

# Transplant Anesthesiology – Building a New Sub- Specialty

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## Disclosures

I have no relevant financial disclosures.



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# Learning Objectives



1. Review the role of anesthesiologists in liver transplantation
2. Summarize essential traits of liver transplant anesthesiologists
3. Propose future directions for transplant anesthesiologists in education and research

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# Does the Anesthesiologist Matter?



Vital to advancements in LT

- Coagulopathy & transfusion management
- Cardiac function
- Post-reperfusion Syndrome
- Metabolic Alterations

**The role of the anesthesiologist as an integral member of the transplant team**

JOHN YOSAITIS, JOSEPH MANLEY, LYNT JOHNSON & JEFFERY PLOTKIN

**Anesthesia for Hepatic Transplantation:  
Cardiovascular and Metabolic Alterations and their Management**

F.J. Carmichael, PhD, MD, FRCP(C), M.J. Lindop, MB, BChir, FFARCS, and  
J.V. Farman, MB, BS, FFARCS

**Postreperfusion Syndrome: Cardiovascular Collapse  
Following Hepatic Reperfusion During Liver  
Transplantation**

S. Aggarwal, Y. Kang, J.A. Freeman, F.L. Fortunato, and M.R. Pinsky

Carmichael FJ, et al. *Anesthesia & Analgesia* 1985;64(2).  
Aggarwal S, et al. *Transplantation proceedings* 1987;19(4 Suppl 3):54-55.  
Yosaitis J, et al. *HPB*:2005;7(3):180-182.

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## Experience Matters



*Yosaitis* – Junior faculty need 15-20 LT to feel comfortable and “work unsupervised”

*Hevesi* – Formation of a dedicated LT team reduced blood transfusion, shortened ICU stay, ventilator days

*Hofer* – 1<sup>st</sup> 5 cases have higher mortality and increased risk of graft failure, suggests a need for training, supervision

Yosaitis J, et al. HPB;2005;7(3):180-182.  
Hevesi ZG, et al. Liver transplantation. 2009;15(5):460-465.  
Hofer I, et al. Liver transplantation;2015;21(1):89-95.

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## Society for the Advancement of Transplant Anesthesia



Formed in 2011, SATA has seen significant growth

- Publications and guidelines
- Education for trainees, faculty
- Professional development
- Practice management



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# SATA Recommendations for LTAT



## SATA Recommendations

### Institution:

- The host institution has advanced physiologic monitoring equipment (eg, pulmonary artery catheterization, transesophageal echocardiography, and processed electroencephalographic monitors).
- The host institution has immediate 24-hour access to expert consulting services to assist with perioperative decision making.
- The host institution supports preprocedure transplant anesthesiology services.
- The host institution provides case record data for each LTAT member upon request.

### DLTA:

- The DLTA is credentialed at the host institution.
- The DLTA satisfies all UNOS Bylaws Appendix F5 requirements.
- The DLTA attends >50% of multidisciplinary selection committee/QR meetings.

### LTATs:

- Each LTAT has written criteria for team membership defined by case volume and previous training.
- All LTAT members are credentialed at the host institution.
- All LTAT members participate in multidisciplinary selection committee/QR meetings.
- Anesthesia risks and benefits are explained to patients by an LTAT member.
- Supervision of the in-room provider is performed by an LTAT member.
- The LTAT has a published schedule of anesthesia coverage for and a written procedure for 24-hour coverage.

Hendrickse A, et al. Liver Transplantation. 2020;26(4):582-590.

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# International Liver Transplantation Society/ Society for Advancement of Transplant Anesthesia Consensus Statement on Essential Attributes of a Liver Transplant Anesthesiologist



Christine Nguyen-Buckley, MD,<sup>1</sup> Dmitri S. Bezinover, MD,<sup>2</sup> Pooja Bhangui, MD,<sup>3</sup> Gianni Biancofiore, MD,<sup>4</sup> Annabel Blasi, MD,<sup>5</sup> Ryan Chadha, MD,<sup>6</sup> Aliaksei Pustavoitau, MD, MHS,<sup>7</sup> Antoni Sabate, MD, PhD,<sup>8</sup> Fuat H. Saner, MD,<sup>9</sup> Gebhard Wagener, MD,<sup>10</sup> Christopher L. Wray, MD,<sup>1</sup> Jeron Zerillo, MD,<sup>11</sup> and Terry Ling Te Pan, MBBS<sup>12</sup>

## Diverse backgrounds in training

- Critical Care Fellowship
- Cardiac Fellowship
- LT Fellowship
- Local Training

Nguyen-Buckley C, et al. Transplantation 2023;107(7):1427-1433.

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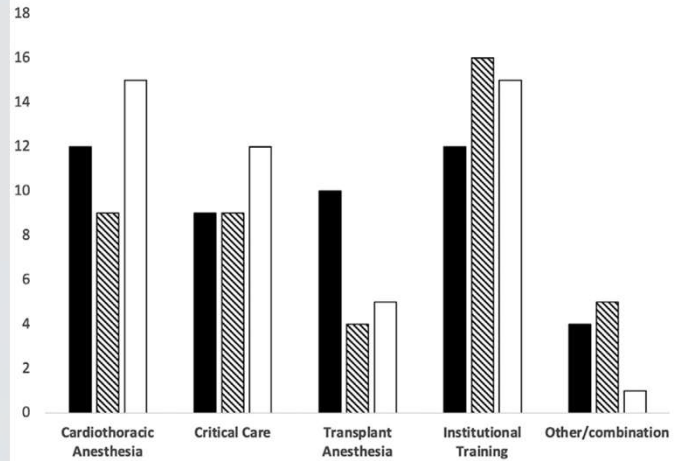
# How Do We Train LTAT?



Survey from 2021

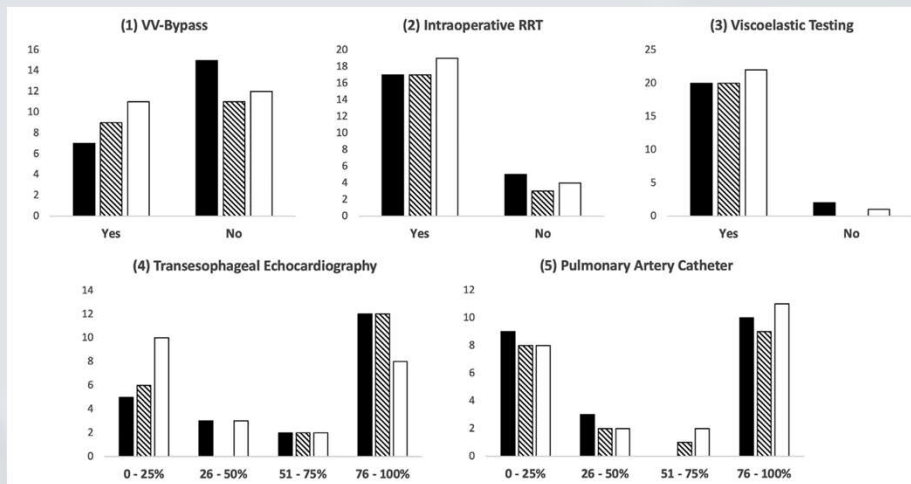
- Practice patterns
- Surgical practice
- Vascular Access
- TEE Use

(1) Liver Transplant Anesthesia Team Advanced Training



Crouch C, et al. Clin Transplant 2022;36(1):e14504.

# Practice Patterns in LT



**FIGURE 3** Intraoperative management of liver transplant patients. (1) Number of responding programs that utilize veno-veno bypass, (2) intraoperative renal replacement and (3) viscoelastic testing. (4) Number of responding programs that use transesophageal echocardiography (TEE) or (5) pulmonary artery catheters (PAC) and average percentage of cases used. High volume centers - black, medium volume centers - striped, low volume centers - white

Crouch C, et al. Clin Transplant 2022;36(1):e14504.



## Skills Needed in LT



### Examples

- Coagulation Management
- Intraoperative Crisis Management
- Communication
- Manage phases of LT surgery, surgical options, intra-operative complications, and intraoperative graft dysfunction
- ERAS and strategies for management of postoperative pain
- Graft quality (including extended criteria grafts) and impact of graft quality

*“There is no international consensus recommendation on the number of cases that an LT anesthesiologist would need to attain the required competencies.”*

Nguyen-Buckley C, et al. Transplantation 2023;107(7):1427-1433.

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## A Dedicated Team Matters



JAMA Surgery | Original Investigation

### Association Between Familiarity of the Surgeon-Anesthesiologist Dyad and Postoperative Patient Outcomes for Complex Gastrointestinal Cancer Surgery

Julie Hallet, MD, MSc; Rinku Sutradhar, PhD; Angela Jerath, MD, MSc; Pablo Perez d'Empaire, MD; François M. Carrier, MD, MSc; Alexis F. Turgeon, MD, MSc; Daniel I. Mclsaac, MD, MPH; Chris Idestrup, MD, MSc; Gianni Lorello, MD, MSc; Alana Flexman, MD; Biniyam Kidane, MD, MSc; Yosuf Kaliwal, MPH; Wing C. Chan, MPH; Victoria Barabash, MSc; Natalie Coburn, MD, MPH; Antoine Eskander, MD, ScM

For each additional dyad time a dyad worked together, there was a 5% decrease in 90-day mortality

Hallet et al. JAMA Surgery 2023;158(5):465-473.

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## It Works Here in Nebraska



Regular Meetings with both surgeons and anesthesiologists

- Machine Perfusion
- Use of VV Bypass
- Pain Management



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## Future of Transplant Anesthesiology



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# Transplant Anesthesiology Fellowship



## Abdominal Transplant Anesthesia Fellowship: A Blossoming Specialty

Ramona Nicolau-Raducu, MD, PhD    Geraldine C. Diaz, DO

Approximately 20 programs currently in North America  
 - UNMC has 1 fellow per year

Can Include Specialty Training

- Surgical Experience
- ICU
- Hepatology
- Transfusion Medicine

Nicolau-Raducu R, et al. ASA Monitor 2023;87(7):31-31

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# SATA Fellowship Committee



Defined 6 core competencies and milestones based on ACGME structure for LT anesthesiology fellows

*“The goal of the trainee is to reach Level 5 in all milestone areas”*

Committee suggests participation in at least 50 LT

Nguyen-Buckley C, et al. Seminars in cardiothoracic and vascular anesthesia 2019;23(4):399-408.

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# SATA Milestones



	Level 1	Level 2	Level 3	Level 4	Level 5
Patient care: <i>Technical procedural skills—venovenous bypass (VVB)</i>	Describes indications for VVB and complications (if not available at institution, discusses theory)	Identifies candidates for VVB and manages patient undergoing VVB under direct supervision (if not available at institution, discusses theory)	Participates in decisions regarding VVB and manages patients undergoing VVB under indirect supervision (if available at institution)	Participates in decisions regarding VVB with conditional independence; manages patients undergoing VVB with minimal assistance (if available at institution)	Independently participates in decisions regarding VVB; independently manages patients undergoing VVB (if available at institution)
Patient care: <i>Surgical considerations</i>	Understands basic surgical terminology and anatomy regarding LT and hepatobiliary surgery	Understands basic surgical considerations for LT and hepatobiliary surgery	Understands advanced surgical considerations for LT and hepatobiliary surgery	Applies knowledge of advanced surgical considerations in the care of LT patients and hepatobiliary surgery patients	Applies knowledge regarding surgical considerations for LT and hepatobiliary surgery at an attending level
Patient care: <i>Care of cirrhotic patients for nontransplant procedures</i>	Understands management of patients with cirrhosis for nontransplant procedures on a basic level	Manages patients with cirrhosis for nontransplant procedures with direct supervision	Manages patients with cirrhosis for nontransplant procedures with indirect supervision	Manages patients with cirrhosis for nontransplant procedures with minimal assistance	Independently manages patients with cirrhosis for nontransplant procedures at an attending level
Patient care: <i>Candidacy</i>	Attends pretransplant selection committee meetings and observes anesthetic consultations regarding determination of candidacy in critically ill patients	Identifies pertinent issues regarding determination of candidacy in critically ill patients	Participates in pretransplant selection committee meetings and in anesthetic consultations regarding determination of candidacy in critically ill patients with direct supervision	Participates in pretransplant selection committee meetings and in anesthetic consultations regarding determination of candidacy in critically ill patients with conditional independence	Determines candidacy of critically ill patients; communicates with consulting services on decisions of candidacy on an attending level

Nguyen-Buckley C, et al. Seminars in cardiothoracic and vascular anesthesia 2019;23(4):399-408.

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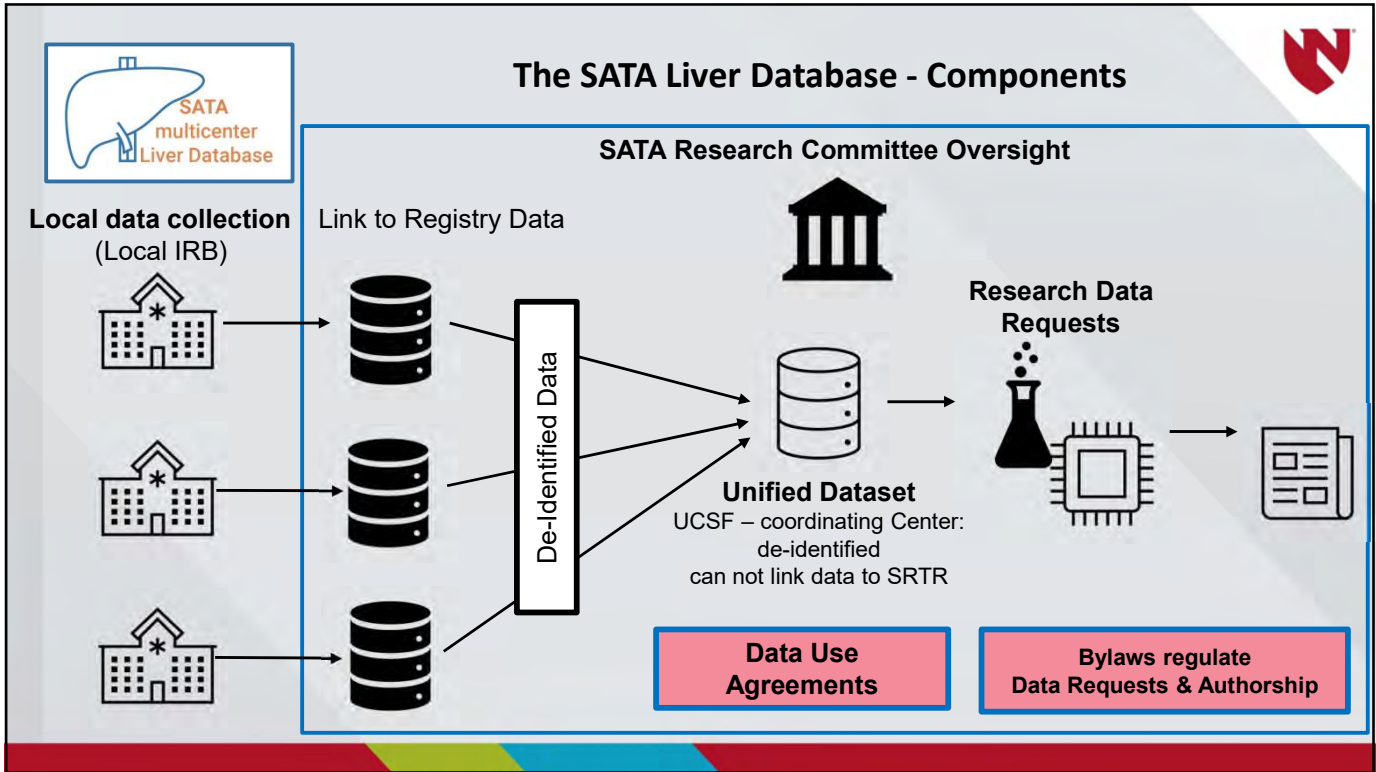
# Liver TOAD Database



Led by UCSF, this is the first national database specific to LT anesthesia

As of January 2024, 17 centers collecting data  
 - Includes 2400 LT, nearly 25% of national volume

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## Liver TOAD Database

**Table 1: Data collected in the SATA Liver Database.**

<b>Transplant Details</b>	Donor Type, Graft Type, Combined Transplant, Re-transplantation
<b>Patient Characteristics</b>	Preoperative Location, Preoperative Vasopressors, MELD 3.0 score & MELD components, History of Coronary Artery Disease / Porto Pulmonary Hypertension / Atrial Fibrillation
<b>Intraoperative Management</b>	Blood Products, Fluids Administered, Pro- and Anticoagulatory Medications, Monitoring Used, Intraoperative Renal Replacement, Veno-Venous Bypass, Machine Perfusion
<b>Postoperative Outcomes</b>	Acute Kidney Injury, Reoperation, Intensive Care Unit Length of stay, need for dialysis at 1 year after transplant.

Table 1: Non-exhaustive list of variables collected in the SATA Liver Database. A complete list of variables can be found online at [liverdatabase.com](http://liverdatabase.com)  
MELD: Model for End-Stage Liver Disease.

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## Liver TOAD Projects



*An Exploration of Perioperative risk factors associated with acute kidney injury following liver transplantation: a multicenter observational study.*

Investigator: Nick Mendez, MD (University of California, San Francisco)

*SATA Liver Transplant Database project: Early Extubation in Liver Transplantation.*

Investigator: Ryan Nazemian, MD, PhD (Tufts University School of Medicine, Lahey Hospital and Medical Center)

*Machine Perfusion and Perioperative Outcomes*

Investigator: Ryan Wang, MD (Icahn School of Medicine at Mount Sinai)

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## Conclusions



Continued growth of LT cases and increasing complexity will require specialty anesthesia care

The field of liver transplant anesthesia is growing to meet these needs through:

- Patient Care
- Education
- Research

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