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Original Research

Carpal Instability Reconstruction and Wrist Procedures in the Medicare Population

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Purpose: We conducted a retrospective study to determine the annual number of patients undergoing various wrist procedures in the Medicare population as well as the revision rate and common revision procedures after carpal instability reconstruction surgeries (Current Procedural Terminology [CPT] billing code 25320).

Methods: We examined the Medicare orthopedic datasets using the PearlDiver application to identify patients who underwent 12 different common wrist procedures, including carpal instability reconstruction procedures, from 2005 to 2014. Carpal instability reconstruction procedures were those identified by CPT 25320, which includes various methods of reconstruction such as capsulodesis, ligament repair, and tendon transfer or graft. Medicare covers approximately 51 million Americans and consists of those aged 65 years and older as well as younger patients enrolled in Social Security disability or with end-stage renal disease. Demographic and payment data were determined for the entire cohort. Patients with less than 3 months of active insurance records after the wrist procedure were excluded.

Results: A total of 29,898 wrist procedures were performed over the study period. The most commonly performed procedure was wrist arthroscopy with joint debridement or triangular fibrocartilage complex repair (6,557 patients). A total of 2,949 patients underwent carpal instability reconstruction procedures, 174 of whom underwent revision or salvage surgeries (5.9%). The most common revision procedure was an additional reconstruction operation whereas the most common salvage procedure was proximal row carpectomy. Average Medicare payment was $4,107.67 for the index procedure and $3,760.95 for revision procedures. The number of wrist procedures increased 43% over the study period.

Conclusions: Carpal instability reconstruction procedures and wrist arthroscopies with joint debridement or TFCC repair are performed more commonly in elderly patients than anticipated or indicated. Procedures such as these, without quality evidence supporting their use in elderly patients, are going to be scrutinized as the United States moves toward value-based health care. Although it appears that carpal reconstruction procedures have a low revision rate in the short to medium term in the Medicare population, the wide variety of procedures captured by CPT 25320 makes outcome measurements challenging. A more specific coding system should be created to reflect the surgeon's effort more accurately, as well as better track revision rates.

Type of study/level of evidence: Therapeutic III.

Wrist procedures are commonly performed in the Medicare population. Some surgeries, such as proximal row carpectomy (PRC), have a proven track record of success in elderly patients. Others have little to no high-quality evidence supporting their use in elderly patients with degenerative conditions of the wrist. This is especially true for procedures aimed at preserving native joint anatomy, such as arthroscopic debridement and carpal ligament repair or reconstruction, which is often indicated in cases of acute carpal instability (CI).

Carpal instability is a broad diagnosis that covers several unique disorders of the wrist, including scapholunate (SL) dissociation; unstable scaphoid fracture, malunion, or nonunion; and lunate triquetrum dissociation. These injuries may lead to symptomatic instability and later arthrosis if untreated. Although common injuries, the actual incidence is difficult to quantify accurately.[1]

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Table 1
Common Wrist Procedures by CPT Code and Description

CPT Code	Description
25320	Capsulorrhaphy or reconstruction wrist open (eg, capsulodesis ligament repair tendon transfer or graft) (includes synovectomy capsulotomy and open reduction) for CI
25210	Carpectomy; 1 bone
25215	Carpectomy; all bones of proximal row
25800	Arthrodesis wrist; complete without bone graft (includes radiocarpal and/or intercarpal and/or carpometacarpal joints)
25810	Arthrodesis wrist; with iliac or other autograft (includes obtaining graft)
25820	Arthrodesis wrist; limited without bone graft (eg, intercarpal or radiocarpal)
25825	Arthrodesis wrist; with autograft (includes obtaining graft)
29840	Arthroscopy wrist diagnostic with or without synovial biopsy (separate procedure)
29844	Arthroscopy wrist surgical; synovectomy partial
29845	Arthroscopy wrist surgical; synovectomy complete
29846	Arthroscopy wrist surgical; excision and/or repair of TFCC and/or joint debridement
29847	Arthroscopy wrist surgical; internal fixation for fracture or instability

Cadaveric studies of elderly patients (aged 60 years and older) have found evidence of SL interosseous ligament or lunotriquetral ligament injuries in roughly a third of specimens.[2,3] It is unknown how many were symptomatic. Importantly, many specimens had evidence of ligamentous injury without evidence of arthrosis. These degenerative findings likely represent a condition different from an acute ligamentous injury.

Most published data on CI focuses on SL dissociation because it is the most common cause.[4,5] Multiple treatment options are well-documented in the literature but are generally indicated in younger patients with acute injuries. These have the common goal of preventing instability and the later development of SL advanced collapse wrist.[6,7] Treatments include but are not limited to Blatt capsulodesis, Brunelli tenodesis, triligament tenodesis (modified Brunelli), dorsal dynamic tenodesis, and capitohamate bone–ligament–bone graft.[8,9] These procedures may improve pain and function but possibly decrease range of motion.[8–11] Static SL dissociation procedures such as these typically result in persistent SL diastasis representing incomplete restitution of normal anatomy. It is largely undetermined how many Medicare patients are undergoing these procedures or how many require salvage procedures such as PRC, radiocarpal arthrodesis, scaphoid excision with 4-corner arthrodesis, or complete wrist arthrodesis.[12]

The purpose of this study was to determine the number of wrist procedures performed annually in the Medicare population, as well as the revision rate and associated common revision procedures for CI reconstruction procedures. Our hypothesis was that reconstruction procedures would have a high revision rate because these surgeries are not generally indicated in elderly patients.

Materials and Methods

We identified patients using the Medicare datasets in the PearlDiver application (www.pearldiverinc.com, Fort Wayne, IN) from 2005 to 2014. PearlDiver is a national database of insurance billing records that can be used to identify patients based on International Classification of Diseases–9th Revision and Current Procedural Terminology (CPT) billing codes. This commercially available database includes records on approximately 51 million patients with orthopedic diagnoses from the Medicare Standard Analytic File. All records are Health Insurance Portability and Accountability Act of 1996 compliant and contain no individual patient identities. The database is stored on a password-protect server maintained by PearlDiver. Institutional review board approval was not required for this study because data were deidentified and thus exempt.

Patients who underwent 12 different common wrist procedures (Table 1) were identified in the database to determine the annual number of these surgeries. We then specifically examined patients who had undergone CI reconstruction procedures as determined by CPT code 25320. This code is described as open wrist capsulorrhaphy or reconstruction for CI (eg, capsulodesis, ligament repair, tendon transfer or graft). It is not specific regarding which reconstructive procedure was completed or the amount of time or complexity of the procedure performed. We then queried this cohort to identify the number of patients requiring revision or salvage procedures at later time points. This consisted of the previously identified common wrist surgeries (Table 1) to include various carpectomies, arthrodesis, and wrist arthroscopies. Laterality is not specified by CPT code, so patients may have undergone procedures on the contralateral wrist that were counted as revision procedures.

Demographics and payment data were determined. Payments were based on charges from the day of surgery. Inclusion criteria was all patients who underwent the index procedure regardless of age. The only exclusion criterion was less than 3 months of active insurance records in the database after the initial procedure.

Table 2
Number of Patients Undergoing Common Wrist Procedures, by Age and Sex

CPT Code*	Patients	Age, y							Sex		
		<65	65–69	70–74	75–79	80–84	>84	Unknown	Female	Male	Unknown
29846	6,557	2,758	1,868	1,119	503	196	69	79	4,001	2,485	79
25210	4,730	926	1,537	1,168	694	278	120	40	3,245	1,447	40
25215	3,636	1,090	1,026	745	466	221	65	45	1,635	1,960	45
25825	3,629	1,033	1,127	771	458	182	52	29	1,464	2,139	29
25810	2,986	1,024	750	629	368	167	35	32	1,292	1,667	32
25320	2,949	929	825	572	341	260	87	32	1,894	1,028	27

* See Table 1 for CPT descriptions.

Table 3
Annual Number of Patients Undergoing Common Wrist Procedures

CPT Code*	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
29846	476	523	617	661	670	725	760	717	786	803
25210	468	392	429	376	455	479	486	541	612	600
25215	276	280	295	358	352	387	381	412	463	486
25825	315	308	331	301	366	362	375	401	478	474
25810	280	234	279	286	259	312	357	343	361	334
25320	298	309	296	294	319	342	335	330	380	331

* See Table 1 for CPT descriptions.

Results

A total of 29,898 wrist procedures were performed in the Medicare population over the study period (Table 1). The single largest age group was aged less than 65 years (43%) and most were female (56%). The most commonly performed procedure was CPT code 29846, wrist arthroscopy with joint debridement or triangular fibrocartilage complex (TFCC) repair (6,557 patients) (Table 2). The largest portion of these patients were female (61%) and from the South (40%). Two different carpectomies, CPT codes 25210 (single carpectomy) and 25215 (PRC), represented the second and third most common procedures, respectively. Open capsulorrhaphy or reconstruction procedures (CPT code 25320) were the sixth most commonly performed. When considering all 6 most commonly performed wrist surgeries, the overall number of procedures went from 2,113 in 2005 to 3,028 in 2014, representing a 43% increase.

Table 3 and Figure 1 display the annual number of commonly performed wrist procedures. All procedures showed a general increase over the examined period, but CPT code 29846 (wrist arthroscopy with joint debridement or TFCC repair) had the greatest increase from 2005 to 2014 (68.7%). Over the same period, Medicare enrollment rose from 41.8 million to 54.0 million people, representing a 29.2% increase.

A total of 2,949 Medicare patients underwent procedures coded as CPT 25320 (Table 4). Most patients were female (64%) and aged less than 70 years (59.5%). Of these, 174 (5.9%) underwent revision or salvage procedures. The most common revision was an additional CPT 25320 procedure, representing 2.7% of the original cohort, whereas the most common salvage procedure was PRC (CPT 25215), representing 1.1% of the original cohort. Average payment was $4,107.67 for the index procedure and $3,760.95 for revision procedures.

Discussion

The primary goal of this study was to evaluate the number of reconstructive procedures performed in the Medicare patient population. When the data were analyzed by age, open capsulorrhaphy or reconstruction procedures for CI (CPT code 25320) were performed more frequently in older patients than expected, especially compared with other procedures. Salvage operations such as scaphoid excision and 4-corner arthrodesis (CPT 25825) or PRC (CPT 25815) would be expected to be more common than complex ligamentous reconstruction procedures for CI in this patient population. Although to the authors' knowledge, no study has been published that evaluates age cutoffs for reconstructive procedures, we did not anticipate this high number.

Even more surprising was the high number of wrist arthroscopies performed over the study interval. Arthroscopies for joint debridement or TFCC repair were the most commonly performed wrist procedure. Indications for these procedures are unknown, but may have been performed for arthrosis. Joint debridement or TFCC repair is not typical in this age group; however, the number of patients undergoing this procedure (as well as other commonly performed wrist procedures) greatly increased over the study period. Importantly, outcomes might not necessarily be improved with operative management, because there is no high-quality evidence supporting the use of wrist arthroscopy debridement procedures.[13]

Wrist carpectomies (CPT codes 25210 and 25215) were also among the most commonly performed wrist surgeries, although less than the previously described wrist arthroscopies. These procedures are generally salvage operations for symptomatic arthrosis and are often indicated in the Medicare population. We would expect more patients to undergo these procedures than arthroscopic joint debridement or TFCC repair.

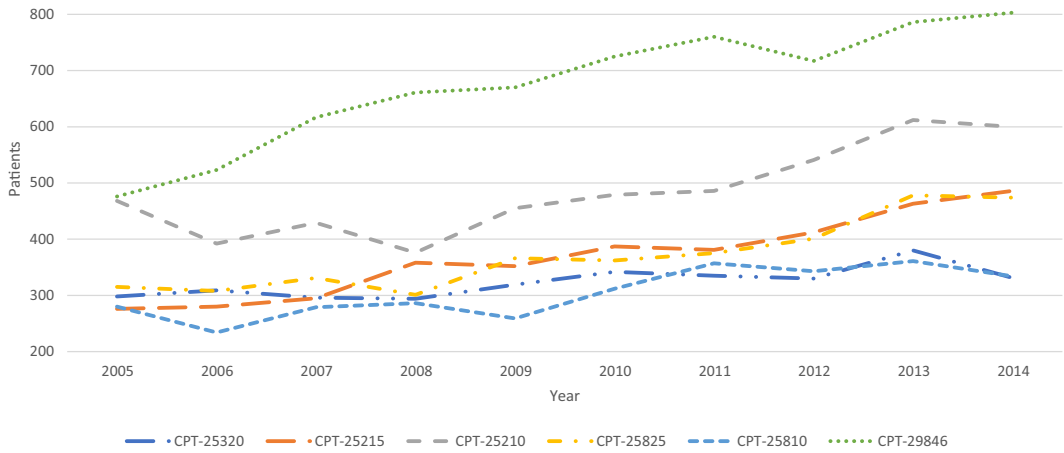

Figure 1. Annual number of patients undergoing common wrist procedures.

Table 4
Demographic, Payment, and Revision Data of Patients Undergoing CI Reconstruction Procedures

Procedure Type	CPT Code*	Index Procedures	Revisions After CPT 25320	Age, y						Sex			Average Payment
				<65	65–69	70–74	75–79	>80	Unknown	Male	Female	Unknown	
Index	25320	2,949		929	825	572	341	260	32	1,028	1,894	27	$4,107.67
Revisions	25215	3,636	32										
	25210	4,730	19										
	25820	1,498	7										
	25825	3,629	20										
	25800	1,568	10										
	25810	2,986	13										
	29840	492	3										
	29843	50	0										
	29844	1,063	3										
	29845	492	1										
	29846	6,557	22										
	29847	248	0										
	25320	2,949	79										
Total revisions			174	59	54	37	14	10	0	73	101	0	$3,760.95
Requiring revision (%)			5.9	6.4	6.5	6.5	4.1	3.8	0	7.1	5.3	0	

* See Table 1 for CPT descriptions.

Fewer patients than anticipated underwent revision procedures after CI reconstructive procedures (CPT 25320) although we would expect elderly patients with degenerative changes of the wrist to fail ligamentous reconstruction procedures. We found that revision rates decreased with increasing age and younger patients were much more likely to undergo a revision operation. The published literature on revision rates comes from a limited number of retrospective case series. Gajendran et al[14] reviewed dorsal intercarpal ligament capsulodesis and found that none of 16 patients required reoperation at a mean follow-up of 86 months despite radiographic arthrosis in 8 patients. Garcia-Elias et al[11] retrospectively reviewed the 3-ligament tenodesis technique in 38 patients and reported no cases of reoperation despite evidence of arthrosis in a quarter of patients at a mean follow-up of 46 months. Sousa et al[15] retrospectively reviewed the modified Brunelli procedure in 22 patients. Only one patient required reoperation at a mean follow-up of 61 months although one third had continued moderate or severe pain after the procedure. The lack of a nonsurgical control group in those studies makes it difficult to determine whether operations resulted in improved outcomes. Overall, our revision rate seems comparable to the limited published literature, which was conducted in younger patient populations. To the best of our knowledge, to date, data do not exist for the elderly population.

A wide range of procedures are included in the CPT 25320 description. For instance, a recent meta-analysis on chronic SL interosseous ligament injury treatments included Brunelli FCR tenodesis, dorsal capsulodesis with suture anchors, Blatt capsulodesis, arthroscopic debridement, and joint pinning, among others.[16] More recently, bone–ligament–bone reconstructions, screw fixation (reduction and association of the scaphoid and lunate), and the ScaphoLunate Axis Method procedure have been added to procedures that seek to address this pathology but lack long-term outcomes. In total, there are a multitude of surgical techniques that range from relatively simple, straightforward percutaneous procedures with few steps to complex, open cases with dozens of steps that need to be meticulously executed. Conceivably, any of these procedures could be coded as CPT 25320 despite the significant variability. A more specific coding system should be created to reflect the surgeon's effort and time invested more accurately, as well as to track outcomes better, specifically revision rates.

This study had limitations. The database depends on physician coding, which is variable. It is difficult to predict outcomes purely on reoperation rates because important measures are not included, such as residual pain, function, and patient satisfaction. We make no claim about the superiority of one procedure over another. Laterality was also not specified, so our revision rates represent a worst-case scenario, because patients might have undergone additional procedures on the contralateral carpus.

Overall, it appears that carpal reconstruction procedures and wrist arthroscopies for joint debridement or TFCC repair are performed more commonly in elderly patients than predicted. Salvage procedures such as wrist arthrodesis or carpectomy were expected to predominate is this population. It appears that carpal reconstruction procedures have low revision rates in the short to medium term in the Medicare population, but the wide variety of procedures captured by CPT 25320 makes outcome measurements and revision rates challenging. Further clinical study is needed to understand the specifics of carpal reconstructive procedures that are being performed in this population and to determine which result in improved patient outcomes. As the United States moves toward a value-based health care model, establishing indications for wrist arthroscopy and carpal reconstruction in the elderly population has become of paramount importance.

References

1. Walsh JJ, Berger RA, Cooney WP. Current status of scapholunate interosseous ligament injuries. *J Am Acad Orthop Surg*. 2002;10(1):32–42.
2. Lee DH, Dickson KF, Bradley EL. The incidence of wrist interosseous ligament and triangular fibrocartilage articular disc disruptions: a cadaveric study. *J Hand Surg Am*. 2004;29(4):676–684.
3. Wright TW, Del Charco M, Wheeler D. Incidence of ligament lesions and associated degenerative changes in the elderly wrist. *J Hand Surg Am*. 1994;19(2):313–318.
4. Pollock PJ, Sieg RN, Baechler MF, Scher D, Zimmerman NB, Dubin NH. Radiographic evaluation of the modified Brunelli technique versus the Blatt capsulodesis for scapholunate dissociation in a cadaver model. *J Hand Surg Am*. 2010;35(10):1589–1598.
5. Hsu JW, Kollitz KM, Jegapragasan M, Huang JI. Radiographic evaluation of the modified Brunelli technique versus a scapholunotriquetral transosseous tenodesis technique for scapholunate dissociation. *J Hand Surg Am*. 2014;39(6):1041–1049.
6. Watson HK, Ballet FL. The SLAC wrist: scapholunate advanced collapse pattern of degenerative arthritis. *J Hand Surg Am*. 1984;9(3):358–365.
7. Shah CM, Stern PJ. Scapholunate advanced collapse (SLAC) and scaphoid nonunion advanced collapse (SNAC) wrist arthritis. *Curr Rev Musculoskelet Med*. 2013;6(1):9–17.

8. Crawford K, Owusu-Sarpong N, Day C, Iorio M. Scapholunate ligament reconstruction: a critical analysis review. *JBJS Rev*. 2016;4(4):e41–e48.
9. van Kampen RJ, Bayne CO, Moran SL, Berger RA. Outcomes of capitohamate bone-ligament-bone grafts for scapholunate injury. *J Wrist Surg*. 2015;4(4):230–238.
10. Chabas JF, Gay A, Valenti D, Guinard D, Legre R. Results of the modified Brunelli tenodesis for treatment of scapholunate instability: a retrospective study of 19 patients. *J Hand Surg Am*. 2008;33(9):1469–1477.
11. Garcia-Elias M, Lluch AL, Stanley JK. Three-ligament tenodesis for the treatment of scapholunate dissociation: indications and surgical technique. *J Hand Surg Am*. 2006;31(1):125–134.
12. Ben Amotz O, Sammer DM. Salvage operations for wrist ligament injuries with secondary arthrosis. *Hand Clin*. 2015;31(3):495–504.
13. Tadjerbashi K, Rosales RS, Atroshi I. Intervention randomized controlled trials involving wrist and shoulder arthroscopy: a systematic review. *BMC Musculoskelet Disord*. 2014;15:252.
14. Gajendran VK, Peterson B, Slater RR Jr, Szabo RM. Long-term outcomes of dorsal intercarpal ligament capsulodesis for chronic scapholunate dissociation. *J Hand Surg Am*. 2007;32(9):1323–1333.
15. Sousa M, Aido R, Freitas D, Trigueiros M, Lemos R, Silva C. Scapholunate ligament reconstruction using a flexor carpi radialis tendon graft. *J Hand Surg Am*. 2014;39(8):1512–1516.
16. Naqui Z, Khor WS, Mishra A, Lees V, Muir L. The management of chronic non-arthritic scapholunate dissociation: a systematic review. *J Hand Surg Eur Vol*. 2018;43(4):394–401.