Factors Associated with Operating Room Time in Adult Tracheostomy: Experience from a Resource-Limited Country

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BACKGROUND & OBJECTIVES

- **High Volume & Surgical Variability:** Over 100,000 adult tracheostomies are performed annually in the U.S. Operative duration varies widely, straining OR scheduling, resource utilization, and trainee education.
- **Clinical Safety Imperative:** Prolonged surgical duration independently predicts higher complication rates, surgical site infection, and longer hospital stays.
- **The BMI Misconception:** Obesity is commonly blamed for procedural difficulty, but body habitus does not equal local cervical anatomy.
- **Study Objective:** Simultaneously evaluate bedside examination, CT radiologic metrics, clinical history, and system/training factors to identify true independent predictors of operating time in isolated adult open tracheostomy.

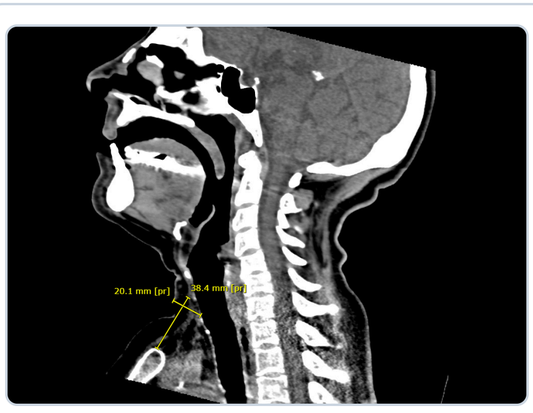
METHODS & STUDY COHORT

- **Study Design:** Single-center retrospective observational cohort study (Jan 2020 – Dec 2025; IRB BIO-2025-0256).
- **Surgical Standardization:** Isolated open adult tracheostomy using a standardized Bjork-flap technique.
- **Cohort Division (N = 192):** OR start-to-finish time analyzed continuously and dichotomized at cohort mean (60 min).

192	108	84
Total Tracheostomies	≤ 60 min (Shorter)	> 60 min (Longer)

- **Statistical Analysis:** Univariate (χ^2, Fisher exact, t-tests, Pearson correlation) followed by multivariable logistic regression (outcome: OR time > 60 min) and multivariable linear regression (continuous OR minutes) using SPSS v29.

ANATOMICAL MEASUREMENTS: PREOPERATIVE CT



Sagittal CT: pretracheal skin-to-trachea depth



Axial CT: transverse cervical dimensions

$$\text{Circumference} \approx \pi \times \sqrt{\frac{\text{AP}^2 + \text{Transverse}^2}{2}}$$

Elliptical approximation of neck circumference from the two axial CT diameters (AP & transverse).

Figure 1: Preoperative CT measurements. Sagittal view demonstrates pretracheal soft-tissue (skin-to-trachea) depth; axial view shows transverse and anteroposterior cervical dimensions. Increased skin-to-trachea distance independently predicted operative time (+0.45 min/mm, p < 0.01; adjusted OR 1.04/mm, p = 0.031).

WHAT DID NOT PREDICT OPERATIVE TIME

Neither overall body habitus, systemic comorbidities, nor trainee experience drove surgical duration:

Variable Category	Evaluated Parameters	P-Value / Significance
Body Habitus	Body Mass Index (BMI)	p = 0.169 (Non-Significant)
Demographics	Age (p = 0.894), Sex (p = 0.316)	p > 0.05 (Non-Significant)
Trainee Level	Resident PGY Level (PGY-2 vs 3 vs 4)	p = 0.490 (Non-Significant)
System/Schedule	Time of Day (p = 0.082), Time of Year (p = 0.529)	p > 0.05 (Non-Significant)
Comorbidities	Smoking, CKD, Anticoagulants, Prior Surgery	p > 0.05 (Non-Significant)

*Note: Attending surgeon individual workflow was statistically significant (one-way ANOVA p = 0.03).

MULTIVARIABLE ANALYSIS & INDEPENDENT PREDICTORS

After multivariable adjustment across demographic, clinical, physical, radiologic, and system domains:

Predictor Parameter	Domain / Clinical Metric	Adjusted Odds Ratio (95% CI)	Linear Time Impact
Short Neck	**Bedside (< 2 finger breadths)**	**OR 2.13 (p = 0.046)**	**+6 to 8 min (p < 0.05)**
Skin-to-Trachea Distance	**Preoperative Sagittal CT (mm)**	**OR 1.04 / mm (p = 0.031)**	**+0.45 min / mm (p < 0.01)**
Stiff Neck	C-Spine extension limitation	Non-independent in Logistic	**+10 to 12 min** (p < 0.01)
Neck Infection	Preoperative active infection	p = 0.003 (Sparse events)	Univariate: +29.1 min
Neck Circumference	Preoperative axial CT (per cm)	Non-independent in Logistic	**+0.56 min / cm** (p = 0.037)
Submental Fat	Bedside (present)	Mediator (not independent)	**+6.2 min** (p = 0.061)

SUBMENTAL FAT: AN INTERFACE, NOT A CAUSE

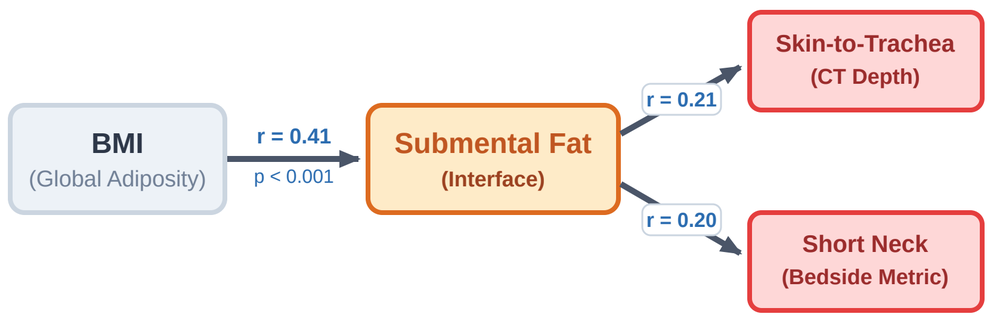


Figure 2: Submental Fat Mediation Framework. Submental fat tracks global body mass index (r = 0.41, p < 0.001) but is not an independent cause of prolonged OR time. Its effect is mediated through coexisting local neck anatomical features.

CONCLUSIONS & ACTIONABLE TAKEAWAYS

- **Local Anatomy Over Global Habitus:** Surgical difficulty and operative time in adult tracheostomy are driven by local neck geometry, not patient BMI, age, sex, or resident training level.
- **Two Primary Independent Predictors:**
  - *Bedside Exam:* Short neck (< 2 finger breadths between cricoid and sternal notch)
  - *Preoperative CT:* Increased skin-to-trachea distance at cricoid level
- **Optimized OR Management:** Screening patients for localized neck geometry preoperatively allows for precise OR scheduling, staff allocation, and anticipation of technical difficulty, especially in resource-limited settings.
- **Future Direction, Predictive Nomogram:** A nomogram combining all associated variables (not only the independent predictors) to predict OR time preoperatively for better scheduling and fewer wasted resources:
  - Short neck
  - Skin-to-trachea distance
  - Neck circumference
  - Neck stiffness
  - Submental fat
  - Neck infection

STUDY LIMITATIONS

- **Retrospective Design:** Single-center retrospective cohort subject to documentation limits.
- **OR Time Scope:** Recorded time measured total OR duration (start to finish, including positioning/anesthesia), not isolated surgical dissection.
- **Generalizability:** Findings apply to elective isolated open adult tracheostomies (excluding pediatric, emergency, or percutaneous procedures).