

Modeling the Impact of Transcarotid Artery Revascularization versus Carotid Endarterectomy on Operating Room Efficiency and Throughput

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BACKGROUND

- Operating room (OR) efficiency and predictability are key drivers of hospital resource utilization and surgical throughput.
- Carotid endarterectomy (CEA), the historical standard for carotid revascularization, is associated with longer and more variable operative times than transcarotid artery revascularization (TCAR) with the ENROUTETM Transcarotid Neuroprotection System, a minimally invasive carotid stenting approach.
- However, the implications of the differences in OR throughput and surgeon capacity are not well characterized.

OBJECTIVE

To model the potential impact of TCAR versus CEA on daily OR throughput and annual vascular surgeon case volume in the United States.

METHODS

- A deterministic procedural efficiency model was constructed using standardized OR scheduling assumptions.
- Model inputs were informed by clinical expert input and published literature, including published Vascular Quality Initiative (VQI) data.
- Total cycle time per case was defined as the sum of operative, anesthesia, and turnover time.
- Model outcomes included total cycle time, cases per day, and annual surgeon case volume.
- Scenario analyses were conducted to evaluate variability in operative efficiency.

Operative Time Inputs:

Statistic	TCAR	CEA
Median	66 minutes	110 minutes
IQR	51-85 minutes	86-139 minutes

Source: Columbo et al., 2022

OR Scheduling Input Parameters:

Parameter	Value
OR block schedule	7:30 AM – 5:00 PM <i>(with 30-minute lunch)</i>
Anesthesia time per case	30 minutes
Turnover time per case	30 minutes
Annual surgeon OR availability	144 days <i>(assumes 3 days/week, 48 weeks/year)</i>

Scenario Analyses:

- Base case: median operative time, standard turnover time.
- Scenario 1 – Faster day: 25th percentile operative time, 20% shorter turnover time.
- Scenario 2 – Slower day: 75th percentile operative time, 20% longer turnover time.

RESULTS

The base case total cycle time was 126 minutes for TCAR and 170 minutes for CEA, a difference of 44 minutes per case (**Figure 1**), enabling 4 versus 3 potential full cases per OR day, respectively (**Figure 2**).

Across scenario analyses, TCAR supported 1-2 additional full cases per day compared to CEA, extrapolating to approximately 144 - 288 additional OR cases annually per vascular surgeon.

Operative time variability was lower for TCAR, with an IQR of 34 minutes for TCAR and 53 minutes for CEA, a 35.8% narrower spread for TCAR (**Figure 3**).

Figure 1. Cycle Time Breakdown per Case for TCAR vs. CEA in Minutes

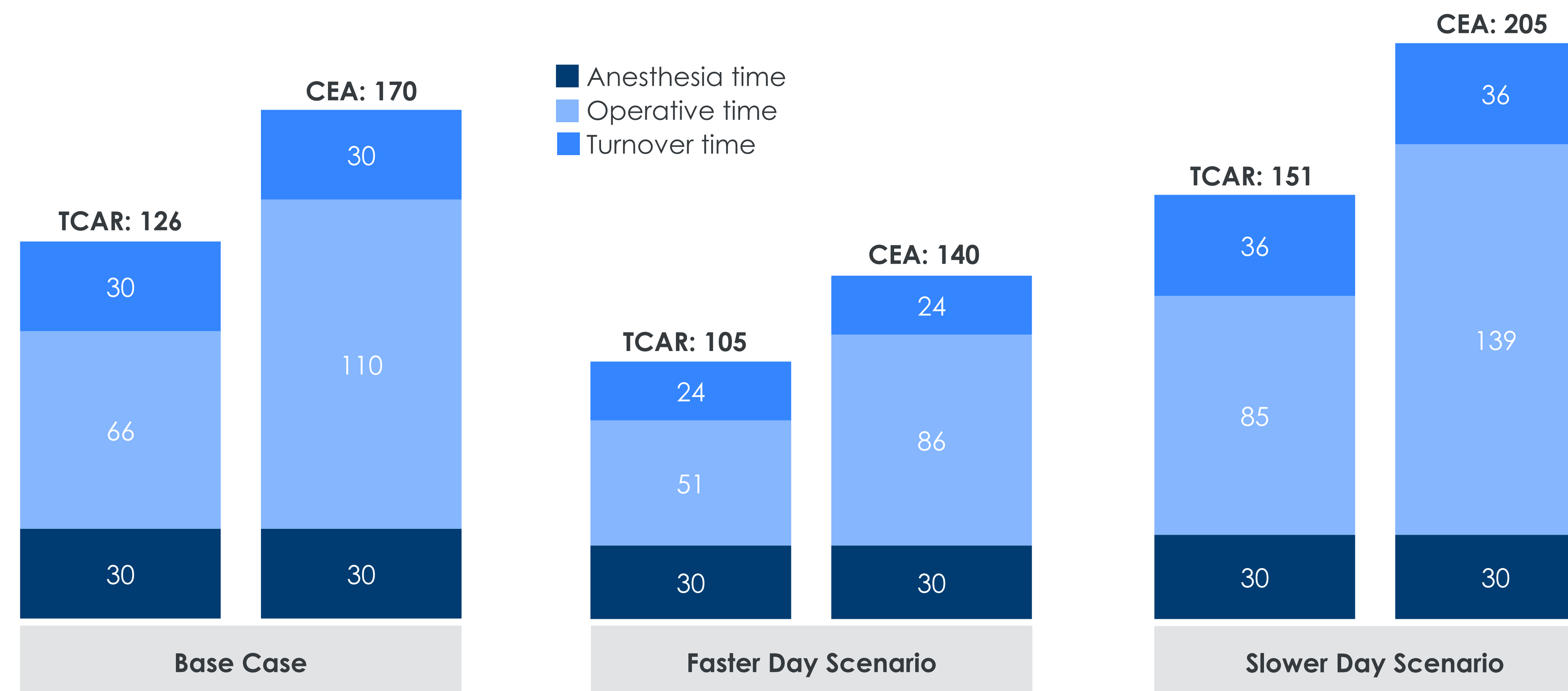


Figure 2. Base Case Modeled OR Throughput per Day for TCAR vs. CEA

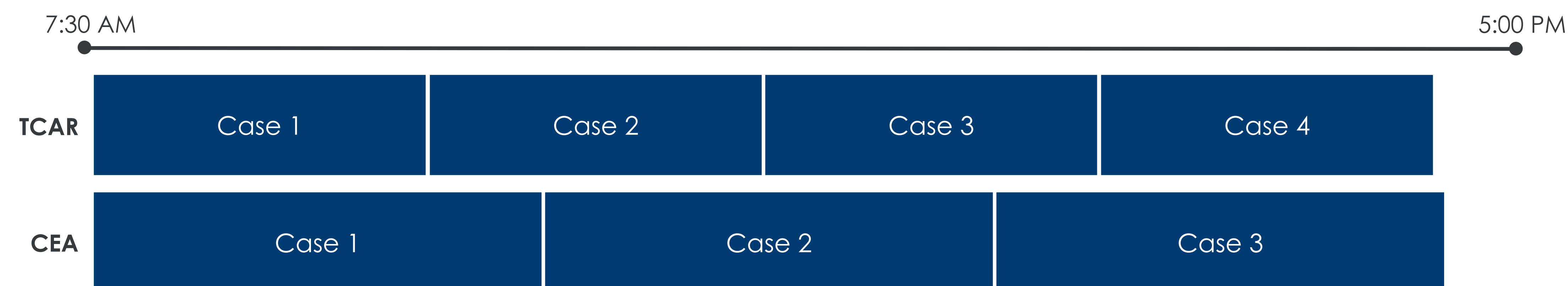
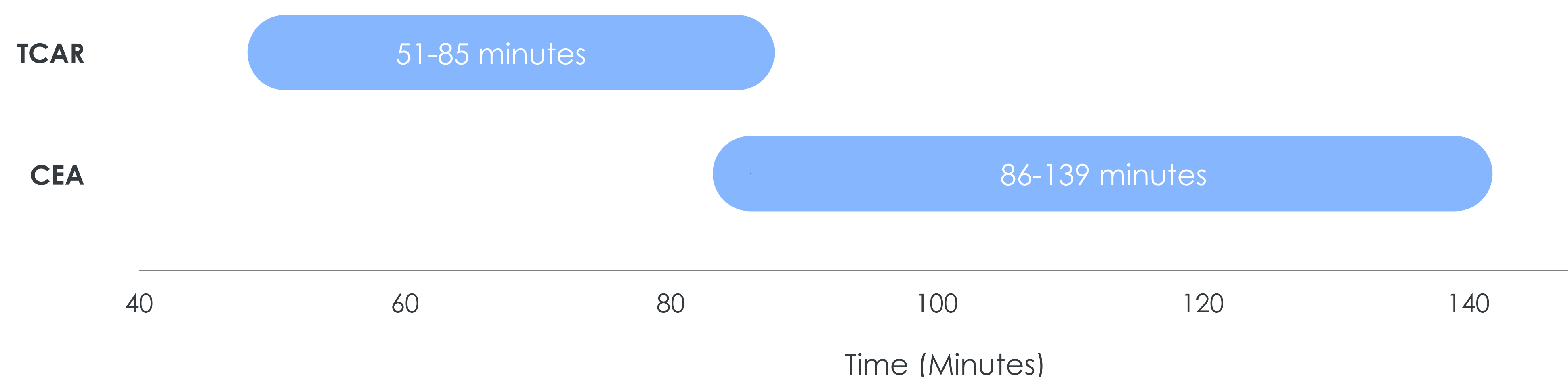


Figure 3. Operative Time IQR for TCAR vs. CEA



CONCLUSIONS

- TCAR's shorter, more consistent OR time may improve predictability and enable 144-288 additional OR cases annually per vascular surgeon compared with CEA.
- From a hospital perspective, the projected increase in effective OR capacity can be redeployed to additional TCAR procedures or other urgent, high-priority cases, enhancing patient access and economic value.
- Future research should validate these findings in real-world settings and measure the impact of procedural efficiency on downstream clinical and economic outcomes.

LIMITATIONS

- Results are derived from a deterministic model and may not fully reflect real-world OR availability or workflow complexity.
- Operative times and scheduling parameters were based on published data and expert clinical input and may not be generalizable across institutions or healthcare systems.
- The model assumed continuous case scheduling within a fixed OR block and did not account for cancellations, add-ons, or delays.
- TCAR was assumed to be performed under general anesthesia; however, it may also be performed under local anesthesia in clinical practice.

REFERENCE

Columbo JA, Martinez-Cambor P, Stone DH, Goodney PP, O'Malley AJ. Procedural Safety Comparison Between Transcarotid Artery Revascularization, Carotid Endarterectomy, and Carotid Stenting: Perioperative and 1-Year Rates of Stroke or Death. *J Am Heart Assoc.* 2022;11(19):e024964.

DISCLOSURES

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