

## ERAS meets Drainology – A Cardiac Surgery Perspective

*Summary of the roundtable discussion on 11 October 2024 in Lisbon, chaired by Jolanda Kluin, MD PhD, and Evaldas Girdauskas, MD PhD.*

The meeting started with a motivating presentation and introduction to Drainology by Kevin Lobdell (MD, LTC, MC) (System Director Sanger Heart & Vascular Institute, USA). Since 2021, the science of Drainology has come a long way. However, generally, it takes 17 years before innovations are adopted<sup>1</sup>. To continue this scientific evolution, we require device awareness, networking, engagement, leadership, teamwork and data acquisition.



### **Preliminary results of the INCREASE study**

Evaldas Girdauskas,  
MD PhD,  
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### **ERAS for all patients**

Michel Kindo, MD PhD,  
Strasbourg/FRA



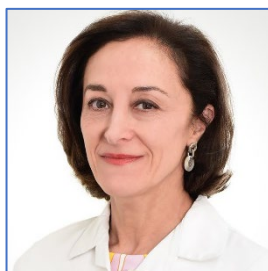
### **Preliminary findings: VR in anxiety reduction**

Jolanda Kluin, MD PhD,  
Rotterdam/NL



### **Drainology: The guidelines so far**

Louis Perrault, MD PhD,  
Montreal/CAN



### **Digital vs Analogue Drainage Systems following Cardiac Surgery**

Marjan Jahangiri,  
FRCS, FRCS (CTh),  
London/UK



### **Efficacy of Hydrogel Coated Chest Tubes in The Prevention of RBS**

Shekhar Saha, MD,  
Munich/GER

## References

- <sup>1</sup> Morris ZS, Wooding S, Grant J. The answer is 17 years, what is the question: understanding time lags in translational research. *J R Soc Med.* Dec 2011;104(12):510-20. doi:10.1258/jrsm.2011.110180

## Preliminary Results of The INCREASE Study

Evaldas Girdauskas, MD PhD  
University Hospital of Augsburg, Germany  
Head of Department of Cardiothoracic Surgery

### Key Message

Perioperative ERAS protocol shortens the length of hospital stay.

Evaldas Girdauskas (Germany) presented descriptive data from their prospective, randomised INCREASE trial, comparing ERAS versus standard of care protocols in minimally invasive heart valve surgery (n=200) (NCT04977362) (manuscript in preparation). The ERAS protocol included preoperative outpatient education, clinical assessments, and intermediate rather than intensive postoperative care. Co-primary endpoints were total days in the hospital at one-year follow-up and the 6-minute walk test (6-MWT) at discharge.

At baseline, the ITT ERAS group had better cardiopulmonary resilience than those in the control group, measured by the 6-MWT ( $549.77 \pm 118.51$  vs  $527.44 \pm 105.82$ , respectively). Potential reasons for this will be discussed in the manuscript. The 6-MWT results improved for both groups at discharge  $377.73 \pm 119.61$  vs  $381.59 \pm 104.63$ , respectively, and were comparable between groups in the per-protocol population.

### Quote

**“In the ERAS intervention group, the 6-Minute Walk Test was better preoperatively as compared to the control group. I don’t really know the reason why; maybe it’s because it’s a kind of motivational stress in preparation for prehabilitation in the intervention group. We have to think about and figure this out for the discussion section of the manuscript, but in the end, after the surgery, you see that there is basically no difference between groups”.**

## ERAS For All Patients: How To Deal With It?

Michel Kindo, MD PhD  
University Hospital of Strasbourg, France  
Head of Department of Cardiovascular Surgery

### Key Message

ERAS protocols used in elective surgery can be tailored for populations undergoing different cardiac procedures to transform patient care.

A perioperative systematic, standardised ERAS protocol is now the standard of care in cardiac surgery, which has led to a significant reduction in postoperative cardiac, pulmonary, neuronal, and renal morbidities. Dr Kindo described how different ERAS protocols are implemented at their institution, depending on the surgical scenario.

- In **elective surgery**, patients receive a comprehensive ERAS protocol brochure detailing lifestyle modifications (e.g., smoking cessation), in addition to a structured prehabilitation and nutritional programme implemented over the two-week preoperative period. A patient blood management (PBM) protocol should be instituted to detect and correct preoperative anaemia and/or iron deficiency, thereby reducing the risk of red blood cell transfusion. The preoperative PBM protocol may require two to three weeks to adequately address anaemia, for example through the use of erythropoietin therapy.
- **Frail and high-risk patients** are referred to an ERAS day hospital for a 4-6 week personalised programme that includes input from other specialists such as nephrologists and cardiologists specialising in heart failure.
- In cases of **semi-urgent surgery**, benefit-risk ratio analysis is conducted to determine whether surgery can be delayed, enabling prehabilitation to take place. When delays are impossible, the ERAS and PBM protocol is applied one day before surgery. The ERAS protocol will be followed intra- and postoperatively in emergencies, with an additional PBM screen to detect and treat anaemia.
- Patients scheduled for **minimally invasive left ventricular assist device (LVAD)** surgery have a six-week preoperative ERAS and PBM protocol, with the same postoperative ERAS protocol as implemented for elective surgery.
- Patients scheduled for a **heart transplant** are referred every two months to the ERAS day hospital, with a focus on respiratory and cardio-muscular prehabilitation. Postoperatively, they will follow an elective surgery ERAS and PBM protocol.
- Patients undergoing **transcatheter aortic valve implantation (TAVI)** follow a preoperative ERAS protocol and PBM screen. Surgery is conducted by a cardiac surgeon and an interventional cardiologist, with optimal vascular access and local analgesia using ultrasound. Postoperative mobilisation occurs quickly with rehabilitation.

### Quote

**“When the patient is involved in the preoperative course, and when they know that it's very important to follow this protocol, they will be very happy to come to the surgery; it completely changed the way we take care of our patients.”**

## Preliminary Findings: VR In Anxiety Reduction

Jolanda Kluin, MD PhD  
Erasmus Medical Centre Rotterdam, Netherlands  
Head of Department of Cardiothoracic Surgery

### Key Message

Preoperative virtual reality patient education significantly improves postoperative patient satisfaction.

### VRECOVERY trial

Dr Kluin presented preliminary results from the VRECOVERY trial. Patients were randomised to either a control (n=96) or a virtual reality (VR) distraction therapy group (n=96). VR therapy provides a soothing atmosphere in different chosen environments, with music and breathing exercises, and is implemented pre-surgery and postoperative days one, two and three. Postoperative NRS pain scores were found to decrease faster in the VR group (-1.45/day) than in the control group (-0.73/day) (p=0.007). Postoperative STAI-6 anxiety scores were not significantly different between the VR group (-0.60/day) and the control group (+0.09/day). The decision to start VR postoperatively on Day 1 was to obtain adequate data, as patients are usually discharged on Day three. However, the dropout rate in the VR group was 24 due to nausea, and therefore, postoperative VR on Day 1 may be too early; it would be better to continue therapy at home.

### VR Tour

A second trial (VR Tour) used VR for preoperative patient education. At the outpatient clinic, patients experience a 3D VR tour. The tour begins in the ward and moves to the operating room (OR), where the OR staff present the questions that will be asked in an actual situation. The patients wake up in the intensive care unit (ICU). Preoperative anxiety assessments (STAI/APAIS) are conducted at outpatients and one day before surgery. Preoperative anxiety is higher in women compared to men; however, no differences were seen between the two study groups. A patient satisfaction questionnaire completed after discharge showed significantly higher patient satisfaction in the VR group compared to the control group (p=0.001). It is worth finding out whether having virtual information before surgery decreases or increases anxiety. It was acknowledged that this question was not asked of patients in this study. Future studies are needed to find out what level of preoperative information and in what format patients would like to reduce their anxiety, which may depend on age and culture.

### Quote

**“If you are a patient and you can [already] experience what you have to undergo and how it is when you wake up, I think it might help patient outcomes”.**

# Drainology: The Guidelines So Far

Louis Perrault, MD PhD  
Montreal Heart Institute, Canada  
Former Head of Cardiac Surgery

## Key Message

Effective drainage of the pericardium reduces postoperative atrial fibrillation, but no current ERAS guidelines exist..

Complications due to retained blood syndrome (RBS) are common in cardiac surgery, and 15%-20% require reinterventions. Residual pericardial blood is a trigger for postoperative atrial fibrillation (POAF)<sup>1</sup>. Many different drains are available on the market for the pericardial and pleural space.

The original ERAS guidelines for cardiac surgery in 2019<sup>2</sup> have been revisited in other consensus statements<sup>3-5</sup>. The elements included in the statements with high-quality consensus data are protective lung ventilation, postoperative systematic delirium screening and prevention, and prevention of surgical site infection. Thus, more data is needed to prove the other elements in the ERAS statements. Future iterations will include early removal of tubes and catheters, heparin-induced thrombocytopenia, chronic opioid use, and minimally invasive surgery. There were topics included in the 2019 statements that were not included in the 2024 statement<sup>5</sup>. Dr Perrault discussed that topics should not be linked to a device, for example, chest tube patency, but they should concentrate on avoiding blood accumulation and subsequent POAF. Meaningful studies are needed to examine specific variables affecting particular outcomes<sup>6</sup>. A systematic review and meta-analysis published in 2017<sup>7</sup> showed the benefits of posterior pericardial drainage, but it has not been well adopted.

Further data published in 2021 found that left posterior pericardiectomy (PP) reduces POAF, with a low incidence of postoperative left pleural drainage (1%) but with a left pleural effusion of 31%<sup>8</sup>. Future drainage studies will need to include an arm for left posterior pericardiectomy. Dr Perrault introduced the upcoming PRINCE trial to recruit 1,400 patients undergoing cardiac surgery. He invites other researchers to participate. The primary objective will be to determine whether left posterior pericardiectomy reduces POAF in the first five postoperative days. The follow-up will be five years.

## Quote

**“The real clinical issue is the optimal evacuation of the pericardial space, but this was not revisited in the 2024 ERAS consensus statement. If you’ve been doing something for the last 30 years, then you’re probably doing something wrong”.**

## References

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## Utility of Digital Drains For Successful Patient Recovery

Marjan Jahangiri, FRCS, FRCS (CTh)  
St. George's Hospital London, UK  
Head of Cardiac Surgery

### Key Message

The use of a digital drainage system significantly reduces the odds of developing postoperative atrial fibrillation.

During the first six-week postoperative period, 12-25% of patients who undergo cardiac surgery have complications due to RBS, including POAF, lower respiratory tract infection and increased readmission rates. Dr Jahangiri presented results from their retrospective study comparing the effects of the Thopaz+ digital drainage system (n=155) with a traditional drain (n=183). There was a significant difference in the incidence of POAF between the digital (n=26, 17.5%) compared to the traditional drain (n=48, 26.4%) (p=0.05).

	<b>Analogue n=183</b>	<b>Digital n=155</b>	<b>p-value</b>
<b>Post op atrial fibrillation</b>	48 (26.4%)	26 (17.5%)	0.05

Adjusting for confounders, the odds of developing POAF were 0.57 times lower in the digital group than in the traditional drainage group. There were no statistical differences in the rates of reoperation, bleeding, cardiac tamponade, pleural effusion requiring drainage, or hospital length of stay.

The UK's NICE has approved the ERAS guidelines, which are being adopted across Europe. Each element of ERAS is small and incremental; therefore, to show the effects of each outcome, we need huge numbers of patients.

### Quote

**“We are doing something wrong in terms of giving information to our patients when results from a UK survey found that patients thought that the average mortality rate following cardiac surgery was 15%-20%.”**

# Efficacy Of Hydrogel-Coated Chest Tubes In The Prevention Of RBS

Shekhar Saha, MD PhD  
University Hospital of Munich, Germany  
Resident at the Department of Cardiac Surgery

## Key Message

Hydrogel-coated drains, in combination with a digital drainage system, maintain higher patency than standard silicone drains.

Retained blood syndrome can occur in the acute, sub-acute or chronic phase following cardiac surgery. A pre-clinical study in mice published in 1984 showed that hydrogel polymer-coated silicone drain reduced blood adherence to the tube and facilitated easy drain removal <sup>1</sup>. In 2024, in a cohort of heterogenous patients (n=178) with 512 chest drains, patency was lower in conventional chest drains compared to hydrogel-coated drains (36.7% vs 98.8%, p<0.001). Conventional chest drains showed 5.9 times greater odds of large pleural effusions than hydrogel-coated drains. Patients with hydrogel-coated drains had the shortest length of hospital stay <sup>2</sup>. The study had limitations, as it was not randomised, and fewer patients had hydrogel-coated chest drains. Dr Saha introduced their ongoing prospective randomised study comparing the ClotStop® hydrogel-coated drain with a standard silicone drain in patients undergoing minimally invasive aortic valve replacement via partial upper sternotomy. All patients were connected to the Thopaz+ digital drainage system. Preliminary results show that in the first six hours, there was slightly more fluid drainage and higher patency from the hydrogel-coated drains than the silicone drains.

## Quote

**“There’s not a specific time when you take the drain out? Because, of course, it will differ if you leave them longer inside, as that will mean more non-patent drains, I guess?”**

## References

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