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Seeger Symposium: Part 1

Pro: Complex Endovascular and Open Aortic Care Should be Centralized to High-Volume Centers

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Disclosure

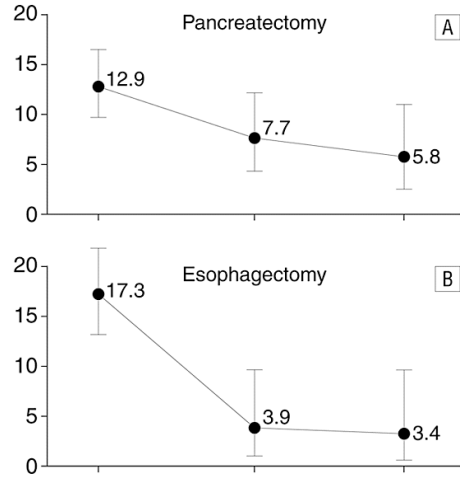
- None

Why Debate the Topic At All? Because…

- It is important
  - ➔OUTCOMES MATTER
- It is timely
  - ➔CASES ARE BECOMING MORE COMPLICATED
  - ➔PATIENTS ARE OLDER AND SICKER
  - ➔FASTER EVOLUTION OF NEW (COMPLEX) TECHNOLOGIES
- Do others know something we don’t?
  - ➔REGIONALIZATION ALREADY EXISTS GLOBALLY
- Data and evidence support it
  - ➔NO COMPELLING REASON NOT TO DO IT

Volume-Outcome Effect

- Well-established, abundant evidence, across different types of major surgeries
  - SEER Registry: 5013 major cancer surgeries (**pancreatectomy**, **esophagectomy**, pneumonectomy, hepatectomy, pelvic exenteration) (Begg CB, JAMA 1998)
  - NIS: 2.5 million patients over 14 different cardiovascular and major cancer surgeries (Birkmeyer JD, NEJM 2002)



Procedure	Hospital Volume				
	Very Low	Low	Medium	High	Very High
Coronary-artery bypass grafting					
Observed mortality rate (%)	6.1	5.5	5.3	5.1	4.8
Unadjusted odds ratio (95% CI)	1.0	0.91 (0.86–0.97)	0.88 (0.82–0.93)	0.84 (0.79–0.90)	0.79 (0.73–0.86)
Adjusted odds ratio (95% CI)	1.0	0.92 (0.86–0.98)	0.89 (0.83–0.95)	0.84 (0.78–0.90)	0.79 (0.73–0.86)
Aortic-valve replacement					
Observed mortality rate (%)	9.9	9.2	9.1	8.7	7.6
Unadjusted odds ratio (95% CI)	1.0	0.91 (0.84–0.99)	0.91 (0.84–0.99)	0.87 (0.80–0.95)	0.75 (0.65–0.85)
Adjusted odds ratio (95% CI)	1.0	0.92 (0.85–0.99)	0.91 (0.84–0.99)	0.84 (0.77–0.92)	0.75 (0.66–0.86)
Mitral-valve replacement					
Observed mortality rate (%)	16.1	15.0	14.4	13.4	12.5
Unadjusted odds ratio (95% CI)	1.0	0.92 (0.84–1.01)	0.87 (0.79–0.97)	0.81 (0.73–0.90)	0.74 (0.66–0.84)
Adjusted odds ratio (95% CI)	1.0	0.91 (0.83–1.00)	0.86 (0.78–0.96)	0.79 (0.71–0.88)	0.74 (0.65–0.84)
Carotid endarterectomy					
Esophagectomy					
Observed mortality rate (%)	23.1	18.9	16.9	11.7	8.1
Unadjusted odds ratio (95% CI)	1.0	0.78 (0.63–0.95)	0.68 (0.54–0.86)	0.44 (0.35–0.55)	0.29 (0.21–0.40)
Pancreatectomy					
Observed mortality rate (%)	23.1				8.1
Unadjusted odds ratio (95% CI)	1.0				0.29 (0.21–0.40)
Adjusted odds ratio (95% CI)	1.0				0.36 (0.26–0.50)
Pancreatic resection					
Observed mortality rate (%)	17.6				3.8
Unadjusted odds ratio (95% CI)	1.0				0.18 (0.13–0.26)
Adjusted odds ratio (95% CI)	1.0				0.20 (0.14–0.29)
Nephrectomy					
Elective repair of abdominal aortic aneurysm					
Observed mortality rate (%)	7.8				4.4
Unadjusted odds ratio (95% CI)	1.0				0.54 (0.49–0.60)
Adjusted odds ratio (95% CI)	1.0				0.58 (0.53–0.65)
Cystectomy					
Unadjusted odds ratio (95% CI)	1.0	0.99 (0.84–1.17)	0.76 (0.62–0.93)	0.69 (0.57–0.84)	0.44 (0.35–0.54)
Adjusted odds ratio (95% CI)	1.0	1.00 (0.84–1.18)	0.78 (0.64–0.96)	0.71 (0.58–0.86)	0.46 (0.37–0.58)
Pulmonary lobectomy					
Observed mortality rate (%)	6.4	5.9	5.5	5.3	4.2
Unadjusted odds ratio (95% CI)	1.0	0.91 (0.83–1.01)	0.85 (0.76–0.94)	0.81 (0.73–0.90)	0.64 (0.55–0.75)
Adjusted odds ratio (95% CI)	1.0	0.94 (0.85–1.04)	0.89 (0.80–0.99)	0.87 (0.78–0.97)	0.70 (0.60–0.81)
Pneumonectomy					
Observed mortality rate (%)	17.0	15.4	15.7	15.0	10.6
Unadjusted odds ratio (95% CI)	1.0	0.89 (0.75–1.06)	0.91 (0.77–1.08)	0.86 (0.73–1.02)	0.58 (0.47–0.73)
Adjusted odds ratio (95% CI)	1.0	0.91 (0.76–1.08)	0.93 (0.78–1.11)	0.91 (0.76–1.08)	0.62 (0.50–0.77)

What about Open AAA Repairs?

- NIS 1996-1997 (Dimick JB, Ann Surg 2002)
- 13,887 AAA repairs in 507 hospitals
- High-volume hospital defined as **>30 intact AAA repairs/year**
  - 15% high-volume
  - 85% low-volume
- In-hospital mortality (high vs. low volume)
  - Intact/elective 3.1% vs 4.7% (RR 1.54, p<.001) across age and gender

What about Open **Complex** AAA Repairs?

- VQI 2003-2016 (O'Donnell TFX, Ann Surg 2020)
- 3470 open **juxtarenal** AAA repairs
- Yearly volume-based definitions
  - High >14 cases
  - Low <4 cases
- 30-day mortality
  - High:
  - Low:

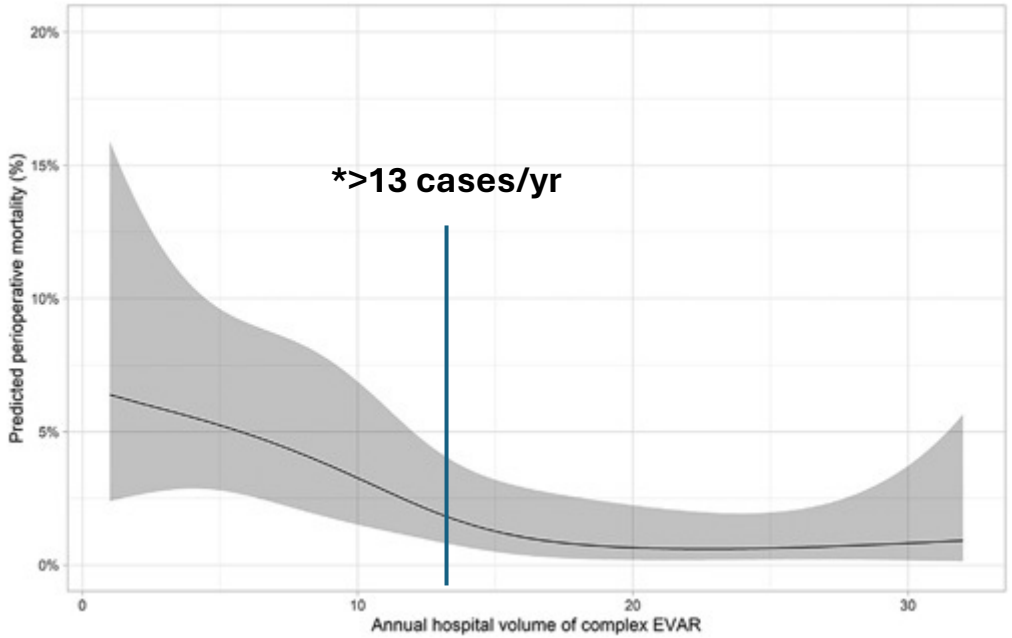
AAA	3.6%
	7.1% (p=.02)

Juxtarenal	3.9%
	9.0% (p<.01)

- AKI: High 18% vs. Low 28% (p=.03)
- High-volume hospitals ➔ retroperitoneal exposure, renal bypasses, iliac anastomoses, renal protection

What about cEVAR?

- Dutch Surgical Aneurysm Audit (2016-2020)—a nationwide mandatory quality registry (98.4% capture rate) (Alberga AJ, Ann Surg 2021)
- 694 intact cAAA (539 FEVAR, 155 BEVAR) over 28 hospitals
- Yearly volume-based definitions
  - High >23 cases
  - Low <9 cases
- Perioperative mortality
  - High* 2.5% (>13 cases/yr)
  - Low 9.1%
  - Other risk factors: aneurysm size, gender



Ruptured AAA—the most “Complex” scenario

- There are “ruptures”, and then there are RUPTURES
- What is the early natural history of (quasi)stable, contained ruptured AAA? (Lloyd GM, JVS 2004)
  - 56 patients with ruptured AAA, unrepaired per surgeon decision
  - Median time to hospital from onset of symptoms: 2.5 hours (range, 44 min – 36 hours)
  - Time to death after admission: <2 hours 13%, >2hours 87%
    - Median time to death: 10.75 hours (range, 1-144 hours)

  ➔ Median time to death from onset of symptoms: 16.5 hours

Is there a Volume-Outcome Effect for rAAA?

- Systematic review and meta-analysis (Kontopodis N, EJVEVS 2021)
- 81,743 rAAA reported in 12 studies (LVH 48%, HVH 52%)
- Overall mortality: LVH 43%, HVH 36% (OR 1.4, 1.2-1.6, p<.001)
- Mortality based on treatment: LVH vs. HVH
  - OAR: 44% vs. 38%, OR 1.5 (1.3-1.8, p<.001)
  - EVAR: 41% vs. 30%, OR 1.6 (1.1-2.4, p=.01)
- No difference between Low vs. High volume **surgeons**

Survival after rAAA is More than the Repair

- VQI 2010-2020 (D'Oria M, JVS 2022)
- All EVAR (n=3188) and OAR (n=1961)
- Relationship between "Failure to Rescue" (FtR) and hospital volume
- Mortality: EVAR 16.5%, OAR 28.9%
- Morbidity: EVAR 45%, OAR 70%
- Mortality from FtR: EVAR 14%, OAR (26%)
  - OAR: Low vs. High-Volume Odds Ratio 0.57 (.4-.9, p=.017)
  - EVAR: Low vs. High-Volume NS

Conclusions

- HIGHER volumes result in BETTER outcomes
- True for OPEN, EVAR
- True for INTACT, RUPTURED
- The future is REGIONALIZATION