

Evolving Patterns of Anesthetic Technique in Total Knee Arthroplasty

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Background

Total knee arthroplasty (TKA) is one of the most commonly performed elective orthopedic procedures in the US

- Practice has shifted toward outpatient and same-day discharge pathways[1]
- CMS removed TKA from the Medicare inpatient-only list in January 2018[2]

Anesthetic options include general, neuraxial (spinal/epidural), and monitored anesthesia care (MAC)/IV sedation, often paired with peripheral nerve blocks

- Neuraxial anesthesia has been associated with fewer short-term complications than general anesthesia in large database studies[3–5]
- ICAROS consensus (2019) favors primary neuraxial anesthesia for knee arthroplasty[6] and recommends peripheral nerve block use (2021)[7]

In this study, we characterize how anesthetic technique for TKA changed over a decade (2010–2020) using a national surgical quality database.

Methods

- **Study Design and Data Source:** Retrospective cohort study using the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) database from 2010–2020
- **Study population:** Adults ≥18 years undergoing total knee arthroplasty, identified by CPT code [27447]; cases missing the anesthetic type variable were excluded, leaving **12,328 patients**
- **Exposure:** Primary anesthetic technique as recorded in NSQIP, classified as **general anesthesia**, **MAC/IV sedation**, or **neuraxial anesthesia** (ex. spinal or epidural)
- **Outcomes:** Overall distribution of anesthetic technique across the study period and annual change in the use of each technique
- **Statistical analysis:** Annual proportions reported as n (%); temporal trends assessed with the Cochran–Armitage test for linear trend, significance set at $p < 0.05$. Analyses performed in IBM SPSS Statistics, version 30 (IBM Corp., Armonk, NY)

Results

- Of 12,328 TKA cases, 6,622 (53.7%) received general anesthesia, 4,177 (33.9%) neuraxial, and 1,529 (12.4%) MAC/IV sedation
- **General anesthesia declined** from 74.9% (2010) to 39.6% (2020) (Cochran-Armitage Z = -22.0, $p < 0.001$)
- **Neuraxial anesthesia increased** from 25.1% to 39.5% (Z = 10.4, $p < 0.001$)
- **MAC/IV sedation increased** from 0% to 20.8% (Z = 18.4, $p < 0.001$)
- General anesthesia fell below 50% of cases by 2018, and neuraxial use reached parity with general anesthesia by 2019–2020

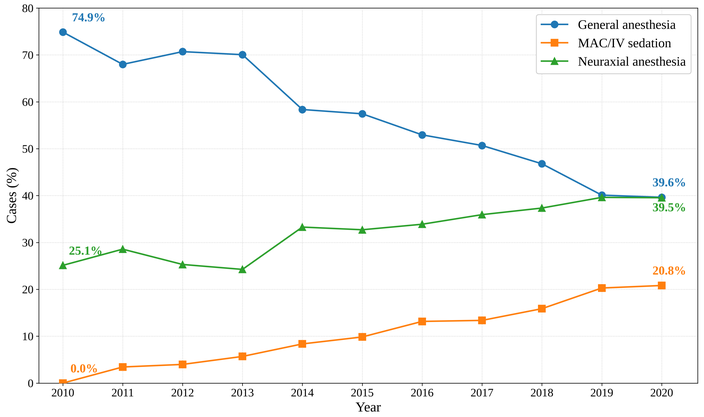


Figure 1. Annual proportion of total knee arthroplasty cases by primary anesthetic technique (general anesthesia, MAC/IV sedation, and neuraxial anesthesia), ACS NSQIP 2010–2020 (n = 12,328).

Year	General, n (%)	MAC/IV Sedation, n (%)	Neuraxial, n (%)	Total, n
2010	161 (74.9%)	0 (0.0%)	54 (25.1%)	215
2011	257 (68.0%)	13 (3.4%)	108 (28.6%)	378
2012	461 (70.7%)	26 (4.0%)	165 (25.3%)	652
2013	751 (70.1%)	61 (5.7%)	260 (24.3%)	1,072
2014	761 (58.4%)	109 (8.4%)	434 (33.3%)	1,304
2015	922 (57.4%)	158 (9.8%)	525 (32.7%)	1,605
2016	861 (53.0%)	214 (13.2%)	551 (33.9%)	1,626
2017	773 (50.7%)	204 (13.4%)	548 (35.9%)	1,525
2018	669 (46.8%)	227 (15.9%)	534 (37.3%)	1,430
2019	591 (40.1%)	299 (20.3%)	584 (39.6%)	1,474
2020	415 (39.6%)	218 (20.8%)	414 (39.5%)	1,047
Total	**6,622 (53.7%)**	**1,529 (12.4%)**	**4,177 (33.9%)**	**12,328**

Table 1. Annual distribution of primary anesthetic technique among adults undergoing total knee arthroplasty, ACS NSQIP 2010–2020. MAC, monitored anesthesia care; IV, intravenous.

Discussion

- Over a decade, general anesthesia lost its majority in TKA, with neuraxial anesthesia reaching parity by 2019-2020
- This shift parallels evidence linking neuraxial anesthesia to fewer short-term complications[3–5]and the 2019 ICAROS recommendation favoring neuraxial anesthesia for knee arthroplasty[6]
- Rapid growth of MAC/IV sedation likely reflects wider use of peripheral nerve blocks and periarticular infiltration within multimodal, opioid-sparing pathways[7]
- The move toward outpatient and same-day TKA, accelerated by the 2018 CMS policy change, favors techniques that allow faster emergence and earlier mobilization[1,2]
- **Limitations:** NSQIP captures only the primary anesthetic, so combined techniques (e.g., neuraxial + general, adjunct nerve blocks) are not distinguished; causality can not be established due tp retrospective nature of data participating hospitals may not reflect national practice

Conclusions

- **Anesthetic practice for TKA shifted away from general anesthesia from 2010 to 2020**
- Neuraxial anesthesia and MAC/IV sedation together accounted for **approximately 60%** of TKA cases by 2020, compared to 25.1% in 2010
- These trends reflect a recalibration of anesthetic care toward faster recovery and patient safety; outcome-focused studies are needed to guide evidence-based anesthetic choice



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