

Demographic Trends and Complication Rates in Arthroscopic Elbow Surgery

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Disclaimer: Dr. Jeffrey Wang owns shares of Pearldiver stock.

Abstract:

Purpose: To investigate demographic trends and the frequency of complications requiring reoperation in arthroscopic elbow surgery.

Methods: The Current Procedural Terminology (CPT) billing codes of patients undergoing elbow arthroscopy were searched using a national insurance database. From the years 2007 to 2011, over 20 million orthopaedic patient records were present in the database with an orthopaedic International Classification of Disease, Ninth Revision (ICD-9) diagnosis code or CPT code. Procedures and the corresponding CPT codes for the elbow searched included diagnostic arthroscopy, loose body removal, synovectomy, and debridement. The type of procedure, date, gender, and region of the country was identified for each patient. Additionally, the incidence of reoperation for infection, stiffness, and nerve injury was examined.

Results: There was a small but significant increase in elbow arthroscopic procedures over the study period. Males accounted for 74% of patients undergoing these procedures. Twenty-two percent of elbow arthroscopy patients were under 20 years old, 25% were 20-39 years old, 47% of patients undergoing arthroscopic elbow procedures were 40-59 years old 6.0% were 60 or older. Other than for synovectomy, there were regional variations in the incidence of each procedure type. The overall rate of re-operation was 2.2%, with a specific rate of 0.26% for infection, 0.63% for stiffness, and 1.26% for nerve injury.

Conclusion: Overall, the incidence of elbow arthroscopy in this patient population is relatively low, and appears to be increasing slightly over time. In this database, elbow arthroscopy procedures were most commonly performed on males and patients 40-59 years of age, with regional variation in incidence of the different procedures. Furthermore, the rate of complication requiring re-operation was very low at 2.2%, with nerve exploration being the most common re-operation performed.

Introduction:

Since its advent in the 1980s¹, elbow arthroscopy has become a more common procedure, allowing for a less-invasive alternative to open elbow procedures². However, complications such as infection, joint stiffness, and most commonly, peripheral nerve injury, can be devastating to the patient, and may require repeat surgical intervention³⁻⁷. To date, a number of retrospective case series have reported on complication rates for a small number of surgeons, in a relatively small number of patients^{2,8}. But the confounding effects of small sample size, regional bias, and reporting bias pose challenges in any such study that estimates the incidence of complications requiring reoperation for a given procedure⁹. Such effects are particularly pronounced when the reoperation rate associated with elbow arthroscopy is so low. To address this issue, large samples from diverse geographic regions, as can be obtained in database studies, can be used to reduce bias. The purpose of this study was to investigate demographic trends in elbow arthroscopy over time, as well as to query complication rates requiring re-operation associated with these procedures. We employed a powerful search of a large insurance database to evaluate demographic patterns of patients undergoing elbow arthroscopy, and the rates of complication requiring reoperation. This retrospective study included the search of records created over a 5-year period. Based on clinical experience, we hypothesized that elbow arthroscopy is most frequently performed on middle-aged males, and that the rate of complication requiring re-operation is low.

Methods:

Database query

The current procedural terminology (CPT) billing codes of patients undergoing elbow arthroscopy were searched using the PearlDiver Patient Record Database (PearlDiver Technologies, Inc., Fort Wayne, IN). This database is a national insurance database with the largest contribution being from the UnitedHealth Group. From

CPT code	Paper description of CPT code	Definition of CPT code
29830	Diagnostic	Arthroscopy elbow diagnostic with or without synovial biopsy (separate procedure)
29834	Loose body	Arthroscopy elbow surgical; with removal of loose body or foreign body
29835	Synovectomy	Arthroscopy elbow surgical; synovectomy partial
29836		Arthroscopy elbow surgical; synovectomy complete
29837	Debridement	Arthroscopy elbow surgical; debridement limited
29838		Arthroscopy elbow surgical; debridement extensive

Table 1. Elbow arthroscopy CPT codes, with descriptions used in this paper as well as formal definitions.

the years 2007 to 2011, 20 million records existed with an orthopaedic International Classification of Disease, Ninth Revision (ICD-9) diagnosis code or CPT code. Procedures and the corresponding CPT codes for the elbow searched included diagnostic arthroscopy, loose body removal, synovectomy, and debridement. The complete definitions of these codes are listed in Table 1. The type of procedure, date, gender, and region of the country (West, Midwest, Northeast, and South) was identified for each patient. To assess rates of complication requiring re-operation, three categories were queried: infection (CPT codes 10140, 10160, 10180, 11042, 11043, 11044, 12020, 12021, 13160, 23930, 23931, 23935, or 24000), stiffness (CPT codes 24006, 24300, or 24149), and nerve injury (CPT codes 64708 or 64718). The incidence of re-

operation for infection within 30 days, stiffness within 90 days, and nerve injury within 180 days was determined.

Statistical analysis

Chi-square analysis was used to determine statistical significance with regard to gender, age, procedure year, and geographic region. Linear regression was performed to test the significance of trends over time (Microsoft Excel 2010). Significance was achieved with $p < 0.05$.

Results:

A total of 6,287 unique records of patients undergoing arthroscopic elbow surgery were identified within the 5-year period from 2007 to 2011. There was a small but statistically significant increase in the incidence of elbow arthroscopic procedures over time, from 1.27 in 10,000 orthopaedic patients in 2007 to 1.45 in 10,000 in 2011 (Figure 1, $p = 0.01$, $r=0.808$). Males accounted for 74% of patients undergoing these procedures (Figure 2). Twenty-two percent of elbow arthroscopy patients were under 20 years old, 25% were 20-39 years old, 47% of patient undergoing arthroscopic elbow procedures were 40-59 years old 6.0% were 60 or older (Figure 3). The database is most well represented by the South (45.8% of orthopaedic patients), whereas the Northeast has the smallest representation (12.8%). With all arthroscopic elbow procedures combined, the observed distribution of procedures by region was as expected. In all

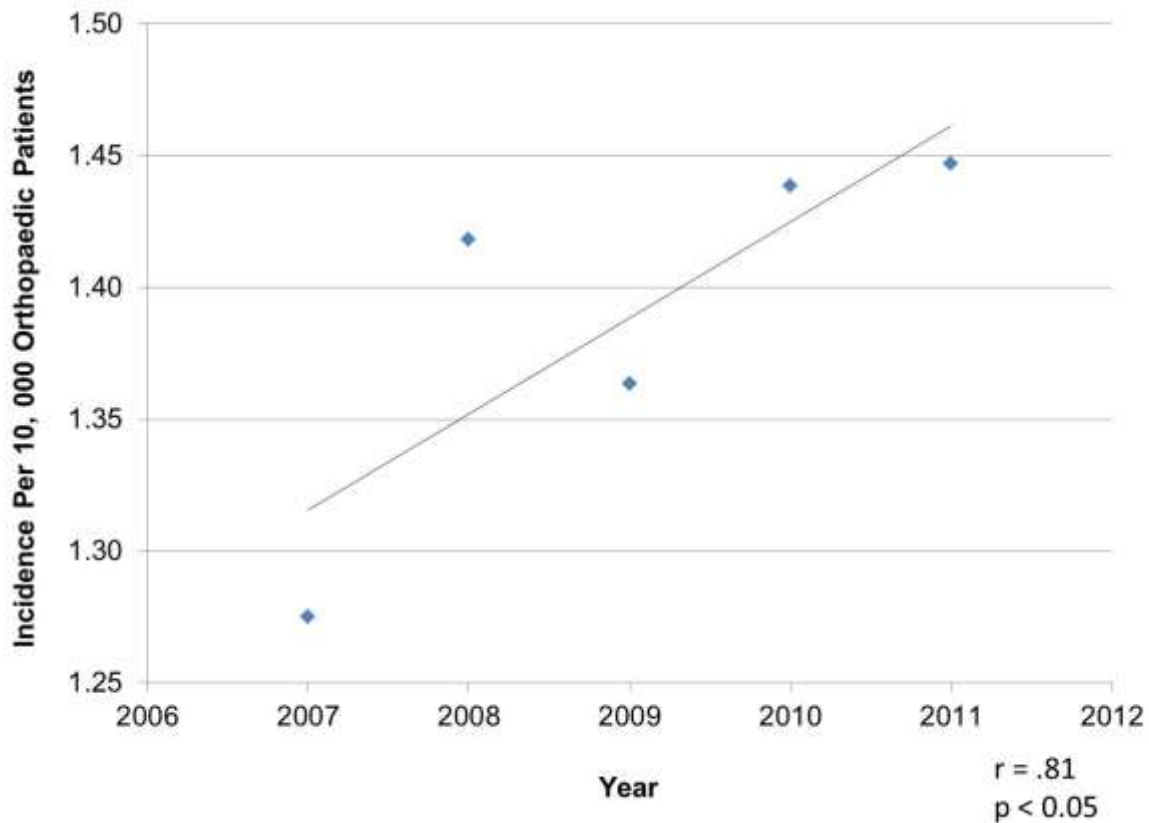


Figure 1. Distribution of elbow arthroscopy procedures by year from 2007-2011 in private insurance database. There was a slight increase in incidence elbow arthroscopy procedures performed over time, relative to number of orthopaedic patients in database.

procedures, other than synovectomy, statistically significant regional differences were observed ($p = 0.001$) (Fig. 4). For diagnostic elbow arthroscopy, the number of procedures performed in the South was 23% more than expected, while 31% fewer than expected were performed in the Northeast. For loose body removal, 27% more procedures were performed than expected in the West, while 19% fewer than expected were observed in the Northeast.

The overall rate of re-operation was 2.2% with 0.26% for infection, 0.63% for stiffness, and 1.26% for nerve injury.

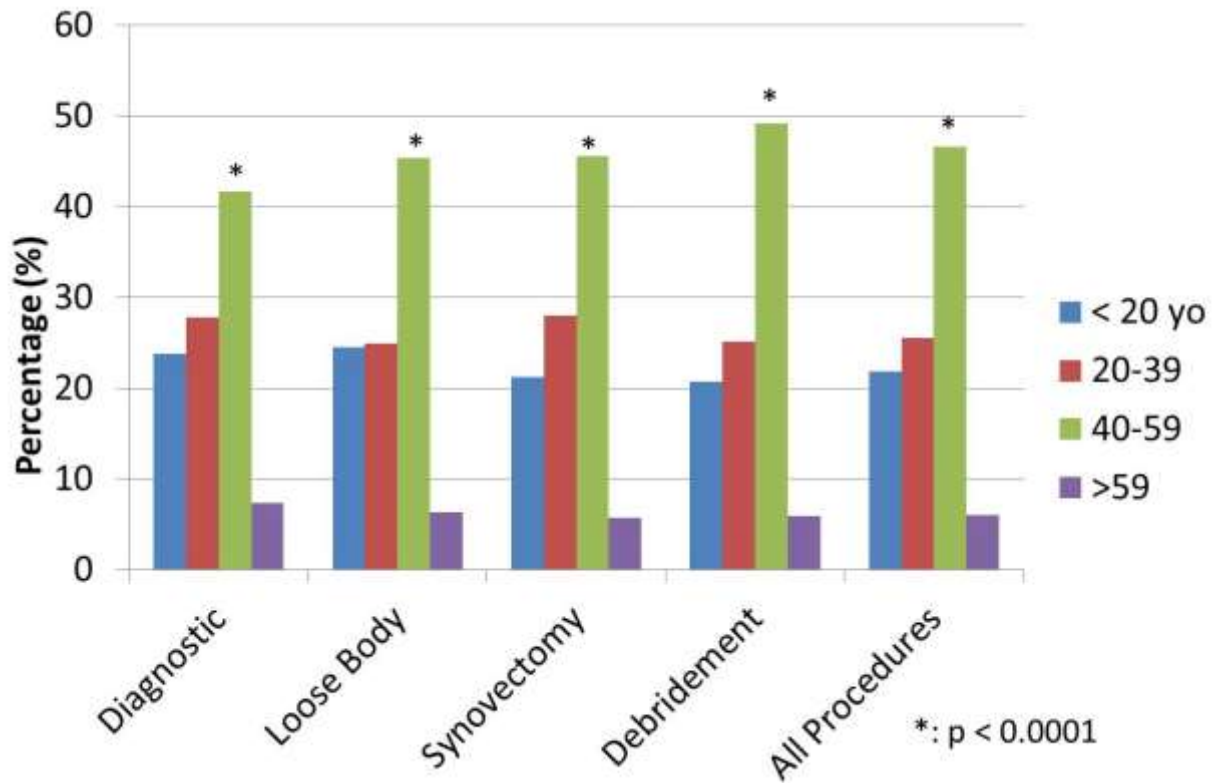


Figure 2. Distribution of elbow arthroscopy procedures by age for 6,287 patients in private insurance database between 2007-2011.

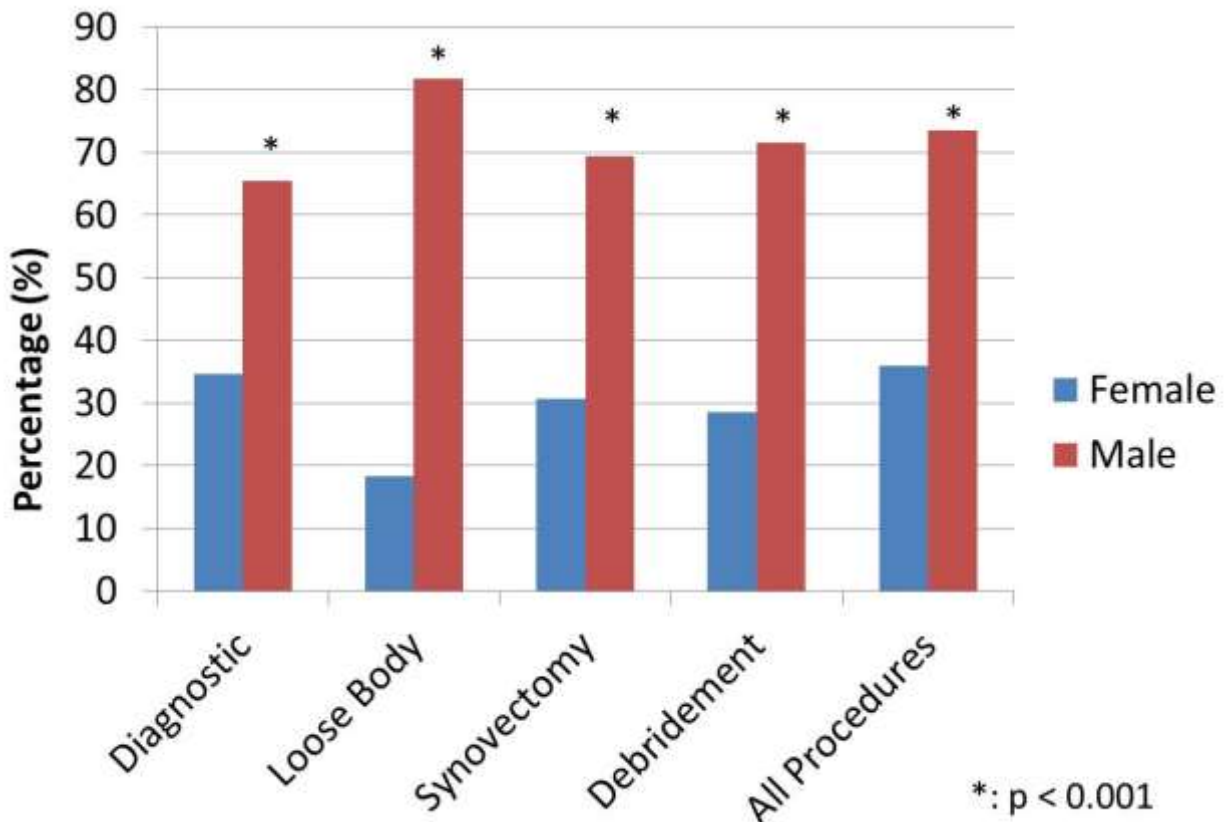


Figure 3. Distribution of elbow arthroscopy procedures by patient gender for 6,287 patients in private insurance database between 2007-2011.

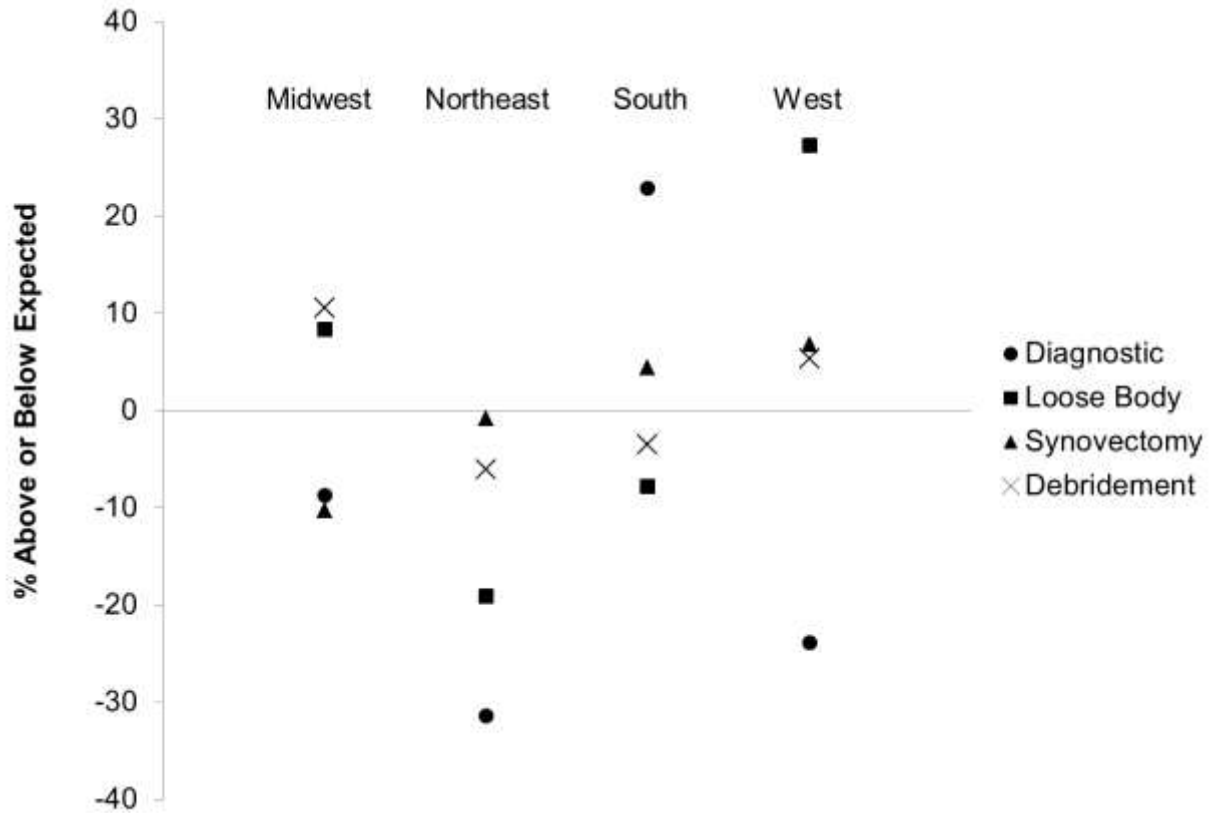


Figure 4. Percentage above or below expected regional incidence of each elbow arthroscopy procedure based on regional distribution of orthopaedic patients in database of over 20 million orthopaedic encounters from 2007-2011.

Discussion:

With over 6,000 unique cases of elbow arthroscopy included in the results of our database search, this represents a large series of elbow arthroscopy procedures. As expected, all four categories of arthroscopic elbow procedures queried were more common in males and patients in the 40-59 year old range. This is consistent with the clinical observation that elbow arthroscopy is often performed in men with degenerative disease in the elbow. Interestingly, while the overall incidence of elbow arthroscopy procedures was not significantly different by

region, the incidence of diagnostic arthroscopy, debridement, and loose body removal were significantly different than expected by region.

Complications such as infection or nerve injury requiring reoperation are rare but serious sequelae of arthroscopic elbow surgery. The rate of infection requiring operation for elbow arthroscopy in the current study (0.26%) is comparable to that previously reported in database studies of shoulder arthroscopy (0.27%)⁹ and for knee arthroscopy (0.15%)¹⁰. A single surgeon's case series of 100 and another series of 70 elbow arthroscopies reported no complications requiring reoperation^{2,8}, which is not wholly unexpected given the low rate of reoperation and the limited power of such a study. Another single surgeon's case series of 200 procedures had one major complication of ulnar nerve injury requiring nerve exploration¹¹. Another review of 449 patients found a 0.8% rate of septic arthritis following elbow arthroscopy³. However, yet another case series of 417 cases from 3 surgeons found a 4.8% major complication rate, with 2.2% of elbow arthroscopies requiring reoperation for infection¹². All of these retrospective case series must be interpreted with cognizance of the inherent limitations of case series performed by only a few surgeons in a limited geographic area. Additionally, it should be remembered that the rate of complication found in our study is lower than most published overall rates of complication for elbow arthroscopy in that complications managed without reoperation were not included in our study.

Limitations:

Utilizing a database of millions of orthopaedic patients confers a level of statistical power to this study that simply cannot be achieved in conventional chart review studies¹⁰. Still, there exist a number of obvious limitations to this study. Although the study included a search of over 20 million patients with an orthopaedic ICD-9 or CPT code across all four regions of the United States, this does not necessarily provide a representative sample of the entire American population. The patients included all were insured by private insurance, indicating a cohort that may have better access to care than the population as a whole. In addition, patient-specific information, operative report details, post-operative rehabilitation protocols, and outcomes data were unavailable. Also, data regarding regional differences in potential confounding factors such as body mass index and smoking habits was not available, and as with any database search using CPT codes, the results are subject to error introduced by improper coding¹³. With regards to the complication rates, it is difficult to assess the rate of complications not requiring operative intervention, as more common issues such as transient nerve injury or hematoma² may have simply been observed, and would not have resulted in a new entry in the database. Furthermore, we assumed that any nerve exploration procedures within 6 months of the index arthroscopic procedure were to address a complication of the surgery, but there is a small chance that the patient had an unrelated problem in another limb. Nevertheless, these limitations are inherent in most database studies, and should not negate the important demographic information that can be gleaned from this study¹³.

Conclusions:

Overall, the incidence of elbow arthroscopy in the patient population studied is relatively low, and appears to be increasing slightly over time. In this database, elbow arthroscopy

procedures were most commonly performed on males and patients 40-59 years of age. Some regional differences in procedure incidence were found. Furthermore, the rate of complication requiring re-operation was very low at 2.2%, with nerve exploration being the most common re-operation performed.

The information gleaned from this study may be useful in counseling patients on the likelihood of complications following arthroscopic elbow surgery. These data may also be applied to the evaluation of newly adapted practices and technologies. Future studies are warranted to further delineate the influence of demographic variables and surgical procedure on the incidence of postoperative complications necessitating reoperation.

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