastic surgeons. Their experience was comparable to hand surgeons, who performed an average of 7.1 pps.

Flexor and extensor tendon repairs of the hand, forearm, and wrist were preformed in greater number by plastic surgeons compared with orthopedic surgeons, with average 13.7 pps and 2.5 pps, respectively. A majority of tendon repairs occurred in the hand rather than the forearm and wrist for all 3 groups.

Lastly, casting and splinting of the forearm, hands, and fingers; used independently, or in conjuncture with other repairs were performed more frequently by orthopedic surgeons (19.1 average annual pps) than plastic surgeons (1.4).

Replantation and repair of neurovascular injuries were exceedingly rare (less than 1 occurrence) in all groups for all years and are not specifically reported in Table 1. Similarly, incision and drainage procedures and decompressive fasciotomies of the distal upper extremity were uncommonly performed.

DISCUSSION

Hand surgeons overall, clearly demonstrate a robust clinical experience in addressing all types of distal upper extremity trauma. Comparing plastic surgeons with orthopedic surgeons, each group demonstrates respective domains of expertise.

Plastic surgeons show an affinity for operative intervention for repairing bony and articular injuries of the hand, using percutaneous methods for 38% of repairs and open methods for 45% of repairs overall (Fig. 1). They also perform more tendon repairs, both proximal and distal. Orthopedic surgeons use mostly closed methods of repair for bony and articular hand injuries and have greater expertise in addressing more proximal bony and articular injuries of the wrist and forearm. They also use casts and splints more frequently.

Several explanations can be given for these observed differences.

First, differences in training paradigm may engender preferences toward various types of repair. For example, orthopedic surgeons are comfortably experienced with closed reductions, splinting, and casting, not just of the forearm, but other parts of the body. Plastic surgeons more frequently operate with microscopes and loupes, and thus may be more adept at addressing fine injuries to soft tissue, like tendons.

Second, referral patterns may help explain differences in clinical practice. At certain university centers, wrist and forearm injuries are addressed primarily by orthopedic surgeons. Tendon injuries are also repaired more often by plastic surgeons. Similarly, complex and/or nonemergent hand trauma may be preferentially referred to hand surgeons, resulting in greater clinical volume in their elective practices.

Third, the diagnostic frequency of injuries plays a role in the therapeutic intervention chosen. Intra-articular injuries of the hand were infrequently encountered compared with extra-articular bony injuries for all 3 groups, but were repaired twice as frequently by plastic surgeons than orthopedic surgeons, who prefer mostly closed methods. A limitation in the data set is that the frequency of hand call among the 3 groups cannot be accurately assessed, and whether the injuries were repaired on an emergent or more elective basis.

The optimal method for addressing various distal upper extremity injuries is largely unknown. However, clinical outcomes data comparing methods is still lacking. There remains room for improvement in the knowledge base of both plastic surgeons and orthopedic surgeons in addressing distal upper extremity trauma. These deficiencies may be addressed with regular multispecialty educational conferences, peer review of outcomes, and service-line pathways for directing certain subtypes of upper extremity injuries to the most appropriate specialty service. Also important to consider is whether a formal Subspecialty of Surgery of the Hand (formerly CAQ Hand) is needed to sufficiently address the full breadth of injuries, because the data suggest that there is a high degree of variability between plastic surgeons and orthopedic surgeons.

CONCLUSIONS

The treatment of distal upper extremity trauma varies greatly based on the specialty service addressing injury. Hand surgeons, not surprisingly, have the most robust clinical experience, whereas plastic surgeons and orthopedic surgeons each display varying strengths and weaknesses, perhaps a consequence of their respective training and clinical practices.

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