Practical Topics in the World of Cardiothoracic Anesthesiology

Guiding the future of patient care

1

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2

Anesthesia in the "Creeping Cardiac" World

- The Structural Heart and Electrophysiology Labs

3

Topics

- Catheterization Procedures
  - Angiography/Angioplasty/Stents
  - Valvuloplasty
  - Mitral Clip
  - TAVR
- Electrophysiology Procedures
  - Anesthetic Impacts on Electrophysiology
  - Pacemaker Management
  - Pacer/ICD Implantation
  - Generator Change
  - Lead Removal
  - Cardioversion
  - VT Ablation
  - SVT Ablation
  - Afib Ablation

4

Catheterization Procedures

- Angiography/Angioplasty/Stents
- Percutaneous Closure of ASD
- Valvuloplasty
- Mitral Clip
- TAVR
- Thromboembolectomy

5

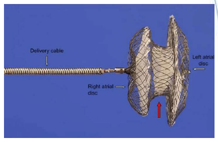
Catheterization Procedures

- Angiography/Angioplasty/Stents
  - Typically performed with light sedation and local anesthesia
  - Anesthesiology called due to multiple comorbidities, heart failure, respiratory distress, acute MI
- Patient's NPO status may lead to ETT being preferred over LMA if continuation of light sedation is not possible
- When called due to iatrogenic pericardial effusion without infectious concern, consider pericardiocentesis by cardiology with the blood returned directly to a patient IV
- Collaboration is key when called non-emergently

6

Catheterization Procedures

- Percutaneous Closure of ASD
  - TEE is used
  - GETA
  - Possible Complications
    - Arrhythmias
    - AV Conduction defect
    - Device Embolization
    - RV dysfunction and pulmonary hypertension may worsen

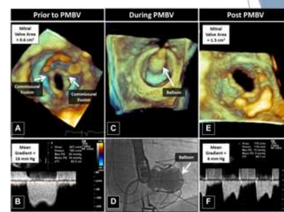


Amplatzer Septal Occluder Device

7

Catheterization Procedures

- Valvuloplasty (Success Rate ~85%)
  - General or MAC depending on the patient conditions
    - If TEE, then general
    - High institutional variation
  - Transient acute decrease in cardiac output
  - Complications for Mitral Valve
    - Regurg (8%)
    - ASD (2%)
    - Stroke (<1%)
    - Valve rupture (<1%)
    - Tamponade (<1%)
    - Conduction Issues (<1%)

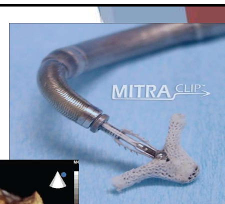


Vainrib, A, et al. Multimodality Imaging of Bioprosthetic Percutaneous Balloon Valvuloplasty Followed by Valve-in-Valve Implantation for Mitral Stenosis Due to Commissural Leaflet Fusion. J Am Coll Cardiol Intv. 2016 https://doi.org/10.1016/j.jcin.2015.11.043

8

Catheterization Procedures

- Mitral Clip
  - A-line per patient condition and ACT practices
  - TEE
  - GETA
  - Complications (<3.5% major adverse events)
    - Mortality (<0.1%)
    - Persistent ASD (50% at 6mo 25% at 12mo)
    - Mitral Stenosis (15%, range 1-35%)
    - Myocardial Infarction (0-3%)
    - Damage to chordae or leaflet (0-2%)
    - Stroke (0-1%)
    - Clip embolization (0.1-0.7%)
    - Pericardial Effusion (0-0.5%)

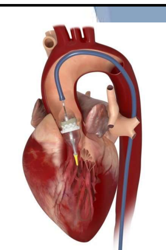



Annals of Cardiac Anaesthesia17(1):17-22, January-March 2014.

9

Catheterization Procedures

- TAVR
  - Blood Available
  - Large Bore PIV
  - Arterial line (varies on whether accessed by cardiology vs anesthesiology)
  - Echocardiography
  - General and MAC both used
  - Complications
    - Mortality (1.5%)
    - Myocardial Infarction (0.5%)
    - Perivalvular leak (1.75%)
    - Stroke (<2%)
    - AV Node Dysfunction (14% from 2008-2018)
    - Myocardial stunning from rapid pacing
    - Pericardial Effusion


TAVR procedure: the illustration shows the new aortic valve being placed in position with a cardiac catheter Source: Edwards Lifesciences

10

Electrophysiology Procedures

- Anesthetic Impacts on Electrophysiology
- Pacemaker Management
- Pacer/ICD Implantation
- Generator Change
- Lead Removal
- Cardioversion
- VT Ablation
- SVT Ablation
- Afib Ablation

11

Electrophysiology Procedures

- Anesthetic Impacts on Electrophysiology
  - Propofol
    - minimal effects on QT interval and conduction system.
    - represses catecholaminergic activity,
    - inhibits ion channels of myocardium.
  - Volatile anesthetics
    - Some prolongation effects on QT interval
    - Use with propofol will reverse its effect on QT interval
    - Reduction of ischemic and reperfusion arrhythmias
  - Dexmedetomidine
    - may suppress supraventricular arrhythmias


12

Electrophysiology Procedures – Pacemaker Management

https://www.verywellhealth.com/living-with-a-pacemaker-1746228

- Yes/No Defibrillator
- Will there be electromagnetic Interference
  - Will Interference be of significant duration
  - Will the pathway be within 15cm of the device or leads
- Is the patient pacemaker dependent?
- Who manufactures the pacemaker?
- Will a magnet do what you want and is it feasible for the procedure?
- Assess available data: EKG, CXR, Interogation Report, Cardiology Notes
  - Pacemaker App (pacemakerid.com)

13

Electrophysiology Procedures – Pacemaker Management

- If you are disabling defibrillation, then consider applying cutaneous defib pads
- Magnet Application
  - If defibrillator, then disables defib function only (magnet does not impact pacing functions)
    - If this is a Boston Scientific PRIZM Device, Tachy Therapy may also be impacted
    - Boston Scientific and Medtronic give audio feedback with magnet placement
  - If no defibrillator and is NOT Biotronik, then asynchronous pacing should begin
  - If no defibrillator and is Biotronik, then asynchronous pacing may not be maintained
  - Default Rates for pacemakers without defibrillators (note: this may be changed)
    - Medtronic 85 bpm
    - Boston Scientific 100 bpm
    - St. Jude 100 bpm
    - Sorin 96 bpm
- Consider the patient's native rate prior to initiating asynchronous pacing

14

Electrophysiology Procedures – Pacemaker Management

https://link.springer.com/chapter/10.1007/978-3-030-95259-4_26

- When to interrogate post-operatively
  - Pre-op programming changes
  - External defibrillation was used
  - Possible device damage or dysfunction
  - If otherwise clinically indicated
  - Consider if magnet was applied intraoperatively
- Manufacturer Contacts
  - Medtronic (800) 878-5616
  - Guidant/Boston Scientific (800) 227-3422
  - St. Jude (800) 722-3423
  - Biotronik (800) 547-0394
  - Sorin (877) 663-7674

15

Electrophysiology Procedures – Pacemaker Management

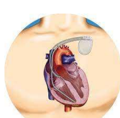
https://www.medgadget.com/2016/04/medtronics-tiny-micra-leadless-pacemaker-approved-in-u-s.html

- Leadless Pacemakers
  - Medtronic Micra
    - Does not respond to magnet
    - Modes:
      - VVI, VVIR, VOO, OVO, OFF
  - Medtronic Micra AV
    - Does not respond to magnet
    - Modes:
      - VVI, VVIR, VOO, OVO, OFF
      - Plus – VDD, VDI (atrial sensing via accelerometer)
  - Abbott Aveir
    - Does (by default) respond to Magnet
      - Initially 100 bpm and then rate depends on battery charge between 100bpm and 85 bpm
      - Modes:
      - VVI, VOO

16

Electrophysiology Procedures

- Pacer/ICD Implantation
  - placed percutaneously under mild to moderate sedation
  - For ICD testing by delivering shocks, deep sedation or general anesthesia
  - For ICDs, Defib pads
    - Defib after inducing Vfib
    - Possible pacing due to bradycardia after defib
  - Complications
    - Cardiac perf
    - Myocardial Injury
    - Stroke
    - Pneumothorax due to Subclavian Access



https://www.medtronic.com/us-en/patients/treatments-therapies/icd-devices/implant-procedure.html

17

Electrophysiology Procedures

- Generator Change
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  - For ICD testing by delivering shocks, deep sedation or general anesthesia
  - For ICDs, Defib pads
    - Defib after inducing Vfib
    - Possible pacing due to bradycardia after defib

18

Electrophysiology Procedures

- Lead Extraction (note: removal refers to a procedure for a lead <1yr old)
  - MAC for Low Risk, GETA for Intermediate and High Risk
  - High Institutional Variation with Intermediate and High Risk
    - A-Line, Vascular Access, TEE, Blood Availability
  - Low Risk (EROS Scale)
    - Pacer Leads <15yrs old, ICD Leads <10yrs old
    - Not Dual Coil ICD Leads
  - High Risk
    - Pacer Leads >15yrs old, ICD Leads >10yrs old
    - Dual Coil ICD Leads
- Intermediate Risk – Otherwise meet low risk criteria but with the following patient conditions
  - Congenital heart disease
  - Initial Implant when patient was <15yo
  - Cr >2mg/dL
  - WBC > 12, Positive Blood Culture, Vegetations on Echo
  - NYHA Class IV
- Reasons for extraction
  - Infection (~53%)
  - Lead recall/malfunction
  - Venous access issues
  - Severe TR
  - MRI/radiotherapy

19

Electrophysiology Procedures

- Cardioversion
  - Without TEE
    - Supplemental oxygen
    - Airway equipment available
    - Bite block in place
    - Very brief (less than a minute): Deep sedation vs General without airway
    - Prepare for bradycardia if cardioversion is successful and patient is beta blocked
  - With TEE
    - Same as above, except to procedure lasts longer
    - Consider topicalization to reduce the sedation requirement

https://acls.com/articles/about-synchronized-cardioversion/

20

Electrophysiology Procedures

- Ablation Procedures
  - Potential Complications (Intra-op Consideration)
    - Cardiac Perforation +/- Tamponade,
    - Valve Damage,
    - Heart Block,
    - Myocardial Infarction,
    - Thromboembolism
    - Esophageal Thermal Injury (Esophageal Temp Sensor)
    - Fluid Overload during RFA procedures (Consider Lasix)
  - Defibrillation pads in place

21

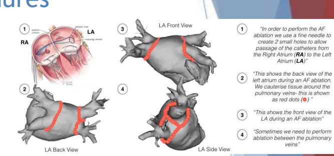
Electrophysiology Procedures

- VT Ablation
  - Often, light sedation for the mapping portion of procedure then deepen
    - Epicardial ablation typically general anesthesia
    - Endocardial typically MAC for stable, general for less stable patients
  - Often with arterial line
  - Support of hemodynamics during electrical stimulation (PES/NIPS/CIED)
  - End organ disfunction in unstable VT patients (lactate, potassium, etc.)
- SVT Ablation
  - Typically, under moderate sedation

22

Electrophysiology Procedures

- Afib Ablation
  - GETA
  - High frequency jet ventilation (HFJV) can reduce chest wall movement and left atrial volume changes
  - A-line only if patient condition warrants
  - 2nd PIV, heparinization indicated
  - No paralysis redosed after induction to monitor phrenic nerve
  - Esophageal temperature probe
  - Minimize fluids (Lasix may be needed)



https://www.melbourneheartrhythm.com.au/learn/procedures/13-atrial-fibrillation-ablation?showall=1

23

Afib Ablation Early Complications

Pericardial effusion (1.2-1.3%)	Stroke (1-2% within 24 hrs)	Phrenic nerve palsy (right)(<0.5%)
• Tamponade (0.9%) • Immediate perc. Drainage • Consider anticoagulation reversal	• Risk increases with left atrial size • Observe for signs after emergence	• During right pulmonary vein and/or SVC isolation • Higher risk with cryo than RF ablation

24

Afib Ablation Delayed Complications

Pulmonary vein stenosis

Historically high incidence, up to 40%
Incidence is now near zero
Present weeks to months after procedure
- cough, chest pain, dyspnea, hemoptysis, recurrent pulmonary infections, new pHTN

Atrial esophageal fistula (0.1%)

Present 2-4 weeks post-procedure
During left atrial posterior wall ablation

25

Updates in Thoracic Anesthesia in the Era of Minimally-Invasive Surgery

2026 CRASH
University of Colorado Anschutz
Division of Cardiothoracic Anesthesia

26

I have no commercial or financial conflict of interest to disclose.

27

Learning Objectives

1. Describe the **historical evolution** of thoracic surgery and how robotic-assisted thoracic surgery fit in our current practices.
2. Discuss **unique anesthetic considerations** for patients undergoing **robotic-assisted thoracic surgery.**
3. Understand the evolving evidence and trend toward **enhanced recovery after thoracic surgery.**

28

Historical Evolution of Thoracic Surgery

- 19th Century: Open Thoracotomy, Tuberculosis pandemic
- 1950: Lung resections for cancer, First thoracic epidural
- 1980: VATS
- 2000: Minimally invasive thoracic surgery, da Vinci FDA approval
- 2019: First thoracic ERAS

Curr Chall Thorac Surg 2023;5:33

29

THE SOCIETY OF THORACIC SURGEONS GENERAL THORACIC SURGERY DATABASE: UPDATE ON OUTCOMES AND RESEARCH

The Society of Thoracic Surgeons General Thoracic Surgery Database: 2025 Annual Update

- General Thoracic Surgery Database: Clinical registry for thoracic procedures worldwide (>300 participating sites)
  - Community/Non-teaching hospital: 60%
  - Academic/University hospital: 30%
  - Hybrid programs: 10%
- Continued rise of minimally invasive and robotic-assisted techniques
  - **Robotic-assisted surgery accounted for 78.8%** of all lung resections performed in 2024.

Ann Thorac Surg 2025

30

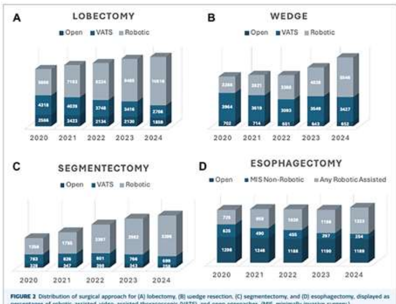


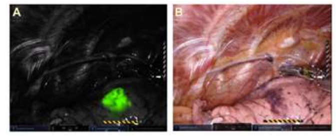
FIGURE 2 Distribution of surgical approach for (A) lobectomy, (B) wedge resection, (C) segmentectomy, and (D) esophagectomy, displayed as percentages of robotic-assisted, video-assisted thoracoscopic (VATS), and open approaches. (MIS, minimally invasive surgery.)

Ann Thorac Surg 2025

31

Clinical Outcomes

- Reported clinical outcomes (mortality, surgical complication rates, and length of stay) are often **comparable** between video-assisted thoracic surgery (VATS) vs. robotic-assisted thoracic surgery (RATS)
- Recent studies highlight **improved visualization and dissection of mediastinal lymph nodes** using the robotic-assisted approach
- Ability to use infrared imaging with ICG contrast



Saudi J Anaesth 2021;15:356-61.
Gen Thorac Cardiovasc Surg 2026;74:1–10.
Thorac Surg Clin 2020;30:293-304

32

Robotic-assisted thoracic surgery: Intra-op

33

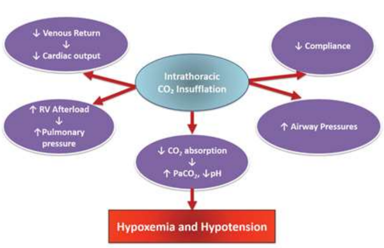
VATS vs. RATS: Key differences

	VATS	RATS
Position	Lateral decubitus	Lateral decubitus
Access to patient	Yes	**Restricted** once robotic docked
Lung isolation	Yes	Yes - **often more demanding**
One-lung ventilation	Yes	Yes - **prolonged**
CO_2 insufflation	No	**Yes**
Neuromuscular blockade	Yes	Yes - **often deeper**
Pressure injury risk	Yes	Yes - **robotic arms**
Surgeon	Bedside	**Console** - communication issues

Curr Opin Anethesiol 2026, 39 :108-114

34

Impact of Intrathoracic CO_2 Insufflation

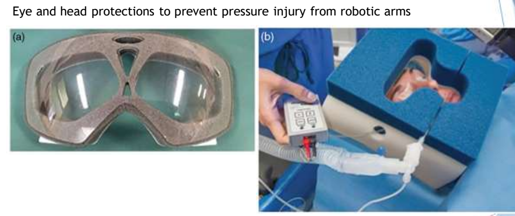


Curr Opin Anethesiol 2026, 39 :108-114

35

Other Unique Consideration

Eye and head protections to prevent pressure injury from robotic arms



Curr Opin Anethesiol 2026, 39 :108-114

36

Everything else is the same as other thoracic procedures

- Lung isolation using DLT vs. bronchial blocker (surgeon and anesthesiologist preference)
- One-lung ventilation: 4-6 ml/kg PBW
- Optimize dependent lung PEEP to achieve the best compliance (lowest driving pressure)
- **Vent optimization is best performed prior to robot docking**
- **Always communicate with the surgeon before recruitment, airway suctions, or supplemental O_2/CPAP to operative lung**

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Step-by-Step Approach

1. Induction and DLT placement (or ETT+BB)
2. Maintain FiO2 100% (facilitate non-dependent lung collapse later)
3. What's the starting lung compliance?
4. Patient positioning
5. Confirm appropriate tube positioning
6. Recruitment and PEEP optimization
7. Start OLV with TV 4-6 ml/kg PBW
8. Decrease FiO2 to the lowest tolerable

   Facilitates early detection of worsening resp status

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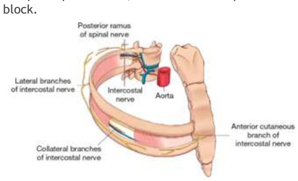
38

Regional Anesthesia

- Thoracic surgery is one of the most painful procedures
- Poorly controlled pain can lead to postoperative pulmonary complications
- Multiple regional anesthesia options exist: thoracic epidural, paravertebral block, erector spinae plane block, serratus anterior plane block, and intercostal block.



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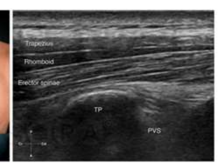
39

Erector Spinae Plane (ESP) Block

- ESP block is becoming the standard regional anesthesia technique for RATS
- A recent meta-analysis of 17 studies (Koo et al 2022)
  - ESP reduced 24h opioid consumption and pain score at rest and with activity compared to no block.
  - ESP is inferior to PVB and intercostal nerve block but superior to serratus anterior plane block, although uncertain clinical differences



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40

Enhanced Recovery After Thoracic Surgery

- Published in 2019 to help improve the care quality and efficiency across the entire patient journey from referral to discharge.
- **45 items** addressing three phases of care: pre-op, peri-op, post-op
- Individual care elements may not have significant benefits in isolation
- Rather, their combination is thought to have synergistic effect
- ERAS has been shown to reduce length of stay and surgical complications in other surgical specialties

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41

Preoperative Phase	Evidence level
Preadmission information, education, and counselling	Low
Malnutrition risk screening	High
Oral nutritional supplantation to malnourished patients	Moderate
Immune-enhancing nutrition	Low
Smoking cessation	High
Alcohol cessation	Moderate
Anemia screening and correction	High
Pulmonary prehabilitation	Low
Allow clear liquids up until 2h before induction and solids up until 6h before induction	High
Oral carbohydrate loading	Low
Avoid routine sedative administration	Moderate

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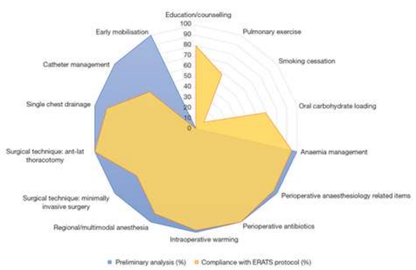
42

Perioperative Phase	Evidence level
Pharmacological and mechanical VTE prophylaxis	Moderate
Antibiotic prophylaxis and skin preparation	High
Prevent intraoperative hypothermia	High
Lung-protective strategies during one-lung ventilation	Moderate
A combination of regional and general anesthesia techniques	Low
PONV prophylaxis	High
Regional anesthesia to reduce postop opioid consumption	High
Combination of Tylenol and NSAIDs unless contraindicated	High
Ketamine for patients with pre-existing chronic pain	Moderate
Dexamethasone for PONV reduction and analgesia	Low
Avoid very restrictive or liberal fluid	Moderate
Balanced crystalloids over 0.9% saline	High
Atrial fibrillation prevention: BB, diltiazem, amiodarone	Mod-High
Muscle and nerve-sparing thoracotomy technique	Moderate
Minimally invasive surgery for early-stage lung cancer	High

43

Postoperative Phase	Evidence level
Avoid routine chest tube suction	Low
Remove chest tubes if output <450 ml/24h	Moderate
A single chest tube instead of 2 after anatomical lung resection	Moderate
Avoid routine urine catheter placement	Moderate
Early mobilization within 24h of surgery	Low
Prophylactic mini-tracheostomy in high-risk patients	Low

44



- Single-site experience at a German University Hospital, highlighting challenges in implementing pre-op recommendations and post-op early mobilization

J Thorac Dis 2024;16(7):4165-4173

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45

Conclusions

1. Robotic-assisted thoracic surgery has become the predominant surgical technique, accounting for roughly 2/3 of all thoracic cases
2. Special considerations for intraoperative management include restricted patient access, prolonged OLV, use of CO_2 insufflation, pressure injury preventions, close communication with the surgeon
3. ESP block is becoming the standard regional anesthesia technique for patients undergoing robotic-assisted thoracic surgery
4. ERAS for thoracic surgery was published in 2019
5. There is growing interests in applying the enhanced recovery pathways for thoracic surgery

46

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Guiding the future of patient care

Recent Research Relevant to the Practice of Cardiac Anesthesiology

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47

Disclosures

- Research funding
  - University of Colorado Department of Anesthesiology
  - Society of Cardiovascular Anesthesiologists
  - National Institute of Aging
  - National Heart Lung and Blood Institute
- Advisory Board Participation
  - Octapharma

48

Learning Objectives

- Review the history of research of cardiac surgery and anesthesia
- Discuss current gaps in knowledge for improving outcomes after cardiac surgery
- Discuss recent studies with a high potential for impact in the practice of cardiac Anesthesiology
- Review recent updates to practice guidelines relevant for the practice of cardiac Anesthesiology

49

Overview

- Origin of clinical research in cardiac surgery/anesthesiology
- Clinical problems in need of answers
- Recent notable research findings
- Notable null studies
- Guideline updates
- Novel techniques in organ recovery
- Xenotransplantation
- Artificial Intelligence
- Conclusion/Discussion
- References

50

A time line of innovations in cardiac surgery and anesthesia still in use.
1543 to 1896

Cardiac surgical innovations	Year	Cardiac anesthesia innovations
	1543	First description of positive pressure ventilation[1]
	1733	Invasive blood pressure measurement[2]
	1774	Discovery of oxygen
	1846	Clinical demonstration of anesthesia[3]
	1853	Clinical syringe invention
	1876	Intravenous crystalloid infusion
Successful repair of the right ventricle[4]	1896	

51

A time line of innovations in cardiac surgery and anesthesia still in use.
1901 to 1952

Cardiac surgical innovations	Year	Cardiac anesthesia innovations
	1901	ABO blood typing
	1905	Non-invasive blood pressure cuff[2]
	1914	Citrate anti-coagulant
	1920	Intravenous epinephrine[5]
	1922	Heparin anti-coagulation[6]
Successful open mitral valvotomy[4]	1923	
	1939	Protamine reversal of heparin[7]
	1940	Commercialization of penicillin[8]
Therapeutic hypothermia[9]	1950	Polyvinyl chloride intravenous catheter[10]
	1952	External cardiac pacing, routine positive pressure ventilation[1]

52

A time line of innovations in cardiac surgery and anesthesia still in use.
1953 to 2015

Cardiac surgical innovations	Year	Cardiac anesthesia innovations
First successful case series with cardiopulmonary bypass[12], introduction of hyperkalemic cardioplegia[13]	1955	
	1957	Arterial blood gas analysis[14]
First prosthetic valve and first coronary artery bypass	1960	
First allogenic lung transplant[15]	1963	
First left ventricular assist device[12]	1966	
Effective synthetic vascular graft[16]	1969	
	1972	Invention of pulse oximetry[17]
	1974	Pulmonary artery catheterization monitoring, transesophageal echocardiography[18], and intraoperative red blood cell salvage[19]
Public reporting of cardiac surgical outcomes[20]	1989	
	2015	PROPPR trial demonstrating mortality benefit with a 1:1:1 transfusion ratio[21]

53

Studies in Extracorporeal Circulation. I. Applicability of Gibbon-Type Pump-Oxygenator to Human Intracardiac Surgery: 40 Cases *

John W. Kirklin, M.D., David E. Donald, B.V.S., M.R.C.V.S., Harry G. Harshbarger, M.D., Peter S. Hetzel, M.D., Robert T. Patrick, M.D., H. J. C. Swan, M.B., M.R.C.P., Ph.D., Earl H. Wood, M.D., Ph.D.

From the Mayo Clinic and Mayo Foundation,† Rochester, Minnesota

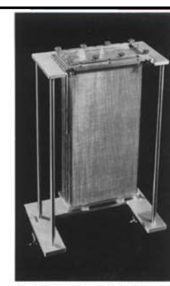


Fig. 1. Stationary screens of the Gibbon-type oxygenator.

- Mortality
  - 1955: (3 of 7) 43%
  - 1956: (1 of 14) 7%
  - 2026: 0.5 - 3%

54

Amino acid infusion reduces AKI

A Randomized Trial of Intravenous Amino Acids for Kidney Protection

- **Hypothesis:** Intravenous amino acid therapy results in a low AKI after cardiac surgery with cardiopulmonary bypass.
- **Intervention:** Intravenous infusion of balanced amino acids 2g/kg per day for 3 days
- **Methods:** Prospective multi-site, multi-national, blinded, randomized placebo controlled trial, N = 3,511, patients scheduled for elective cardiac surgery with cardiopulmonary bypass.
- **Primary Outcome:** Incidence of AKI within 7 days
- **Results**

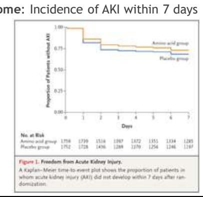


Figure 1. Freedom from Acute Kidney Injury.
A Kaplan–Meier time-to-event plot shows the proportion of patients in whom acute kidney injury (AKI) did not develop within 7 days after randomization.

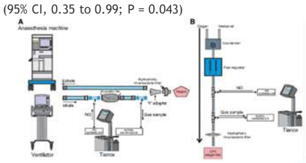
55

Nitric oxide reduces AKI in CKD Patients

ANESTHESIOLOGY

Perioperative Nitric Oxide Conditioning Reduces Acute Kidney Injury in Cardiac Surgery Patients with Chronic Kidney Disease (the DEFENDER Trial): A Randomized Controlled Trial

- **Hypothesis:** Perioperative nitric oxide results in a lower incidence of AKI in patients with CKD after cardiac surgery with cardiopulmonary bypass.
- **Intervention:** Nitric oxide 80 ppm intraoperative and 6 hours post-operatively
- **Methods:** Single site, blinded, randomized placebo controlled trial, N = 136, patients with CKC stage 3 or 4 scheduled for elective cardiac surgery with cardiopulmonary bypass.
- **Primary outcome:** Incidence of AKI within 7 days
- **Results:** Control group: 27 of 68 (**39.7%**) vs. NO group 16 of 68 (**23.5%**) RR of 0.59 (95% CI, 0.35 to 0.99; P = 0.043)

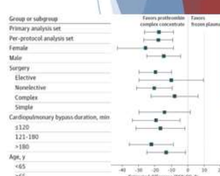


56

Prothrombin concentrate improves hemostasis compared to FFP

JAMA | Original Investigation
Prothrombin Complex Concentrate vs Frozen Plasma for Coagulopathic Bleeding in Cardiac Surgery
The FARES-II Multicenter Randomized Clinical Trial

- **Hypothesis**: Prothrombin concentrate is non-inferior/superior to FFP for hemostasis after cardiac surgery with cardiopulmonary bypass
- **Intervention:** 1500 to 2000 IU PCC after cardiopulmonary bypass
- **Methods:** Prospective multi-site unblinded randomized controlled trial of patients requiring coagulation factor replacement after CPB, N = 528 enrolled, n = 420 in primary analysis
- **Primary outcome:** Hemostatic response after CPB
  - No further hemostatic treatment within 1 to 24 hours
- **Results:** Hemostatic efficacy: PCC group **77.9%** and FFP **60.4%**
  - PCC group: Fewer transfusions and adverse events

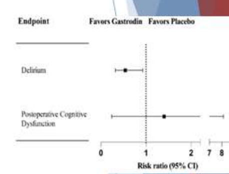


57

Gastrodin reduces delirium

BRIEF REPORT
Open Access
Efficacy and safety of gastrodin in preventing postoperative delirium following cardiac surgery: a randomized placebo controlled clinical trial

- **Hypothesis:** Gastrodin will result in a lower incidence of delirium and post-operative cognitive dysfunction after elective CABG +/-valve cardiopulmonary bypass compared to placebo
- **Intervention:** Gastrodin 600 mg IV BID on the day of surgery to POD6
- **Methods:** Prospective single-site blinded randomized placebo controlled trial N = 160 enrolled, n = 155 in primary analysis
- **Co-Primary outcomes:** Incidence of delirium by CAM-ICU (POD1 – POD7) and post-operative cognitive assessment by the mini-mental status examination at 7 days, 1 month, 3 months
- **Results:** Lower incidence of delirium but not POCD
  - Gastrodin: **19.5%**
  - Placebo: **35.9%**

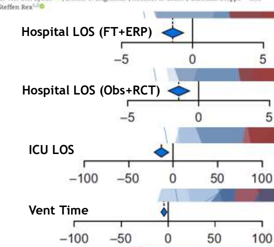


58

Enhanced recovery programs reduce hospital LOS, ICU LOS and vent time

Efficacy of enhanced recovery programmes for cardiac surgery: a systematic review and meta-analysis

- **Hypothesis**: Enhanced recovery programs reduce LOS
- **Intervention:** Enhanced recovery/fast track
- **Methods:** Systematic review and meta-analysis
- **Primary outcome:** Hospital LOS
- **Results:**

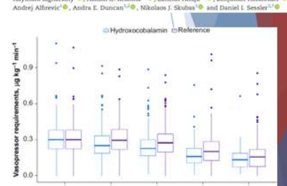


59

Hydroxocobalamin reduces vasopressor requirements for vasoplegia for 24 hours

Hydroxocobalamin for vasoplegia in cardiac surgery: a retrospective cohort analysis

- **Hypothesis:** Hydroxocobalamin exposure is associated with reduced vasopressor requirements in patients with Vasoplegia during and up to 24 hours after cardiac surgery
- **Intervention:** Intravenous bolus of 5 g of hydroxocoablamin
- **Methods:** Retrospective propensity-matched cohort
  N = 2727 and 229 matched pairs
- **Primary outcome:** Vasopressor requirements in NE equivalents
- **Results:**
  - Lower vasopressor requirements up to 24 hours
  - No difference in clinical outcomes



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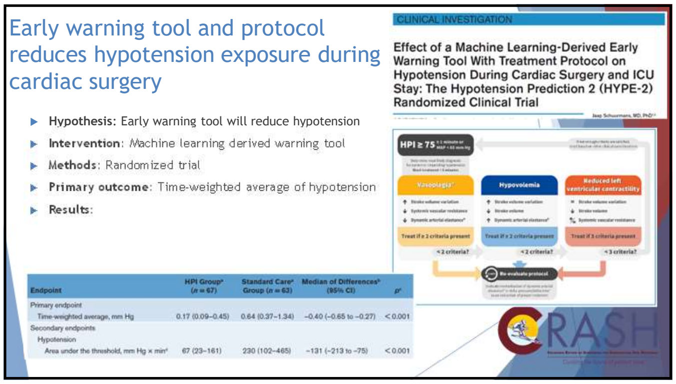

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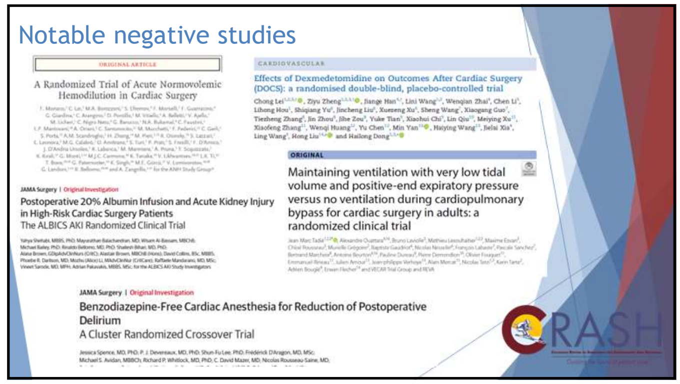

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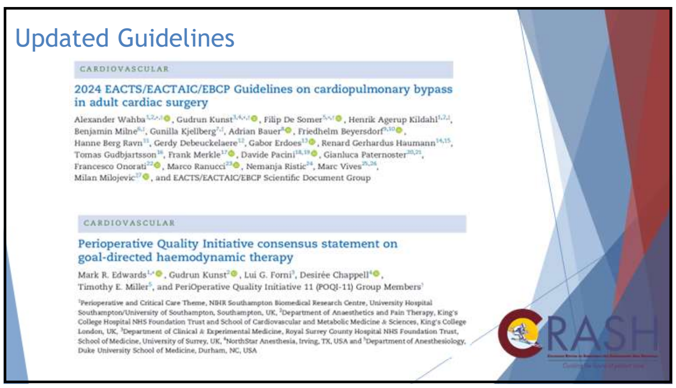

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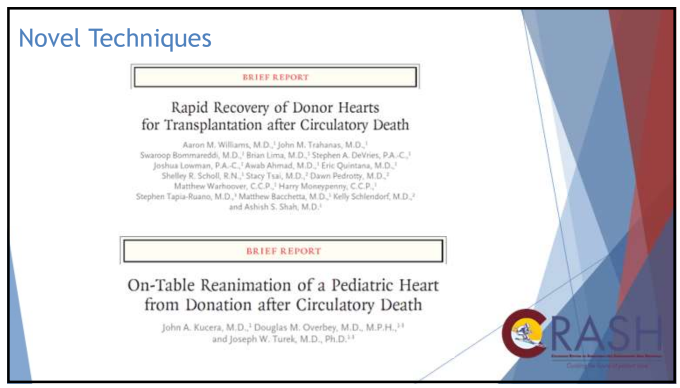

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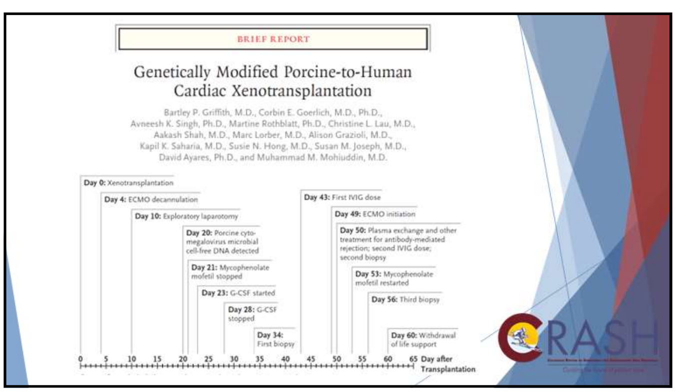

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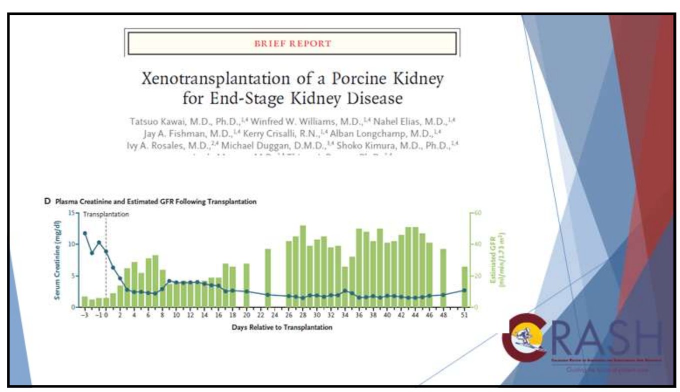
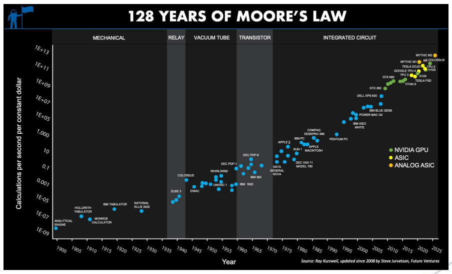


66

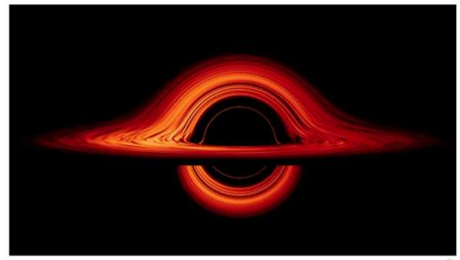
Artificial Intelligence in historical context.



https://en.wikipedia.org/wiki/Technological_singularity#/media/File:The_Moore's_Law_Update_%E2%80%94_for_128_years_-_54181414828.jpg

67

Conclusions



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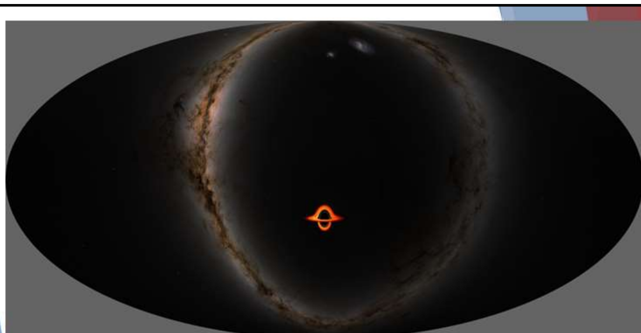
68



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69

Conclusions

- Research relevant to cardiac anesthesia was incremental
- Discoveries and innovation remain administratively constrained
- Transplantation is the main driver of open cardiac surgery innovation
- Technological innovation remains on an exponential curve that is bending up even more
- The only constant is change

70

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75

PBLD CASE 1- TAVR's and Sedation

An 84-year-old female for TF TAVR

- Severe symptomatic aortic stenosis, AVA 0.7cm2, EF 39%
- 3 pillow orthopnea at home
- Severe COPD (FEV1 28% predicted)
- Home O_2 2L rest, 4-6 with exertion
- Pulmonary hypertension (RVSP 70 mmHg)
- BMI 19, frail
- Planned transfemoral TAVR.
- CT shows favorable iliofemoral access.

76

PBLD #2 Challenging Lung Isolation

A 63-year-old, 110 kg male presents for **robotic right upper lobectomy** for NSCLC

- Chronic tracheostomy (placed 2 years ago after prolonged ventilation 2/2 COVID PNA)
- 7.0 cuffed Shiley tracheostomy tube in place
- OSA
- Limited neck extension
- Mallampati IV (oral exam still possible above trach)
- Short, thick neck
- Pulmonary function:
- FEV1 65% predicted
- CT imaging shows no tracheal stenosis but a short tracheal length above the carina.

77

PBLD #3 Managing Major Coagulopathy

A 68-year-old male presents emergently with an acute Stanford Type A aortic dissection

- Bio-Bentall procedure with Cabrol of coronary arteries
- Hemiarch replacement
- Moderate hypothermic circulatory arrest (28 C) with retrograde cerebral protection (rcp)
- CPB time: 235 minutes
- Cross-clamp time: 170 minutes
- Circ-arrest time: 12 minutes
- Profound vasoplegia while on CPB requiring high-dose norepinephrine and vasopressin
- Methylene blue administered
- The patient is now rewarmed to 36°C and preparing for separation from cardiopulmonary bypass.
- Re-warming labs: Fibrinogen: **105 mg/dL** Platelets: **46,000** INR: 1.9

78