# Impact of eGFR on Outcomes of Carotid Revascularization Interventions: *A Comparative Analysis*

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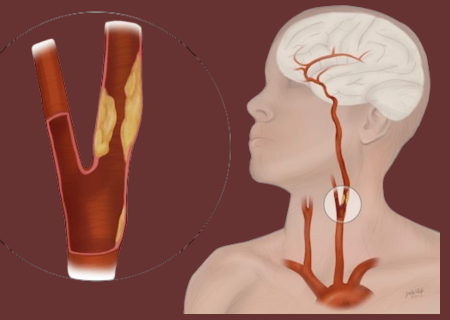
## BACKGROUND

- Carotid revascularization is used to prevent ischemic stroke in patients with carotid artery occlusive disease
- These procedures in patients with Chronic Kidney Disease (CKD) are considered high-risk
- This study addresses the knowledge gap in outcomes for CKD patients undergoing carotid artery endarterectomy (CEA), transfemoral carotid artery stenting (TFCAS), and trans-carotid artery revascularization (TCAR)

## OBJECTIVE

- To determine the optimal approach for carotid revascularization stratified by CKD severity



## METHODS

Retrospective cohort study

**Database:** Vascular Quality Initiative (VQI) from Sept. 2016 – May 2023

**Inclusion criteria:** Patients who underwent CEA and CAS

**Exclusion criteria:** Patients with ESRD

**Comparison Groups:**

- ***Baseline:*** No CKD, and Stage 1, eGFR > 90 mL/min/1.73 m² and Stage 2, eGFR 60-89 mL/min/1.73 m² included
- ***Moderate*:** Stage 3, eGFR 30-59 mL/min/1.73 m²
- ***Severe:*** Stage 4eGFR 15-29 mL/min/1.73 m²

Staging according to National Kidney Foundation's Kidney Disease Outcomes Quality Initiative

**Primary Outcomes (in-hospital):**

- Stroke
- Death
- Stroke/Death

**Secondary Outcomes (in-hospital):**

- Trans-ischemic attack (TIA)
- Myocardial Infarction (MI)
- Extended length of stay (eLOS)
- Combined stroke/death/MI

## RESULTS

- 114,384 patients undergoing CEA (30.5% moderate, 2.5% severe)
- 23709 patients undergoing TFCAS (31.3% moderate, 2.6% severe)
- 42,432 patients undergoing TCAR (35.4% moderate, 2.5% severe)

| | CEA | | | | TFCAS | | | | TCAR | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Moderate CKD | | Severe CKD | | Moderate CKD | | Severe CKD | | Moderate CKD | | Severe CKD | |
| | aOR (95%CI) | P-value | aOR (95%CI) | P-value | aOR (95%CI) | P-value | aOR (95%CI) | P-value | aOR (95%CI) | P-value | aOR (95%CI) | P-value |
| Stroke | 1.05(0.93, 1.2) | 0.392 | 0.91(0.64, 1.3) | 0.596 | 1.08(0.92, 1.27) | 0.355 | 1.32(0.84, 2.07) | 0.234 | 1.15 (0.96, 1.38) | 0.12 | 1.06(0.65, 1.76) | 0.8 |
| Death | 1.33(1.05,1.69) | 0.018 * | 1.96(1.24, 3.10) | 0.004 ** | 1.25(0.97, 1.61) | 0.091 | 1.76(1.01, 3.06) | 0.043 * | 1.31(0.91, 1.87) | 0.134 | 1.12(2.47, 6.85) | <0.001 *** |
| 30 day mortality | 1.3(1.12, 1.56) | 0.001 ** | 2.11(1.57, 2.85) | <0.001 *** | 1.18(0.94, 1.48) | 0.138 | 1.31(0.78, 2.23) | 0.299 | 1.16(0.92, 1.47) | 0.21 | 2.61(1.70, 4.02) | <0.001 *** |
| TIA | 0.99(0.81,1.21) | 0.92 | 1.05(0.60,1.88) | 0.847 | 1.02(0.75, 1.40) | 0.893 | 0.94(0.38, 2.34) | 0.899 | 0.99(0.73, 1.32) | 0.926 | 1.18(0.55, 2.57) | 0.659 |
| MI | 1.22(1.03,1.45) | 0.019 ** | 2.48(1.83, 3.10) | <0.001 *** | 1.37(0.93, 2.01 | 0.117 | 2.71(1.38, 5.33) | 0.004 ** | 1.83 (1.36, 2.48) | <0.001 *** | 2.43(1.30, 4.53) | 0.005 ** |
| Stroke/Death | 1.09(0.97,1.22) | 0.128 | 1.14(0.85, 1.55) | 0.367 | 1.20(1.01, 1.43) | 0.08 | 1.41 (0.95, 2.12) | 0.09 | 1.17(0.99, 1.38)) | 0.06 | 1.77(0.99, 1.38) | 0.002 ** |
| eLOS | 1.03(0.99, 1.08) | 0.102 | 1.42(1.30, 1.56) | <0.001 *** | 0.93(0.85, 1.02) | 0.106 | 1.08(0.89, 1.31) | 0.444 | 0.99(0.95, 1.04) | 0.8 | 1.24(1.08, 1.43) | 0.002 ** |
| Stroke/Death /MI | 1.13(1.03, 1.24) | 0.012 * | 1.49(1.18, 1.89) | <0.001 *** | 1.19(1.01, 1.42) | 0.06 | 1.49(1.04, 2.13) | 0.034 ** | 1.25(1.08, 1.45) | 0.002 ** | 1.91 (1.35, 2.68) | <0.001 *** |

***Table I. Multivariable outcomes for CEA, TFCAS, and TCAR.*** aOR = adjusted odds ratio, CI= confidence interval. TIA = transient ischemic attack, MI= myocardial infarction, eLOS = extended length of stay. All adjusted for demographics (age, gender, race, BMI), comorbidities (hypertension, diabetes, COPD, CHF, CAD, CKD, dialysis, active smoking, ASA class 4/5, 80% or greater degree of ipsilateral stenosis), urgency (elective, emergent, urgent) preoperative medications (P2Y inhibitor, statin, aspirin, beta blocker, ace inhibitor, anticoagulant), and intraoperative variables if applicable (contrast volume, radiation, total procedure time). Reference to normal eGFR group.

| | MODERATE | | | | SEVERE | | | |
|---|---|---|---|---|---|---|---|---|
| | TFCAS | | TCAR | | TFCAS | | TCAR | |
| Outcome | aOR | P-value | aOR | P-value | aOR | P-value | aOR | P-value |
| Stroke | 1.8 (1.4, 2.2) | <0.001*** | 1.4(1.1, 1.7) | 0.001** | 2.0(1.1, 3.7) | 0.015 | 1.2(0.7, 2.2) | 0.462 |
| Death | 3.0 (2.1, 4.3) | <0.001*** | 1.0 (0.8, 1.4) | 0.79 | 2.0(0.9, 4.3) | 0.09 | 2.6 (1.3, 5.3) | 0.007** |
| TIA | 1.4(0.9, 2.2) | 0.156 | 1.0 (0.7 1.4) | 0.94 | 0.5(0,1, 1.8) | 0.295 | 1.0 (0.8, 1.4) | 0.95 |
| MI | 0.8(0.5, 1.2) | 0.323 | 0.6 (0.5, 0.8) | 0.49 | 0.7(0.3, 1.4) | 0.32 | 0.4(0.2, 0.8) | 0.007** |
| Stroke/ Death | 2.3(1.8, 3.0) | <0.001*** | 1.3(1.0, 1.5) | 0.019* | 1.8(1.0, 3.1) | 0.034* | 1.7(1.0, 2.7) | 0.039* |
| Extended LOS | 1.3(1.1, 1.5) | <0.001*** | 0.9(0.8, 1.0) | 0.015* | 1.1 (0.9, 1.6) | 0.281 | 0.9(0.7, 1.0) | 0.09 |
| Stroke/Death/MI | 1.8 (1.4, 2.2) | <0.001*** | 0.9 (0.8, 1.0) | 0.505 | 1.4 (0.9, 2.1) | 0.111 | 1.2(0.8, 1.9) | 0.386 |

***Table II. Multivariable Outcomes comparing TFCAS and TCAR, with reference to CEA.*** aOR = adjusted odds ratio, CI= confidence interval. TIA = transient ischemic attack, MI= myocardial infarction, eLOS = extended length of stay. All adjusted for demographics (age, gender, race, BMI), comorbidities (hypertension, diabetes, COPD, CHF, CAD, CKD, dialysis, active smoking, ASA class 4/5, 80% or greater degree of ipsilateral stenosis), urgency (elective, emergent, urgent) preoperative medications (P2Y inhibitor, statin, aspirin, beta blocker, ace inhibitor, anticoagulant), and intraoperative variables if applicable (contrast volume, radiation, total procedure time).

## LIMITATIONS

- Retrospective study
- ESRD excluded because significant disease burden and risk in all procedures
- Clinical rationale (i.e. indication) for procedure

## CONCLUSIONS

- CEA: significant death, MI, eLOS, and stroke/death/MI in both moderate and severe patients
- TFCAS: in patients with severe CKD had significant adverse outcomes, in death, MI, and stroke/death/MI.
- TCAR: MI and stroke/death/MI were found to be significant in patients with moderate CKD, and death, MI, stroke/death, eLOS, and stroke/death/MI in patients with severe CKD
- Carotid revascularization poses a real risk for patients with CKD undergoing any carotid revascularization, namely for severe patients.
- **CEA may be a safer option** compared to TFCAS and TCAR, for patients with both moderate and severe CKD