Hand and Upper Extremity Procedures Are Significantly More Cost Effective When Performed in Ambulatory Surgery Centers Versus Hospital Outpatient Departments

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Objectives: Orthopaedic surgery has a high rate of utilization of outpatient settings, including ambulatory surgery centers (ASC) and hospital outpatient departments (HOPD). We seek to compare costs at these outpatient facilities, ASC versus HOPD, for hand and upper extremity procedures.

Design: Database review was performed with publicly available data from the Center for Medicare and Medicaid Services (CMS) via the Medicare Procedure Price Lookup Tool.

Main Outcome Measurements: Current Procedural Terminology (CPT) codes for hand and upper extremity procedures. Total costs, facility fees, Medicare payments, and patient payments were obtained for each procedure code.

Results: Thirty-seven CPT codes were divided into arthroscopy, fracture, arthroplasty/arthrodesis, and other. Arthroscopy demonstrated cost savings in the total cost of the procedure, facility fees, Medicare payments, and patient payments in ASCs compared to HOPD. Fracture procedures had lower total costs, Medicare payments, facility fees, and patient payments in ASCs. When CPT codes were grouped together, there were 35% savings in total cost, 41% savings for facility fees, 36% savings in Medicare payments, and 28% in patient payments for procedures performed at ASCs.

Conclusions: ASCs demonstrate cost-savings across multiple procedures for the hand and upper extremity in various areas, including total costs, facility fees, Medicare payments, and patient payments when compared to HOPDs.

Level of Evidence: Level 4; Retrospective cost-analysis

Key Words: ambulatory surgery center, cost, hand, hospital outpatient departments, upper extremity

INTRODUCTION

Healthcare expenditure in the United States remains an ongoing topic of discussion for policymakers, state departments, and hospital officials. The United States remains at the top of the list for countries with the highest healthcare costs and the greatest portion of gross domestic product attributed to healthcare expenses.[1-2] Given the continual rise of costs, it is prudent to determine areas of savings while maximizing patient outcomes and decreasing overall disease burden. When evaluating the breakdown of U.S. healthcare spending, the most is consumed by inpatient hospital services.[3] Therefore, targeting inpatient resource utilization may be a promising area to mitigate the overall rise of U.S. healthcare costs. This has been recognized, as there has been a trend of transitioning from inpatient to outpatient settings for cost reduction while maintaining the same high level of care, especially in specialties such as orthopaedic surgery.[4-5] Moreover, the COVID pandemic pushed hospital capacity limits across the country unlike ever before, emphasizing the necessity to transition elective orthopaedic procedures from the inpatient to outpatient setting.[6-9]

Electively-based orthopaedic subspecialties, such as hand and elbow, sports, and foot and ankle, have dominated the outpatient space, with more recent literature demonstrating the safety of performing outpatient procedures in adult reconstruction and spine.[9-11] Different healthcare settings are utilized as treatment centers for elective hand and upper extremity procedures, including

inpatient hospital operating rooms, hospital outpatient departments (HOPDs), ambulatory surgery centers (ASCs), and in-office procedures. Each facility's benefits are considered when deciding where patients would be most appropriately cared for based on the complexity of the procedure, patient comorbidities, and equipment necessities. The benefits of ambulatory surgery centers and hospital outpatient departments are well established, with significant cost-savings, increased efficiency, and high levels of patient satisfaction.[12-13]

Hand and upper extremity procedures performed in stand-alone ASCs result in low rates of postoperative utilization of urgent care and emergency department visits and infrequent hospital readmissions.[14] Furthermore, ASC surgical visits are 25% to 39% shorter than hospital outpatient department visits.[15] Carey reported that ASCs can effectively operate at lower costs than HOPDs across multiple surgical specialties.[16] However, there is limited literature evaluating the difference in costs associated with specific hand and upper extremity procedures in ambulatory surgery centers versus hospital outpatient departments. We seek to report on differences between these two healthcare settings, highlighting potential cost-savings in one over the other for hand and upper extremity procedures.

METHODS

Data Collection

Medicare is a federal health insurance program administered to United States citizens over 65 and those who meet certain eligibility requirements, including younger people with disabilities and patients with end-stage renal disease.[17] Due to previous legislation, Medicare has attempted to increase price and volume transparency via the publication of various online databases. The use of these databases to track volume and reimbursement data has been well-established within the orthopaedic literature. [18-23]

Ambulatory surgery centers and hospital outpatient departments allow for various outpatient procedures without the significant costs associated with hospital stays. The limitations on patient length of stay vary according to state and local regulations. The difference between the facilities relates to regulations specific to each center, with an ASC typically a freestanding facility with a distinct financial and administrative contract with Medicare and/or private insurance.[24,25] Conversely, an independent surgery center can still be considered an HOPD if it is close to a hospital and negotiates with the same financial and administrative contracts as the hospital governing body.

To evaluate differences in cost between ASCs and HOPDs, the Medicare Procedure Price Lookup Tool was queried for individual Current Procedural Terminology (CPT) codes approved for outpatient surgery by the Center for Medicare and Medicaid Services (CMS). The included CPT codes are included in Table 1. Procedures were grouped into arthroscopy, fracture, arthroplasty/arthrodesis, other procedure cohorts, and an overall cohort. Data regarding total costs, facility fees, surgeon fees,

Table 1. CPT codes and description of procedure.

CPT Code	Procedure
Arthroscopy	
29840	Arthroscopy, wrist, diagnostic, with or without synovial biopsy (separate procedure)
29843	Arthroscopy, wrist, surgical; for infection, lavage and drainage
29845	Arthroscopy, wrist, surgical; synovectomy, complete
29846	Arthroscopy, wrist, surgical; excision and/or repair of triangular fibrocartilage and/or joint debridement
Fracture	
25525	Open treatment of radial shaft fracture, includes internal fixation, when performed, and closed treatment of distal radioulnar joint dislocation (galeazzi fracture/ dislocation), includes percutaneous skeletal fixation, when performed
25526	Open treatment of radial shaft fracture, includes internal fixation, when performed, and open treatment of distal radioulnar joint dislocation (galeazzi fracture/ dislocation), includes internal fixation, when performed, includes repair of triangular fibrocartilage complex
25574	Open treatment of radial and ulnar shaft fractures, with internal fixation, when performed; of radius or ulna
25575	Open treatment of radial and ulnar shaft fractures, with internal fixation, when performed; of radius and ulna
25606	Percutaneous skeletal fixation of distal radial fracture or epiphyseal separation
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
25609	Open treatment of distal radial intra-articular fracture or epiphyseal separation; with internal fixation of 3 or more fragments
25628	Open treatment of carpal scaphoid (navicular) fracture, includes internal fixation, when performed
25651	Percutaneous skeletal fixation of ulnar styloid fracture
26727	Percutaneous skeletal fixation of unstable phalangeal shaft fracture, proximal or middle phalanx, finger or thumb, with manipulation, each
26756	Percutaneous skeletal fixation of distal phalangeal fracture, finger or thumb, each
Arthroplasty/Arthrodesis	
24363	Arthroplasty, elbow; with distal humerus and proximal ulnar prosthetic replacement (eg, total elbow)
25446	Arthroplasty with prosthetic replacement; distal radius and partial or entire carpus (total wrist)
25447	Arthroplasty, interposition, intercarpal or carpometacarpal joints
25800	Arthrodesis, wrist; complete, without bone graft (includes radiocarpal and/or intercarpal and/or carpometacarpal joints)
25820	Arthrodesis, wrist; limited, without bone graft (eg, intercarpal or radiocarpal)
Other	
24359	Tenotomy, elbow, lateral or medial (eg, epicondylitis, tennis elbow, golfer's elbow); debridement, soft tissue and/or bone, open with tendon repair or reattachment
25000	Incision, extensor tendon sheath, wrist (eg, de quervains disease)
25111	Excision of ganglion, wrist (dorsal or volar); primary
25210	Carpectomy; 1 bone
25215	Carpectomy; all bones of proximal row
25240	Excision distal ulna partial or complete (eg, darrach type or matched resection)
25260	Repair, tendon or muscle, flexor, forearm and/or wrist; primary, single, each tendon or muscle
26045	Fasciotomy, palmar (eg, dupuytren's contracture); open, partial
26055	Tendon sheath incision (eg, for trigger finger)
26350	Repair or advancement, flexor tendon, not in zone 2 digital flexor tendon sheath (eg, no man's land); primary or secondary without free graft, each tendon
26352	Repair or advancement, flexor tendon, not in zone 2 digital flexor tendon sheath (eg, no man's land); secondary with free graft (includes obtaining graft), each tendon
26356	Repair or advancement, flexor tendon, in zone 2 digital flexor tendon sheath (eg, no man's land); primary, without free graft, each tendon
26540	Repair of collateral ligament, metacarpophalangeal or interphalangeal joint
29848	Endoscopy, wrist, surgical, with release of transverse carpal ligament
64718	Neuroplasty and/or transposition; ulnar nerve at elbow
64721	Neuroplasty and/or transposition; median nerve at carpal tunnel

CPT = Current Procedural Terminology

Medicare payments, and patient payments were extracted for each procedure.

Statistical Analysis

Descriptive statistics were used to express each variable's mean and standard deviation. Given the non-parametric distribution of the data, Mann-Whitney *U* tests were utilized to assess differences in total costs, facility fees, surgeon fees, Medicare payments, and patient payments between ASC and HOPD for arthroscopy procedures, fracture procedures, arthrodesis/arthroplasty procedures, other procedures, as well as all a combined cohort including all available CPT codes. All tests were 2-sided, with significance set at a probability value of $p<0.05$.

RESULTS

Arthroscopy Codes

When comparing four different CPT codes (**Table 1**), significant cost savings in the total cost of the procedure (1,886.00±58.72 vs. 3,418.00±58.78; p=0.009), facility fees (1,360.00±0 vs. 2,892.00±0; p=0.021), Medicare payments (1,509.00±47.27 vs. 2,734.00±47.27 p=0.021), and patient payments (376.75±11.87 vs. 682.75±11.87; p=0.021) in ASCs as compared to HOPD were identified (**Table 2**). This resulted in an approximately 45% savings for total costs, Medicare payments, and patient payments, as well as approximately 53% cost savings for facility fees if procedures are performed at an ASC compared to a HOPD. Surgeon fees were the same regardless of the surgery setting.

Fracture Codes

Twelve Medicare-approved outpatient CPT codes were identified (**Table 1**). Fracture procedures had significantly lower total costs (3,886.58±1,527.61 vs 5,975.92±1,890.96; p=0.021), Medicare payments (3,109.17±1,221.21 vs 4,780.75±1,511.90; p=0.021), facility fees (3,055.17±1,503.23 vs 5,228.67±1,725.74; p=0.018), and patient payments (776.92±305.46 vs 1,194.75±377.97; p=0.021) in ASCs (**Table 2**). This resulted in an approximately 35% savings for total costs, Medicare payments, and patient payments, as well as approximately 42% cost savings for facility fees if procedures were performed at an ASC as compared to a HOPD. Surgeon fees were the same regardless of the surgery setting.

Arthroplasty/Arthrodesis Codes

When comparing five different CPT codes (Table 1), overall costs at ASCs were lower for total costs of procedure (8,105.80±5,714.19 vs 10,734.40±6,643.11; p=0.347), facility fees (7,113.80±5,997.65 vs 9,742.40±6,344.16; p=0.343), and Medicare payments (6,484.20±4,365.60 vs 9.285.60.00±6,254.08; p=0.347). For these five procedures, the average amount of the procedure required to be covered by the patient was higher at the ASC than the HOPD (1,620.40±1,159.13 vs 1,447.60±440.43; p=0.917). However, none of these differences reached statistical significance. Surgeon fees were the same regardless of the surgery setting.

Other Codes

When comparing 16 different CPT codes (Table 1), significant cost savings in the total cost of procedure (1,815.81±686.56 vs 3,181.38±1,343.83; p=0.003), facility fees (1,240.63±551.50 vs 2,606.19±1,212.08; p<0.001), Medicare payments (1,452.63±549.27 vs 2,554.75±1,074.92; p=0.003), and patient payments (362.44±137.22 vs 635.31.17±268.69; p=0.003) in ASCs as compared to HOPD were identified (Table 2). This resulted in an approximately 43% savings for total costs, Medicare payments, and patient payments, as well as approximately 52% cost saving for facility fees, if procedures are performed at an ASC as compared

to a HOPD. Surgeon fees were the same regardless of surgery setting.

Overall

When grouping all 37 procedural codes into a single cohort, significant cost savings in an ASC setting were demonstrated across all variables outside of surgeon fees. Total cost (3,345.00±3,026.81 vs. 5,133.98±3,655.54; p=0.002**),** facility fees (2,635.70±2,839.88 vs. 4,451.97±3,444.87; p<0.001), Medicare payments (2,675.92±2,421.41 vs. 4,201.32±3,269.11; p=0.002), and patient payments (668.41±605.40 vs. 931.65±448.42; p=0.002) were all significantly lower if performed at an ASC (**Table 2**). This resulted in an approximately 35% savings in total cost, 41% savings for facility fees, 36% savings in Medicare payments, and 28% in patient payments for procedures performed at ASCs. Surgeon reimbursements were the same regardless of the surgery setting.

Table 2. Mean and standard deviation of costs associated with ambulatory surgical centers and hospital outpatient departments for common hand and upper extremity procedures.

	ASC (Mean ± SD)	**HOPD** (Mean ± SD)	*p-value
Arthroplasty			
Total Cost	1,886.00±58.78	3,418±58.78	**0.009**
Doctor Fee	526.00±58.78	526.00±58.78	1.000
Facility Fee	1,360.00±0.00	2,892.00±0.00	**0.021**
Medicare Payment	1,509±47.27	2,734±47.27	**0.021**
Patient Payment	376.75±11.87	682.75±11.87	**0.021**
Fracture			
Total Cost	3,886.58±1,527.61	5,975.92±1,890.96	**0.021**
Doctor Fee	748.08±200.02	748.08±200.02	1.000
Facility Fee	3,055.17±1,503.03	5,228.67±1,725.74	**0.018**
Medicare Payment	3,109.17±1,222,21	4,780.75±1,511.90	**0.021**
Patient Payment	776.92±305.46	1,194.75±377.97	**0.021**
Arthroplasty/Arthrodesis			
Total Cost	8,105.80±5,794.19	10,734.40±6,643.11	0.347
Doctor Fee	992.00±339.47	992.00±339.47	1.000
Facility Fee	7,113.80±5,497.65	9,742.40±6,344.16	0.343
Medicare Payment	6,484.20±4,635.60	9,285.60±6,344.16	0.347
Patient Payment	1,620.40±1,159.13	1,447.60±440.42	0.917
Other			
Total Cost	1,815.81±686.56	3,181.38±1,343.83	**0.003**
Doctor Fee	575.19±177.11	575.19±177.11	1.000
Facility Fee	1,240.63±551.50	2,606.19±1,212.08	**<0.001**
Medicare Payment	1,452.63±549.27	2,544.75±1,074.92	**0.003**
Patient Payment	362.44±137.22	635.31±268.69	**0.003**
Overall			
Total Cost	3,345.00±3,026.81	5,133.97±3,655.54	**0.002**
Doctor Fee	682.27±246.91	682.27±246.91	1.000
Facility Fee	2,635.70±2,839.89	4,451.97±3,444.87	**<0.001**
Medicare Payment	2,675.92±2,421.41	4,201.32±3,269.12	**0.002**
Patient Payment	668.41±605.40	931.65±448.62	**0.003**

ASC = ambulatory surgical center; HOPD = hospital outpatient department; SD = standard deviation
*p-value calculated using Mann-Whitney *U* tests. **Bolding** indicates significance (p<0.05).

DISCUSSION

Over the last few decades, there has been a shift and growth to free-standing ambulatory surgery centers, with a 77% increase in orthopaedic procedures performed in them between 2000 to 2007.[26] More recently, The Centers for Medicare and Medicaid Services (CMS) removed over 250 musculoskeletal procedures from the "inpatient only" list, allowing a wider breadth of outpatient and ASC utilization.[27] In orthopaedics, prior studies have demonstrated the safety of outpatient procedures that were once believed to require inpatient hospitalization, including total joint arthroplasty, and minimally-invasive spine procedures. [9-10]

Regarding hand and upper extremity surgery, procedures are smaller, less invasive, and shorter, and therefore, intrinsically more suitable to be carried out in the outpatient setting. One circumstance that would offset the benefits of outpatient settings, such as HOPDs and ASCs, is postoperative emergency department visits or hospital readmissions. Goyal et al. reviewed over 28,000 cases over 11 years of upper extremity procedures performed in ambulatory surgery centers, reporting 0.2% of adverse events, including only 18 postoperative transfers to the hospital and 21 admissions after discharge.[28] Furthermore, Sandrowski et al. substantiated the extremely low rate of ER visits and hospital readmissions, as only 1.6% of patients required further care at these facilities following over 500 hand and upper extremity procedures at a free-standing ASC.[14]

While the benefits of HOPDs and ASCs are well known regarding cost-savings, efficiency, and patient satisfaction, many have attempted to further delineate the differences in cost-savings and efficiency between the two healthcare facilities.[5,31] Carey reported rising costs had affected HOPDs to greater degrees than ASCs in numerous specialties, including gastroenterology, ophthalmology, and orthopaedics.[16] Among common orthopaedic procedures, it has been shown there are 26% lower total costs and 33% lower technical fees at ASCs than HOPDs.[32] Hair et al. demonstrated a 39% decrease in operative times in free-standing ambulatory care centers compared to hospital-based outpatient departments in numerous specialties with notable efficiency across all phases of care, including surgical time, time spent in the operating room, and postoperative care time.[33]

While previous reports portray the benefits of ASCs over HOPDs, there is a lack of literature focusing on cost-saving, specifically in hand and upper extremity procedures. Ngyugen et al. emphasized the cost savings ASCs can provide over HOPDs, up to 30%, following carpal tunnel release.[12] While they evaluated only one procedure, our study expands upon their finding by demonstrating large discrepancies between ASCs and HOPDs in total costs, facility fees, Medicare payments, and patient payments in over 20 common procedures.

We evaluated major categories of hand and elbow procedures, including arthroscopy, fracture fixation, arthroplasty/arthrodesis, and others involving nerve decompressions, flexor tendon

repairs, and additional bony procedures. Areas of comparison related to cost saving include total costs, facility fees, Medicare payments, and patient payments. We demonstrated significant differences between ACSs and HOPDs, with cost-savings coming from ACSs in the majority of individual and grouped CPT codes across all variables, with the exception of surgeon's fees. In areas of arthroscopy and other CPT code categories, there was approximately 43-45% cost savings in total procedure costs, Medicare payments, and patient payments in ASCs over HOPD, with facility fees almost half at ACS than they are at HOPDs. Moreover, fracture fixation demonstrated 1/3rd less in total procedure costs, Medicare payments, and patient payments in ACSs when compared to HOPD, with 42% less for facility fees. These findings cannot be ignored, as they demonstrate an enormous healthcare expenditure that can be mitigated by performing most of these procedures at ASCs if both facilities are available to the surgeon and patient.

Although there was a trend towards cost-savings for ASCs in total procedure costs, Medicare payments, and facility fees for arthroplasty/arthrodesis codes, we did not demonstrate statistically significant differences. Patient payments were comparable at both facilities for arthroplasty/arthrodesis.

In the last three years, theoretical situations that would push the limits of healthcare worldwide have become an unfortunate reality. The COVID-19 pandemic had a notable physical and psychological impact on patients, healthcare workers, and hospitals; further, the financial impact was significant. There was an increased demand for medical supplies, hospital beds, and intensive care unit level of care, with disruption of supply chains leading to substantial financial challenges. The American Hospital Association estimated a loss of 202.6 billion for American healthcare systems, with large academic systems experiencing disproportionate financial stress as they maintain relatively small operating margins.[8, 29-30] Our study demonstrates the potential for significant cost savings as we move towards a system focused on evidence-backed, value-based care.

Limitations to this study are inherent to database studies, including appropriate coding and general data organization. This study's data was compiled from Medicare patients and does not reflect cost savings associated with private sector, Medicaid, or self-pay. Furthermore, while we sought to report on differences in costs, we did not evaluate the clinical outcomes or complication data between the two healthcare settings.

CONCLUSION

Outpatient settings, including hospital outpatient departments and ambulatory surgery centers, are primary healthcare facilities for patients undergoing hand and upper extremity procedures. As healthcare expenditure increases, it's prudent to determine possible areas of savings. While the benefits of ASCs over HOPDs have been established in the literature, specific subspecialty data regarding cost-saving is limited. We demonstrate the enormous cost savings in

arthroscopy, fracture fixation, and many common procedures performed in the upper extremity in ASCs over HOPDs. Further prospective studies are warranted to unveil the potential benefits of ASCs over HOPDs, including clinical outcomes and efficiency measures.

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