SCIENTIFIC ARTICLE

The Impact of Smoking on Early Postoperative Complications in Hand Surgery

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Purpose Smoking is a prevalent modifiable risk factor that has been associated with adverse postoperative outcomes across numerous surgical specialties. We examined the impact of smoking on 30-day complications in patients undergoing hand surgery procedures.

Methods The American College of Surgeons National Surgical Quality Improvement Program data sets were queried for patients who underwent common hand surgery procedures from 2011 to 2016. Cohorts were divided into smoking and nonsmoking and compared in terms of demographic characteristics, comorbidities, and postoperative complications. Multivariable logistic regression models were used to control for demographic characteristics and comorbidities in assessing the association between smoking and postoperative infections as well as other major and minor complications.

Results We identified a cohort of 48,370 patients in the National Surgical Quality Improvement Program who underwent certain outpatient and inpatient hospital facility-based hand surgery procedures from 2011 to 2016. Up to 22% of these patients reported active smoking. Compared with nonsmokers, smokers were more likely to be younger and male and to have a lower body mass index. In addition, they were more likely to have a higher American Society of Anesthesiologists classification and to report dyspnea and chronic obstructive pulmonary disease. Multivariable logistic regression identified an independent association between smoking and major complications. Smoking was not significantly associated with minor complications. When regrouped by complication type, smoking was associated with infectious and wound healing complications. In subgroup analysis, smokers undergoing elective hand surgery had increased odds of wound healing complications but not major, minor, or infectious complications.

Conclusions Smokers may be at a significantly higher odds of certain complications compared with nonsmokers. For patients undergoing the elective procedures evaluated in this study, perioperative smoking may increase the risk of wound-healing complications. *(J Hand Surg Am. 2021;46(4):336.e1-e11. Copyright © 2021 by the American Society for Surgery of the Hand. All rights reserved.)*

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Key words Complications, hand surgery, NSQIP, smoking, tobacco.

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CIGARETTE SMOKING IS harmful to nearly every organ system of the body and is the leading preventable cause of death and disease in the United States.[1] Although smoking prevalence among US adults has decreased from 42% in 1965 to 15% in 2015, an estimated 40 million people in the United States continue to smoke.[2] Across numerous surgical specialties, adverse postoperative outcomes have been linked to smoking. Specifically, smoking has been associated with an increased risk for infection and wound-healing complications.[3–7]

Smoking has a negative impact on wound healing through a variety of mechanisms.[8–11] Despite several studies linking smoking with wound-healing complications after abdominal and joint replacement surgery, there are limited studies investigating the impact of smoking in hand surgery.[3,7] Using data from the American College of Surgeons' National Surgical Quality Improvement Program (ACS-NSQIP) database, we examined the impact of smoking on short-term (30-day) complications in patients undergoing hand surgery procedures. We hypothesized that smoking status would be associated with an increased risk for major and minor complications after hand surgery.

MATERIALS AND METHODS

Study sample

The ACS-NSQIP database is a validated, prospective database that reports perioperative surgical data and 30-day complications on adult patients undergoing inpatient or outpatient surgical procedures across more than 315 participating hospitals.[12] Patients who underwent outpatient or inpatient hand surgery procedures in a hospital-based setting between 2011 and 2016 were identified from the ACS-NSQIP database using Current Procedural Terminology (CPT) codes. These codes were chosen based on Centers for Medicare and Medicaid data to identify the most common procedures performed by hand surgeons. All isolated, Accreditation Council for Continuing Medical Education–tracked CPT procedure codes that were performed more than 1,000 times annually (facility, non-office setting) nationwide were included (Procedure Summary Table 2015), yielding a total of 83 codes.[13] Hand surgery procedures were categorized as either trauma-related or elective (Table E1). Any patient who underwent hand surgery as determined by the primary CPT code listed in the ACS-NSQIP database between 2011 and 2016 was included in the analysis. Notably, procedures considered high volume with a low incidence of complications are excluded from the NSQIP database and therefore could not be included in this analysis. Examples of such procedures include carpal tunnel release, trigger finger release, incision, and drainage, among others (a complete list of excluded procedures is provided in Table E1). In addition, ACS-NSQIP does not include patients treated in freestanding ambulatory surgery centers. All patient-level identifiers are unavailable in NSQIP; thus, this study was exempt from institutional review board evaluation.

Independent variables

Demographic characteristics and comorbidities were identified using variables available in the ACS-NSQIP database. The demographics assessed in this study included age, sex, body mass index (BMI) (calculated from height and weight), and race. Comorbidities assessed in this study included diabetes, current smoking within 1 year before surgery, dyspnea on exertion, dependent functional status, chronic obstructive pulmonary disease (COPD), congestive heart failure, hypertension requiring medication, renal insufficiency, dialysis, chronic steroid use, metastatic oncologic disease, recent weight loss, bleeding disorder, and the presence of an open wound.

Postoperative outcome variables

The ACS-NSQIP identifies and records the occurrence of postoperative complications for a 30-day period. For this study, the primary outcome variable was incidence of 30-day postoperative minor complications including wound dehiscence, deep vein thrombosis, blood transfusion, superficial infection, and urinary tract infection. Complications were classified as minor if further treatment was required, but they were unlikely to have the same lasting impact on health status as major complications. Secondary outcomes were major complications including myocardial infarction, cardiac arrest, renal failure, stroke, pulmonary embolus, sepsis, septic shock, pneumonia, need for reintubation, prolonged ventilation, deep infection, and death. Complications were classified as major if they required reoperation or were likely to have a profound and lasting impact on health status, as described by Schairer et al.[14] For secondary analyses, sepsis, deep infection, and superficial infection were grouped together as infectious complications.

Statistical analysis

All data were summarized using descriptive statistics, and group comparisons were performed with Student *t* tests for continuous variables and chi-

square tests for categorical variables. Bivariate and multivariable logistic regression models were used to assess the association of smoking status with postoperative complications. Significant findings from bivariate analyses with a cutoff of $P < .1$ guided variable inclusion for multivariable analysis. Results are presented as odds ratios with 95% confidence intervals (CIs). Subgroup analysis for trauma-related or elective procedures was performed using multivariable logistic regression. Significance was set at $P < .05$.

Treatment of missing data

Prior studies suggested that asymmetric proportions of missing data can introduce bias, resulting in different outcomes depending on how missingness is handled.[15] In our study, we identified the proportion of missing data in each population group (smokers and nonsmokers). When the proportion of missing data between smokers and nonsmokers was compared in each independent variable, we found no significant difference. Therefore, we did not impute or exclude patients with missing data, because it likely would not have had a substantial impact on the differences between the 2 groups.[16]

RESULTS

Sample characteristics

A total of 48,370 patients were identified as having undergone one of the included hand surgery procedures from 2011 to 2016. Of these patients, 10,577 (21.9%) reported active smoking. Smoking was less common among patients undergoing elective hand procedures (19.2%) compared with patients undergoing trauma-related hand surgery (23.5%). Smokers tended to be younger (45 vs 53 average years; $P < .05$) and male (55% vs 42%; $P < .05$) and to have a lower BMI (26.9 vs 27.8; $P < .05$). Both smoking and nonsmoking cohorts were composed predominantly of white individuals; however the group of smokers had a significantly higher proportion of black patients compared with the nonsmoker group (1,090 [10.3%] vs 2,642 [7.0%]; $P < .05$). Smokers were more likely to have respiratory comorbidities including dyspnea (3.7%; $P < .05$) and COPD (6.4%;, $P < .05$). Nonsmokers were more likely to have diabetes (9.3%; $P < .05$), dependent functional status (1.6%; $P < .05$), hypertension (31.8%; $P < .05$), open wounds (7.0%; $P < .05$), chronic steroid use (2.8%; $P < .05$), and bleeding disorders (2.3%; $P < .05$) (Table 1).

TABLE 1. Characteristics of Smoking and Nonsmoking Patients Undergoing Hand Surgery

Characteristic	Total	Smoker (%)	Nonsmoker (%)
Total cases	48,370	21.8	78.2
Trauma-related	30,038	23.5	76.5
Elective	18,332	19.2	80.8
Female (%)	26,600	45.17	57.74
Age, average y	50.93	44.65	52.7
Race			
White	33,261	67.2	69.2
African American	3,731	10.3	7.0
Asian	1,359	1.5	3.2
Native American	403	1.3	0.7
Pacific Islander	241	0.7	0.5
BMI, average, kg/m^2		26.88	27.77
ASA classification			
I	3,301	7.2	91.2
II	10,373	21.4	78.6
III	4,234	22.0	78.0
IV	204	26.0	74.0
Comorbidities			
Diabetes	4,564	7.7	9.3
Dyspnea	1,280	3.7	2.4
Dependent functional status	717	1.1	1.6
COPD	1,461	6.4	2.1
Hypertension	14,494	23.3	31.8
Open wound	2,306	4.2	7.0
Bleeding disorder	1,274	2.0	2.8
History of weight loss	1,052	1.8	2.3
Metastatic disease	78	0.2	0.2
Dialysis	80	0.1	0.2
Chronic kidney disease	379	0.7	0.8
Chronic heart failure	70	0.2	0.1
Ascites	158	0.3	0.3

Postoperative complications

The overall postoperative complication rate was 2.5%. Smokers had a 3.3% overall complication rate compared with 2.2% in nonsmokers. For smokers undergoing hand surgery procedures, the number needed to harm for any complication was 91. There was no significant difference in the rate of minor complications between smokers and nonsmokers. Smokers had a higher rate of major complications

TABLE 2. Incidence of Operative Complications After Hand Surgery, by Smoking Status

Complication Reported	Current Smoker	Nonsmoker	*P* Value
Major complication	169 (1.60)	398 (1.10)	<.01
Deep infection	72 (0.68)	149 (0.39)	<.01
Dehiscence	31 (0.29)	61 (0.16)	.02
Pneumonia	21 (0.20)	46 (0.12)	.10
Reintubation	9 (0.08)	20 (0.05)	.30
Pulmonary embolus	1 (0.01)	16 (0.04)	.02
Need for ventilation	9 (0.08)	20 (0.05)	.30
Stroke	5 (0.04)	15 (0.03)	.75
Need for cardiopulmonary resuscitation	3 (0.03)	10 (0.03)	.92
Myocardial infarction	7 (0.07)	17 (0.04)	.44
Sepsis	41 (0.39)	97(0.26)	.04
Septic shock	8 (0.08)	21 (0.06)	.49
Acute renal failure	4 (0.03)	10 (0.03)	.58
Minor complication	152 (1.44)	468 (1.24)	.12
Deep vein thrombosis	3 (0.03)	25 (0.06)	.07
Urinary tract infection	20 (0.19)	119 (0.31)	.01
Transfusion	24 (0.23)	116 (0.31)	.14
Progressive renal insufficiency	3 (0.03)	11 (0.03)	.97
Superficial infection	105 (1.00)	215 (0.57)	<.01
Any infection	207 (1.96)	334 (1.16)	<.01
Any wound complication	173 (1.64)	347 (0.92)	<.01

Data are shown as n (%).

(1.6% vs 1.1%). In the secondary group analyses, smokers had a higher rate of deep and superficial infections, wound dehiscence, and sepsis (Table 2).

We used multivariable logistic analysis to adjust for demographic characteristics and comorbidities and found that smoking was not associated with minor complications as a broad category (odds ratio = 1.10; 95% CI, 0.90−1.34; $P = .36$.) (Table 3). However, when looking specifically at infectious and wound-healing complications, smokers had increased odds of these complications compared with nonsmokers (odds ratio = 1.30; 95% CI, 1.06−1.60; $P < .05$ and odds ratio = 1.41; 95% CI, 1.16−1.72; $P < .05$, respectively) (Table 3). Furthermore, white and Asian patients had decreased odds for minor complications (odds ratio = 0.71; 95% CI, 0.58−0.87; $P < .05$ and odds ratio = 0.52; 95% CI, 0.27−0.99; $P < .05$, respectively). In addition, smoking was independently associated with major complications (odds ratio = 1.34; 95% CI, 1.09−1.63; $P < .05$). Similar to smoking, diabetes was an independent risk factor for major complications (odds ratio = 1.41; 95% CI, 1.12−1.75; $P < .05$). Other factors including higher American Society of Anesthesiologists (ASA) classification, history of having a chronic wound, chronic steroid use, and having a bleeding disorder were all independently associated with minor and major complications (Table 3). The additive effect of multiple risk factors was not estimated.

Subgroup analysis of patients undergoing either elective or trauma-related hand procedures found that smokers who underwent trauma procedures had increased odds of major, infectious, and wound-healing complications (Table 4). In patients who underwent elective hand procedures, smoking was associated with increased odds of wound-healing complications.

DISCUSSION

Of 48,370 patients undergoing outpatient and inpatient hospital-based hand surgery, 21.9% reported active smoking. This is considerably higher than the reported smoking prevalence of 15% nationwide and emphasizes the relevance of investigating the impact smoking on postoperative outcomes in hand surgery patients.[2] Overall, we found a low incidence of complications within 30 days of undergoing hand surgery (2.54%). Smokers had a higher rate of complications compared with nonsmokers (3.3% vs 2.2%); the number needed to harm was 91. This suggests that for 91 additional smokers who undergo hand surgery, one additional patient will develop a complication compared with the nonsmoking group. The exact incidence of complication after hand surgery is difficult to extrapolate from this study because several common hand surgery procedures (eg, carpal tunnel release, trigger finger release) (Table E1), considered high volume with a low incidence of complications, are excluded from the NSQIP database.

A number of significant differences were identified between smoker and nonsmoker cohorts. Smokers tended to be younger, have lower BMIs, and report dyspnea and COPD. These findings are unsurprising given that smoking remains the most common risk

TABLE 3. Multivariable Logistic Regression Models Evaluating Associations Between Patient-Specific Variables and Different Categories of Adverse Outcomes After Hand Surgery

	Minor Complication			Major Complication			Any Infection			Wound Complication		
Patient-Specific Variable	OR	95% CI	*P* Value	OR	95% CI	*P* Value	OR	95% CI	*P* Value	OR	95% CI	*P* Value
Risk factor												
Smoking	1.10	0.90–1.34	.36	**1.30**	**1.06–1.60**	**<.05**	**1.30**	**1.06–1.60**	**<.05**	**1.41**	**1.16–1.72**	**<.05**
Female sex	0.85	0.72–1.01	.06	**0.57**	**0.48–0.68**	**<.05**	**0.57**	**0.48–0.68**	**<.05**	**0.40**	**0.33–0.49**	**<.05**
ASA class	**1.96**	**1.71–2.24**	**<.05**	**2.46**	**2.14–2.84**	**<.05**	**2.46**	**2.14–2.84**	**<.05**	**1.64**	**1.42–1.89**	**<.05**
BMI	0.99	0.98–1.01	.19	**0.98**	**0.97–0.99**	**<.05**	**0.98**	**0.97–0.99**	**<.05**	0.99	0.98–1.00	.07
Comorbidities												
Diabetes	1.16	0.92–1.46	.22	**1.41**	**1.12–1.75**	**<.05**	**1.41**	**1.12–1.75**	**<.05**	**1.45**	**1.12–1.87**	**<.05**
Dyspnea	0.93	0.64–1.36	.71	1.07	0.75–1.54	.70	1.07	0.75–1.54	.70	0.83	0.50–1.38	.47
Dependent functional status	**1.70**	**1.20–2.42**	**<.05**	**1.98**	**1.43–2.73**	**<.05**	**1.98**	**1.43–2.73**	**<.05**	1.27	0.79–2.06	.32
COPD	1.34	0.96–1.88	.08	1.08	0.77–1.53	.65	1.08	0.77–1.53	.65	0.99	0.63–1.55	.98
Hypertension	0.86	0.71–1.05	.14	1.09	0.89–1.34	.42	1.09	0.89–1.34	.42	0.87	0.69–1.08	.20
Open wound	**2.33**	**1.83–2.97**	**<.05**	**3.44**	**2.77–4.27**	**<.05**	**3.44**	**2.77–4.27**	**<.05**	**2.69**	**2.10–3.45**	**.05**
Chronic steroids	**1.45**	**1.03–2.05**	**<.05**	**1.62**	**1.15–2.26**	**<.05**	**1.62**	**1.15–2.26**	**<.05**	1.50	0.98–2.29	.06
Bleeding disorder	**1.67**	**1.22–2.29**	**<.05**	**1.89**	**1.41–2.54**	**<.05**	**1.89**	**1.41–2.54**	**<.05**	1.09	0.70–1.71	.70

OR, odds ratio.
Bolded results indicate statistically significant findings at $P < .05$.

TABLE 4. Multivariable Logistic Regression for Adverse Outcomes Related to Smoking Status in Trauma and Elective Hand Surgery Procedures

Adverse Outcome	Trauma Procedures		Elective Procedures	
	Odds Ratio (95% CI)	*P* Value	Odds Ratio (95% CI)	*P* Value
Minor complications	1.06 (0.84−1.34)	.48	1.16 (0.79−1.72)	.43
Major complications	**1.38 (1.09−1.75)**	**<.05**	1.25 (0.85−1.84)	.26
Any infection	**1.38 (1.11−1.72)**	**<.05**	1.35 (0.97−1.88)	.07
Wound-healing complication	**1.48 (1.17−1.89)**	**<.05**	**1.49 (1.04−2.12)**	**<.05**

Bolded results indicate statistically significant findings at $P < .05$.

factor for the development of COPD.[17] A study by Woods et al[18] reported that smokers were more likely to have unintentional weight loss and report poor physical function. As might be expected, smokers had higher ASA status compared with nonsmokers, especially considering that smoking status is a component of ASA classifications. In addition, smokers were less likely to have other common comorbidities such as diabetes, which has been shown to be associated with an increased risk for wound-healing complications after upper-extremity surgery[19] This serves to support our primary finding, because we controlled for these other variables with our regression approach and the impact of smoking on infectious complications remained.

Most hand surgery procedures are relatively focal in nature; accordingly, most complications were related to infectious or wound-healing problems. Postoperative complication rates for deep and superficial infections and wound dehiscence were greater in smokers compared with nonsmokers. According to regression analysis, smoking was independently associated with infectious and wound-healing complications. These results coincide with previous studies that described the deleterious impact of smoking on wound healing. These mechanisms include the impairment of immune cell function by altering pathways related to chemotactic response, cell migration, and protease-antiprotease secretion.[20–22] Moreover, smoking has been shown to induce a temporary adverse vasoactive effect on peripheral vasculature resulting in decreased tissue perfusion and oxygenation.

Several clinical studies have assessed the association between smoking and postoperative complications after surgery in the upper extremity. In a retrospective study of patients undergoing palmar fasciectomy for Dupuytren disease, Sakai et al[23] reported that smoking was associated with delayed wound healing. Hess et al[24] identified that smokers who underwent surgery for distal radius fractures had higher rates of hardware removal, stiffness, and revision procedures compared with nonsmokers. However, Hall et al[25] reported that smokers with surgically treated distal radius fractures had similar patient-reported outcomes, range of motion, and complication rates compared with nonsmokers. In a retrospective study of patients undergoing surgical repair of elbow fractures, Claessen et al[26] identified smoking as the only modifiable risk factor that was associated with surgical site infection.

To define better which surgical procedures may be most affected by smoking, we categorized procedures as either trauma-related or elective. Smoking was less common in patients undergoing elective procedures compared with those undergoing trauma-related procedures (19.2% vs 23.5%, respectively). This may be related to elective procedures, which lend themselves to a greater opportunity for preoperative smoking cessation counseling and certain baseline demographic differences between these populations. Our subgroup analysis showed that smokers who underwent trauma-related procedures had higher odds of having a major, infectious, or wound-healing complication. The negative impact of smoking may be especially detrimental to traumatic injuries in which tissues are damaged and perfusion may be attenuated, although the opportunity to encourage smoking cessation is lower in this population as well.

In patients undergoing elective hand procedures, smoking was associated with wound-healing complications. These results are important because a considerable proportion of hand procedures can be considered elective, with the timing of surgery often determined after a patient−physician discussion regarding the risks and benefits of pursuing surgery.

The ACS-NSQIP database includes inpatient and outpatient procedures performed at participating

hospitals. Procedures performed at ambulatory surgery centers are not included in this data set; as a result, our results may not be generalizable to a large group of hand surgery patients. The ACS-NSQIP database defines active smokers as patients who have smoked within the year before surgery; thus, we could not specifically assess the impact of preoperative smoking cessation on complications. Regardless, our results support that smoking status is an important discussion topic during the preoperative consultation before elective hand surgery. Further studies are required to assess the potential impact of preoperative smoking cessation on outcomes after hand surgery.

These results should be interpreted in light of several limitations related to our study. The ACS-NSQIP data collection is limited to the 30-day postoperative period. As a result, we are unable to assess long-term complications related to smoking, including delayed union and nonunion of fractures. When controlling for patient characteristics, our analysis relied on the comorbidities included in NSQIP; characteristics such as smoking status are self-reported and may be underreported. Notably, socioeconomic data are not readily available in NSQIP; having these data could have an impact on our analyses of factors associated with postoperative complications. As mentioned, the NSQIP database is predominantly hospital-based and excludes minor procedures including trigger finger release, endoscopic carpal tunnel release, and cubital tunnel release (Table E1). Thus, our findings may be less generalizable to these common outpatient procedures. We also do not know whether any patient-related factors biased the decision to perform the procedure in a hospital-based center rather than a freestanding ambulatory surgery center, which also might have introduced bias.

This study serves as a large-scale population-based analysis to improve our understanding of postoperative complications after hand surgery. Despite decreasing prevalence nationwide, a substantial proportion of patients undergoing hand surgery are smokers. Although complications are uncommon, smoking is a modifiable risk factor that may increase a patient's risk for complications after hand surgery. Patients undergoing both trauma-related and elective hand surgery procedures may be at risk for postoperative complications.

These results may aid surgeons in preoperative counseling and objective risk assessment for smoking patients who are undergoing hand surgery. Uncertainty remains regarding the potential impact of smoking cessation, including the effect of cessation duration on outcomes after hand surgery. Further prospective studies are needed to elucidate the impact of perioperative smoking on clinical outcomes. Literature examining the cigarette smoking dose–response and pack-year history are sparse and remain areas of considerable interest.

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TABLE E1. Most Common Hand Surgery CPT Codes

CPT Code	Surgical Procedure
Elective cases	
64721*	Neuroplasty and/or transposition; median nerve at carpal tunnel
26055*	Tendon sheath incision (eg, for trigger finger)
29848*	Endoscopy, wrist, surgical, with release of transverse carpal ligament
64718*	Neuroplasty and/or transposition; ulnar nerve at elbow
25320	Capsulorrhaphy or reconstruction, wrist, open (includes synovectomy, capsulotomy and open reduction) for carpal instability
24305	Tendon lengthening, upper arm or elbow, each tendon
26520	Capsulectomy or capsulotomy; metacarpophalangeal joint, each joint
25447	Arthroplasty, interposition, intercarpal or carpometacarpal joints
26160*	Excision of lesion of tendon sheath or joint capsule (eg, cyst, mucous cyst, or ganglion), hand or finger
26480	Transfer or transplant of tendon, carpometacarpal area or dorsum of hand; without free graft, each tendon
26123*	Fasciectomy, partial palmar with release of single digit including proximal IP joint, with or without z-plasty, local tissue rearrangement, or skin grafting
26593	Release, intrinsic muscles of hand, each muscle
25000	Incision, extensor tendon sheath, wrist (eg, de Quervain disease)
25310	Tendon transplantation or transfer, flexor or extensor, forearm and/or wrist, single; each tendon
26145*	Synovectomy, tendon sheath, radical (tenosynovectomy), flexor tendon, palm and/or finger, each tendon
25076	Excision, tumor, soft tissue of forearm and/or wrist area, subfascial (eg, intramuscular); < 3 cm
25825*	Arthrodesis, wrist; with autograft (includes obtaining graft)
26236*	Partial excision (craterization, saucerization, or diaphysectomy) bone (eg, osteomyelitis); distal phalanx of finger
26045*	Fasciotomy, palmar (eg, Dupuytren contracture); open, partial
25111	Excision of ganglion, wrist (dorsal or volar); primary
24105	Excision, olecranon bursa
26860*	Arthrodesis, IP joint, with or without internal fixation
25115	Radical excision of bursa, synovia of wrist, or forearm tendon sheaths; flexors
26116	Excision, tumor, soft tissue, or vascular malformation, of hand or finger, subfascial (eg, intramuscular); <1.5 cm
64719*	Neuroplasty and/or transposition; ulnar nerve at wrist
25210	Carpectomy; one bone
25290	Tenotomy, open, flexor or extensor tendon, forearm and/or wrist, single, each tendon
26440	Tenolysis, flexor tendon; palm OR finger, each tendon
25075*	Excision, tumor, soft tissue of forearm and/or wrist area, subcutaneous; <3 cm
26531	Arthroplasty, metacarpophalangeal joint; with prosthetic implant, each joint
26121*	Fasciectomy, palm only, with or without z-plasty, other local tissue rearrangement, or skin grafting (includes obtaining graft)
24071*	Excision, tumor, soft tissue of upper arm or elbow area, subcutaneous; ≥3 cm
26437	Realignment of extensor tendon, hand, each tendon
25295	Tenolysis, flexor or extensor tendon, forearm, and/or wrist, single, each tendon
29846	Arthroscopy, wrist, surgical; excision and/or repair of triangular fibrocartilage and/or joint debridement
23071*	Excision, tumor, soft tissue of shoulder area, subcutaneous; ≥3 cm
26525	Capsulectomy or capsulotomy; IP joint, each joint
26445	Tenolysis, extensor tendon, hand OR finger, each tendon
26111*	Excision, tumor or vascular malformation, soft tissue of hand or finger, subcutaneous; ≥1.5 cm
26850*	Arthrodesis, metacarpophalangeal joint, with or without internal fixation

(Continued)

TABLE E1. Most Common Hand Surgery CPT Codes (Continued)

CPT Code	Surgical Procedure
26536	Arthroplasty, IP joint; with prosthetic implant, each joint
25215	Carpectomy; all bones of proximal row
24359	Tenotomy, elbow, lateral or medial; debridement, soft tissue and/or bone, open with tendon repair or reattachment
25280	Lengthening or shortening of flexor or extensor tendon, forearm and/or wrist, single, each tendon
25071*	Excision, tumor, soft tissue of forearm and/or wrist area, subcutaneous; ≥3 cm
25240	Excision distal ulna partial or complete (eg, Darrach type or matched resection)
15736	Muscle, myocutaneous, or fasciocutaneous flap; upper extremity
26040*	Fasciotomy, palmar (eg, Dupuytren contracture); percutaneous
25116	Radical excision of bursa, synovia of wrist, or forearm tendon sheaths, extensors, with or without transposition of dorsal retinaculum
Trauma cases	
26910	Amputation, metacarpal, with finger or thumb (ray amputation), single, with or without interosseous transfer
26765	Open treatment of distal phalangeal fracture, finger or thumb, includes internal fixation, when performed, each
26356	Repair or advancement, flexor tendon, in zone 2 flexor tendon sheath (eg, no-man's-land); primary, without free graft, each tendon
26540	Repair of collateral ligament, metacarpophalangeal or IP joint
26410	Repair, extensor tendon, hand, primary or secondary; without free graft, each tendon
25118	Synovectomy, extensor tendon sheath, wrist, single compartment;
64702	Neuroplasty; digital, one or both, same digit
26952	Amputation, finger/thumb, primary or secondary, any joint or phalanx, single, including neurectomies; with local advancement flaps
26951	Amputation, finger or thumb, primary or secondary, any joint or phalanx, single, including neurectomies; with direct closure
26010*	Drainage of finger abscess; simple
26011*	Drainage of finger abscess; complicated (eg, felon)
26020*	Drainage of tendon sheath, digit and/or palm, each
26080*	Arthrotomy, with exploration, drainage, or removal of loose or foreign body; IP joint, each
25028*	Incision and drainage, forearm and/or wrist; deep abscess or hematoma
26608*	Percutaneous skeletal fixation of metacarpal fracture, each bone
26735	Open treatment of phalangeal shaft fracture, proximal or middle phalanx, finger or thumb, includes internal fixation, each
26727	Perc skeletal fixation of unstable phalangeal shaft fracture, proximal/middle phalanx, finger or thumb, with manipulation, each
26615	Open treatment of metacarpal fracture, single, includes internal fixation, when performed, each bone
26746	Open treatment of articular fracture, involving metacarpophalangeal or IP joint, includes internal fixation, when performed, each
25260	Repair, tendon or muscle, flexor, forearm and/or wrist; primary, single, each tendon or muscle
26180*	Excision of tendon, finger, flexor or extensor, each tendon
25609	Open treatment of distal radial intra-articular fracture or epiphyseal separation; with internal fixation of ≥3 fragments
25607	Open treatment of distal radial extra-articular fracture or epiphyseal separation, with internal fixation
25608	Open treatment of distal radial intra-articular fracture or epiphyseal separation; with internal fixation of 2 fragments
24685	Open treatment of ulnar fracture, proximal end (eg, olecranon or coronoid process[es]), includes internal fixation, when performed
25606*	Percutaneous skeletal fixation of distal radial fracture or epiphyseal separation

(Continued)

TABLE E1. Most Common Hand Surgery CPT Codes (Continued)

CPT Code	Surgical Procedure
23930*	Incision and drainage, upper arm or elbow area; deep abscess or hematoma
25545	Open treatment of ulnar shaft fracture, includes internal fixation, when performed
25020	Decompression fasciotomy, forearm and/or wrist, flexor OR extensor compartment; without debridement of muscle and/or nerve
25575	Open treatment of radial AND ulnar shaft fractures, with internal fixation, when performed; of radius AND ulna
24666	Open treatment of radial head/neck fx, includes internal fixation or radial head excision with radial head prosthetic replacement
24341	Repair, tendon or muscle, upper arm or elbow, each tendon or muscle, primary or secondary (excludes rotator cuff)
23030	Incision and drainage, shoulder area; deep abscess or hematoma

IP, interphalangeal.
*Excluded from NSQIP database.