# Risk of nerve injury after shoulder surgery with brachial plexus block: A target trial emulation with Epic Cosmos

Daniel Gessner, MD dangessner@gmail.com
Vikram Fielding-Singh, MD, JD, MS
Franklin Dexter, MD, PhD, FASA
Rakesh Sondekoppam, MBBS

## Introduction

- Relative contribution of surgery or block to nerve injury risk after shoulder surgery is unknown
- Epic Cosmos contains data from 350+ health systems covering 310+ million patients

## Methods

- Included adults without pre-existing nerve injury having elective shoulder surgery with surgical and anesthesia providers who demonstrated variable block practice
- Causal contrast was brachial plexus block vs no block on day of surgery (time zero)
- Propensity scores based on a generalized linear mixed model with random effects for surgical and anesthesia providers and primary procedure
- Inverse probability of treatment weighting targeted average treatment effect in the treated
- Outcome was first documented upper extremity nerve injury through 365 days, with death as a competing event and censoring at loss to follow-up
- Subdistribution hazard ratio from a weighted Fine–Gray model was the primary effect measure

## Results

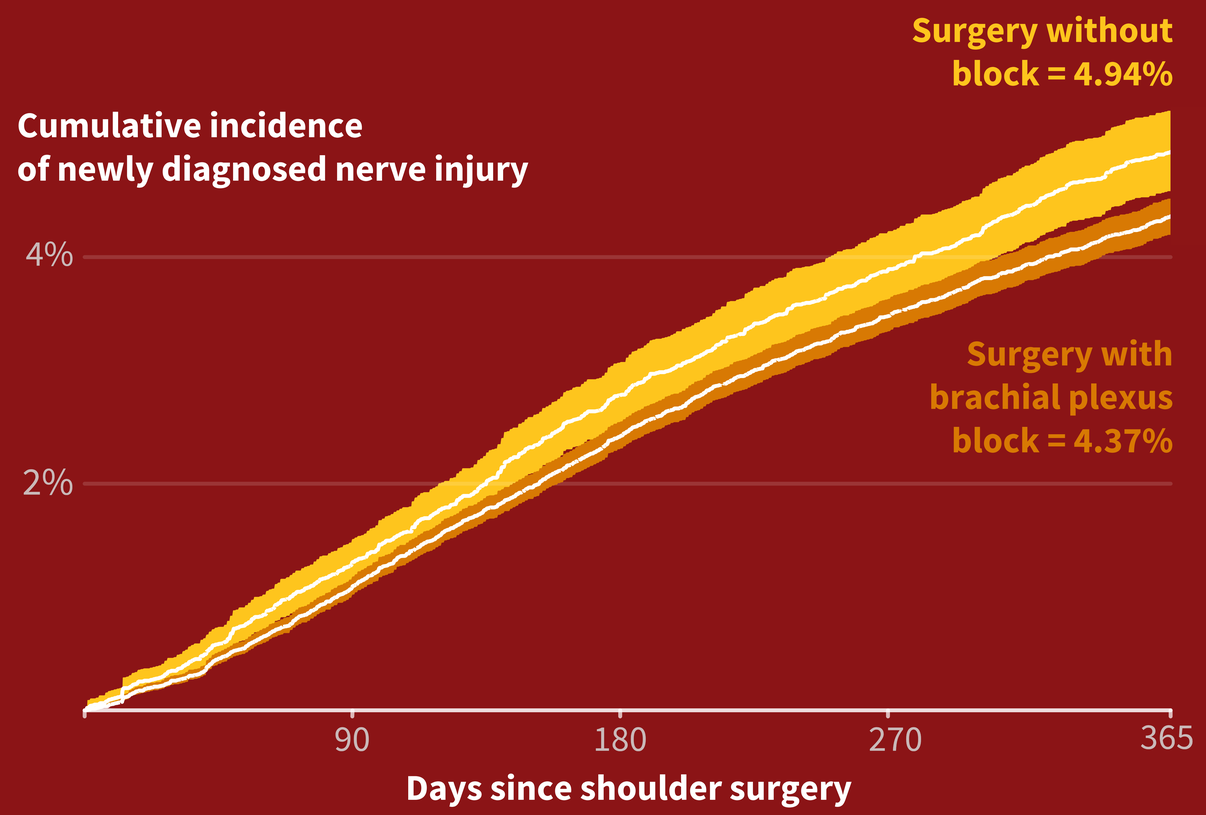
- 70,040 (65.6%) of patients received a block
- All covariates balanced after weighting (ASD < 0.02)
- Block was associated with a 12% lower subdistribution hazard of nerve injury (p = 0.0032)

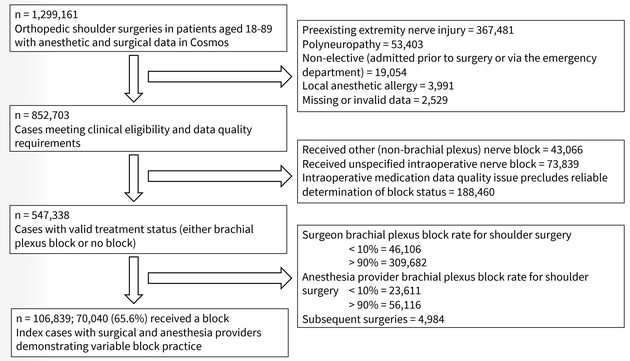
## Discussion

- Among patients of providers without strong block preferences, brachial plexus block for shoulder surgery was not associated with an increase in subsequently diagnosed nerve injury

Stanford MEDICINE
School of Medicine

# In a target trial emulation with **106,839** shoulder surgeries, **brachial plexus block** was **not associated** with increased risk of **nerve injury**




**Patient and surgical covariates and balance, before and after weighting**
Values are expressed as mean (SD) or n (%)

| Covariate | | With block (n = 70,040) | Without block, un-weighted (n = 36,799) | ASD, un-weighted | Without block, IPTW (ESS = 15,300.21) | ASD, IPTW |
|---|---|---|---|---|---|---|
| Age, years | | 58.1 (15.6) | 58.8 (15.9) | 0.048 | 58.0 (15.7) | 0.006 |
| Height, in | | 67.4 (4.1) | 67.2 (4.1) | 0.050 | 67.4 (4.1) | 0.002 |
| Weight, lbs | | 196.1 (46.4) | 195.2 (47.4) | 0.020 | 196.5 (46.6) | 0.009 |
| Language | Other (vs English) | 10,711 (15.3) | 4,581 (12.4) | 0.079 | 12.4 | 0.005 |
| Race | White | 47,195 (67.4) | 25,318 (68.8) | 0.030 | 10,419 (68.1) | 0.015 |
| | AI/AN | 238 (0.3) | 192 (0.5) | 0.031 | 52 (0.3) | <0.001 |
| | Asian | 705 (1.0) | 354 (1.0) | 0.004 | 130 (0.8) | 0.016 |
| | Black | 4,553 (6.5) | 2,377 (6.5) | 0.002 | 977 (6.4) | 0.005 |
| | Multiracial | 5,997 (8.6) | 3,751 (10.2) | 0.058 | 1,293 (8.4) | 0.004 |
| | Missing | 9,723 (13.9) | 4,036 (11.0) | 0.084 | 2,095 (13.7) | 0.005 |
| | Other | 1,629 (2.3) | 771 (2.1) | 0.015 | 335 (2.2) | 0.009 |
| Hispanic/ Latino Ethnicity | Yes | 3,290 (4.7) | 1,669 (4.5) | 0.008 | 683 (4.5) | 0.011 |
| | No | 55,511 (79.3) | 30,280 (82.3) | 0.075 | 12,201 (79.7) | 0.012 |
| | Missing | 11,239 (16.0) | 4,850 (13.2) | 0.078 | 2,416 (15.8) | 0.007 |
| Sex | Male | 39,656 (56.6) | 20,066 (54.5) | 0.042 | 8,648 (56.5) | 0.002 |
| | Female | 29,950 (42.8) | 16,494 (44.8) | 0.042 | 6,569 (42.9) | 0.004 |
| | Ambiguous | 434 (0.6) | 239 (0.6) | 0.004 | 82 (0.5) | 0.010 |
| Anticoagulant use, 1–180 days prior, n (%) | | 6,308 (9.0) | 3,858 (10.5) | 0.052 | 1,415 (9.2) | 0.008 |
| Antiplatelet agent use, 1–180 days prior | | 20,858 (29.8) | 20,858 (29.8) | 0.001 | 4,520 (29.5) | 0.005 |
| Opioid use, 1–30 days prior | | 32,311 (46.1) | 16,786 (45.6) | 0.010 | 7,014 (45.8) | 0.006 |
| Opioid use, 31–180 days prior | | 26,531 (37.9) | 14,284 (38.8) | 0.019 | 5,906 (38.6) | 0.015 |
| VW Elixhauser score | | 3.1 (7.4) | 3.6 (7.9) | 0.070 | 3.2 (7.5) | 0.010 |
| Total intraoperative wRVU, log-transformed | | 2.86 (0.40) | 2.79 (0.43) | 0.192 | 2.86 (0.40) | 0.011 |
| Total concurrent CPT codes | 1 | 30,440 (43.5) | 18,956 (51.5) | 0.162 | 6,689 (43.7) | 0.005 |
| | 2 | 22,124 (31.6) | 10,510 (28.6) | 0.065 | 4,867 (31.8) | 0.005 |
| | 3 | 11,666 (16.7) | 4,932 (13.4) | 0.087 | 2,511 (16.4) | 0.007 |
| | 4 or more | 5,810 (8.3) | 2,401 (6.5) | 0.064 | 1,234 (8.1) | 0.008 |
| Total anatomic regions | Shoulder only | 58,385 (83.4) | 32,075 (87.2) | 0.102 | 12,860 (84.0) | 0.019 |
| | Shoulder + 1 | 11,581 (16.5) | 4,686 (12.7) | 0.102 | 2,424 (15.8) | 0.019 |
| | Shoulder + 2 | 74 (0.1) | 38 (0.1) | <0.001 | 17 (0.1) | 0.001 |

**Cumulative incidence of new upper extremity nerve injury and time-specific risk differences**
All confidence intervals at 99%, with p < 0.01 considered significant after adjustment for multiple comparisons.

| Postop Day | Without block (n = 36,799; 1,518 injuries) | With block (n = 70,040; 2,742 injuries) | Risk ratio | Risk difference | p-value |
|---|---|---|---|---|---|
| 30 | 0.34% (0.23, 0.50) | 0.26% (0.21, 0.31) | 0.75 (0.49, 1.15) | -0.09 (-0.23, 0.05) | >0.01 |
| 90 | 1.31% (1.07, 1.57) | 1.09% (0.99, 1.20) | 0.84 (0.68, 1.04) | -0.21 (-0.48, 0.06) | >0.01 |
| 180 | 2.78% (2.44, 3.16) | 2.42% (2.27, 2.58) | 0.87 (0.75, 1.01) | -0.36 (-0.75, 0.03) | >0.01 |
| 365 | 4.94% (4.48, 5.42) | 4.37% (4.17, 4.59) | 0.89 (0.80, 0.99) | -0.57 (-1.08, -0.05) | 0.005 |

