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Enhanced Recovery After LDLT Surgery

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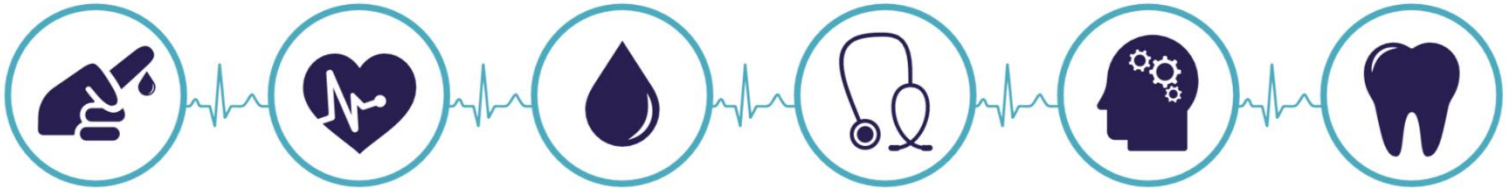

- Multimodal
- Streamline care
- Reduce complications
- Collection of interventions
- Improve outcomes


Nurses
Physiotherapists
Anaesthetists
YOU
Specialist doctors
Surgeons and ward doctors
Pharmacists
Practice nurse
GP

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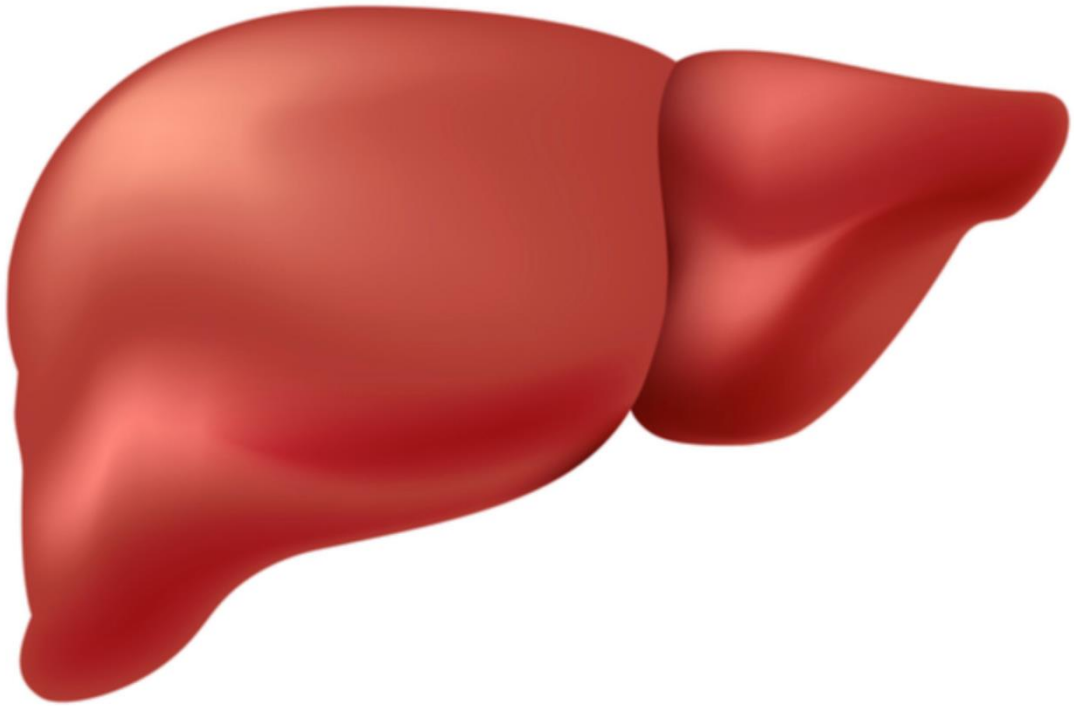

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ENHANCED RECOVERY FOR LIVER TRANSPLANT

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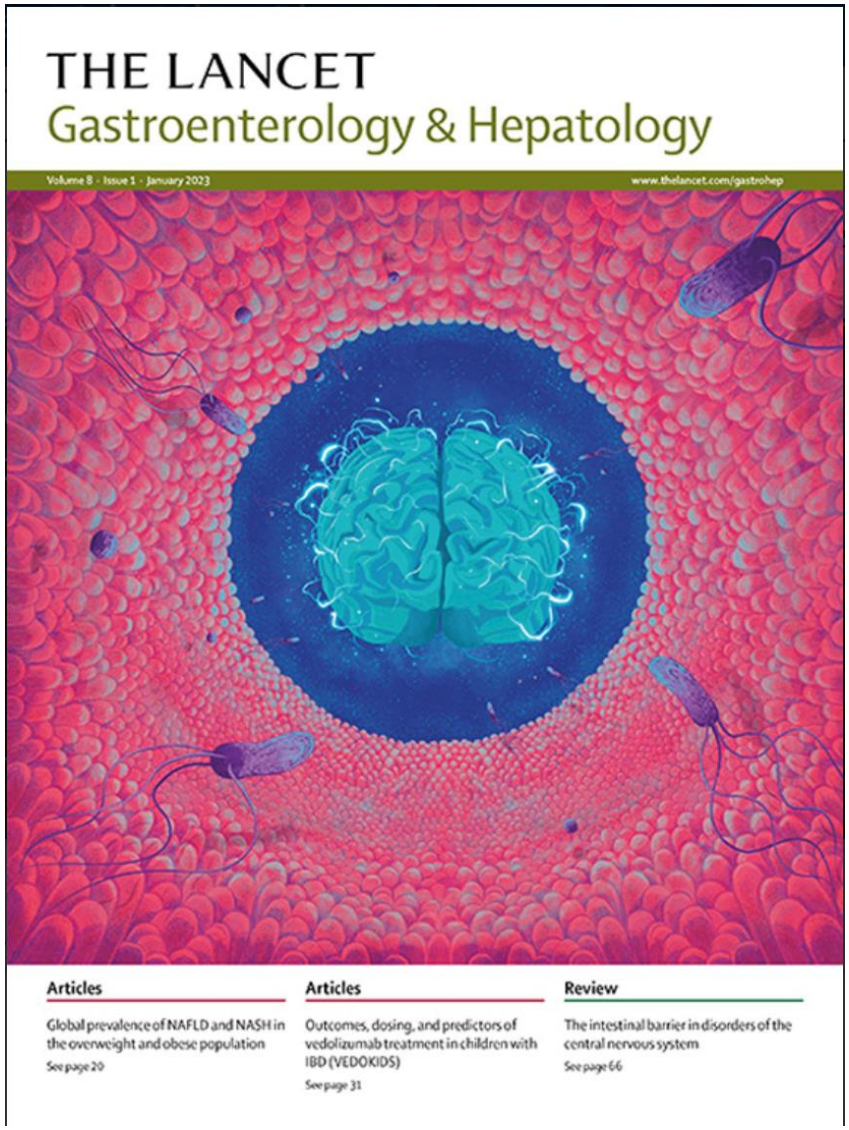
THE LANCET
Gastroenterology & Hepatology
Volume 8 · Issue 1 · January 2023
www.thelancet.com/gastrohep
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THE LANCET
Gastroenterology & Hepatology
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Enhanced recovery for liver transplantation: recommendations from the 2022 International Liver Transplantation Society consensus conference

Joerg M Pollok, Pascale Tinguely*, Marina Berenguer, Claus U Niemann, Dimitri A Raptis†, Michael Spiro†, on behalf of the ERAS4OLT.org collaborative‡*

There is much controversy regarding enhanced recovery for recipients of liver transplants from deceased and living donors. The objectives of this Review were to summarise current knowledge on individual enhanced recovery elements on short-term outcomes, identify key components for comprehensive pathways, and create internationally accepted guidelines on enhanced recovery for liver-transplant recipients. The ERAS4OLT.org collaborative partnered by the International Liver Transplantation Society performed systematic literature reviews on the effect of 32 relevant enhanced perioperative recovery elements on short-term outcomes, and global specialists prepared expert statements on deceased and living donor liver transplantation. The Grading Recommendations, Assessment, Development and Evaluations approach was used for rating of quality of evidence and grading of recommendations. A virtual international consensus conference was held in January, 2022, in which results were presented, voted on by the audience, and discussed by an independent international jury of eight members, applying the Danish model of consensus. 273 liver transplantation specialists from 30 countries prepared expert statements on elements of enhanced recovery for liver transplantation based on the systematic literature reviews. The consensus conference yielded 80 final recommendations, covering aspects of enhanced recovery for preoperative assessment and optimisation, intraoperative surgical and anaesthetic conduct, and postoperative management for the recipients of liver transplants from both deceased and living donors, and for the living donor. The recommendations represent a comprehensive overview of the relevant elements and areas of enhanced recovery for liver transplantation. These internationally established guidelines could direct the development of enhanced recovery programmes worldwide, allowing adjustments according to local resources and practices.

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Living Donor Liver Transplantation

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	Quality of evidence	Grade of recommendation
Preoperative measures		
Which pretransplantion factors, such as MELD, renal function, performance status, recent sepsis, and sarcopenia, influence suitability for and outcomes after living donor liver transplantation?		
1. MELD scores >25–30, along with one or more other adverse factors, are likely to result in an increased risk of mortality, morbidity, and length of hospital stay in recipients after liver transplantation. Hence, these patients should undergo transplantation with an optimal graft only after careful multidisciplinary consideration of the recipient.	Low	Strong
2. Renal dysfunction increases mortality, morbidity, and length of hospital stay in recipients after liver transplantation, therefore, these patients should undergo transplantation with an optimal graft only after careful multidisciplinary consideration of the recipient.	Low	Strong
3. Sarcopenia is considered a component of the overall candidacy of the patient. When compounded by other risk factors (eg, MELD and renal dysfunction), careful multidisciplinary consideration of the recipient is required and an optimal graft might benefit the recipient.	Low	Strong
4. Recently treated infections in the recipient do not contraindicate living donor liver transplantation because they do not increase risk of post-transplantation mortality.	Low	Strong
What is the lower limit of graft-to-recipient weight ratio compatible with enhanced recovery of the recipient after living donor liver transplantation?		
5. A ratio of ≥0·8% is often compatible with enhanced recovery, but a ratio of <0·8% can be used in selected recipients of a liver transplant from a living donor with optimal donor–recipient selection, surgical technique, and perioperative management.	Low	Strong
Intraoperative measures		
Does portal flow modulation enhance recovery of the recipient after living donor liver transplantation?		
6. We recommend that preoperative and intraoperative validation of actual graft weight, portal pressure and flow measurements, and a comprehensive donor evaluation for the determination of potentially small-for-size or small-for-flow grafts are mandatory.	Moderate	Strong
7. Pharmacological portal inflow modulation is recommended to improve early renal function in recipients.	Moderate	Strong
8. In selected patients with small-for-size grafts, portal inflow modulation is recommended to reduce small-for-size syndrome, early allograft dysfunction, and sepsis.	Moderate	Strong
9. Splenic artery ligation is recommended over portal inflow modulation in the form of splenectomy due to reduced morbidity.	Moderate	Strong
10. In recipients with small-for-size grafts, portal inflow modulation is recommended to enhance recovery and to reduce morbidity and mortality.	Moderate	Strong

Table 3: **Recommendations on enhanced recovery of the recipient after living donor liver transplantation**

	Quality of evidence	Grade of recommendation
Preoperative measures		
How can physiological evaluation before donation be optimised for enhanced recovery after living liver donation?		
1. Living liver donation can be performed in older donors (aged 60–69 years).	Low	Weak
2. No specific predonation cutoff for BMI can currently be recommended.	Low	Weak
3. Abbreviated predonation physiological testing is suggested for all candidates.	Low	Weak
4. Comprehensive testing is recommended in candidates at high risk, while considering the pretest probability in various populations.	Low	Strong
What is the optimal surgical investigation to ensure safe recovery of the donor after living liver donation?		
5. Primary detection of liver steatosis in the donor liver should be performed by imaging techniques. MRI assessment provides adequate sensitivity and negative predictive value for the assessment of low percentages of steatosis.	Low	Strong
6. Liver biopsy is the only way to quantify and specify liver steatosis and to detect additional hepatopathies and is suggested (percutaneous ultrasound-guided fine needle aspiration biopsy) in patients with suspected 10% liver steatosis or more on imaging.	Low	Weak
7. The general standard for donors should be a remnant liver volume of at least 30% of the estimated liver parenchymal volume. The effect of steatosis, age, and sex on volume calculations should always be considered.	Low	Strong
8. Magnetic resonance cholangiopancreatography and CT angiography are the recommended imaging tests for liver vascular and biliary anatomy.	Low	Strong
9. Catheter angiography is currently not recommended for evaluation of living donors.	Low	Strong
Does preoperative counselling of the donor improve immediate and short-term outcomes after living liver donation?		
10. Provision of comprehensive preoperative counselling to living liver donors is recommended because it is associated with improved short-term outcomes after donation.	Moderate	Strong
Intraoperative measures		
Does a multimodal approach to the pain of the donor intraoperatively enhance immediate and short-term outcomes after living liver donation?		
11. A multimodal analgesia strategy should be offered to individuals undergoing living donor hepatectomy.	Low	Strong
12. The use of opioid-reduction techniques in enhanced recovery programmes is recommended in living liver donors during the postoperative period.	Low	Strong
What is the influence of surgical technique in donor hepatectomy on immediate and short-term living outcomes in donors?		
13. Left donor hepatectomy might be preferred over right hepatectomy because it is related to improved short-term outcomes in the donor.	Moderate	Weak
14. Right donor hepatectomy with or without middle hepatic vein can be performed because both procedures show equivalent outcomes.	Moderate	Weak
15. No recommendation can currently be made on the mode of donor hepatectomy (minimally invasive *vs* open) due to scarce data. Decisions should be based on the experience and expertise of a programme.	Low	Strong
16. No difference in short-term outcomes was observed in relation to incision type; however, midline incisions as opposed to subcostal incisions are suggested to improve long-term outcomes in the donor, including cosmesis and self-confidence scores.	Low	Weak
Postoperative measures		
What is the optimal prophylaxis against postoperative deep vein thrombosis in the living liver donor to avoid complications and enhance recovery?		
17. Chemoprophylaxis is recommended to prevent deep venous thrombosis following living donor hepatectomy because the procedure is associated with reduced adverse thrombotic events.	Low	Strong
18. A minimum of 10 days of unfractionated heparin or low-molecular-weight heparin for individuals undergoing living donor hepatectomy is suggested.	Low	Weak
When is it safe for the donor to be discharged and how can unnecessary rehospitalisations be prevented?		
19. Monitoring and prevention of donor complications should be crucial in decision making. Pain and diet control, removal of all drains and catheters, prophylaxis for deep venous thrombosis, and use of routine imaging (CT scan or liver ultrasonography) before discharge should be included in fit-for-discharge checklists.	Low	Strong
20. Transient impaired liver function (defined by elevated bilirubin and international normalised ratio) usually occurs after right hepatectomy in the donor and should be monitored. Improving trends for bilirubin and international normalised ratio values should be observed by day 5 after hepatectomy and should be included in fit-for-discharge checklists.	Low	Strong

Table 2: **Recommendations on enhanced recovery of the living liver donor**

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Clinical TRANSPLANTATION
The Journal of Clinical and Translational Research
WILEY

ORIGINAL ARTICLE

Does pre-operative counselling of the donor improve immediate and short-term outcomes after living liver donation? – A review of the literature and expert panel recommendations

Megan A. Adams[1,2] | Oya Andacoglu[3] | Cara E. Crouch[4] | Martin de Santibañes[5] | Whitney E. Jackson[6] | Arif Jalal[7] | Iman F. Montasser[8] | Susan Rubman[9] | Michael Spiro[10,11] | Dimitri Aristotle Raptis[11,12] | Charles Miller[13] | Elizabeth Pomfret[1] | On behalf of the ERAS4OLT.org Working Group: Claus Niemann, San Francisco, CA, USA, Joerg-Matthias Pollok, London, UK, Marina Berenguer, Valencia, Spain, Pascale Tinguely, London, UK, Carlo Frola, London, UK, Jonathan Potts, London, UK

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Clinical TRANSPLANTATION
The Journal of Clinical and Translational Research
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ORIGINAL ARTICLE

Does pre-operative counselling of the donor improve immediate and short-term outcomes after living liver

Conclusions: Providing comprehensive pre-operative counselling to living liver donors is associated with improved short-term outcomes after donation (QOE; moderate to low I Grade of Recommendation; Strong).

Michael Spiro[10,11] | Dimitri Aristotle Raptis[11,12] | Charles Miller[13] | Elizabeth Pomfret[1] | On behalf of the ERAS4OLT.org Working Group: Claus Niemann, San Francisco, CA, USA, Joerg-Matthias Pollok, London, UK, Marina Berenguer, Valencia, Spain, Pascale Tinguely, London, UK, Carlo Frola, London, UK, Jonathan Potts, London, UK

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ORIGINAL ARTICLE

Influence of surgical technique in donor hepatectomy on immediate and short-term living donor outcomes – A systematic review of the literature, meta-analysis, and expert panel recommendations

Yee L Cheah[1] | Julie Heimbach[2] | Choon Hyuck David Kwon[3] | James Pomposelli[4] | Dianne LaPointe Rudow[5] | Dieter Broering[6] | Michael Spiro[7,8] | Dimitri Aristotle Raptis[8,9] | John P. Roberts[10] | On behalf of the ERAS4OLT.org Working Group: Claus Niemann, San Francisco, CA, USA, Joerg-Matthias Pollok, London, UK, Marina Berenguer, Valencia, Spain, Shahi Abdul Ghani, London, UK and Ka Siu Fan, London, UK

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ORIGINAL ARTICLE

Conclusions: Left donor hepatectomy should be preferred over right hepatectomy, as it is related to improved donor short-term outcomes (QOE; Moderate | Grade of Recommendation; Strong). Right donor hepatectomy with or without MHV has equivalent outcomes (QOE; Moderate | Grade of Recommendation; Strong); no preference is recommended, decision should be based on program's experience and expertise. No difference in outcomes was observed related to incision type, minimally invasive vs. open (QOE; Low | Grade of Recommendation; Weak); no preference can be recommended.

Group. Claus Niemann, San Francisco, CA, USA, Joerg Matthias Pollok, London, UK, Marina Berenguer, Valencia, Spain, Shahi Abdul Ghani, London, UK and Ka Siu Fan, London, UK

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ORIGINAL ARTICLE

Does multimodal perioperative pain management enhance immediate and short-term outcomes after living donor partial hepatectomy? A systematic review of the literature and expert panel recommendations

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ORIGINAL ARTICLE

Conclusions: Opioid use for patients undergoing donor hepatectomy is likely to impact both their short- and long-term outcomes. To reduce post-operative pain scores, shorten length of hospital stay, and promote earlier post-operative return of bowel function, we recommend that multi-modal analgesia be offered to patients undergoing

living donor hepatectomy. Further research is required to confirm which multi-modal techniques are most associated with enhanced recovery in living liver donors.

ERAS4OLT.org Working Group: Claus Niemann, San Francisco, CA, USA, Joerg-Matthias Pollok, London, UK,Marina Berenguer, Valencia, Spain, Pascale Tinguely, London, UK, Carlo Frola, London, UK. Jonathan Potts, London, UK.

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Clinical TRANSPLANTATION
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REVIEW ARTICLE

Optimizing pre-donation physiologic evaluation for enhanced recovery after living liver donation – Systematic review and multidisciplinary expert panel recommendations

Manhal Izzy[1] | Robert S. Brown[2] | Susumu Eguchi[3] | Shin Hwang[4] | Maria A. Matamoros[5] | Cristiano Quintini[6] | Akila Rajakumar[7] | Dimitri A. Raptis[8,9] | Michael Spiro[9,10] | Nancy L. Ascher[11] | the ERAS4OLT.org Working Group: Claus Niemann, San Francisco, CA, USA, Joerg-Matthias Pollok, London, UK, Marina Berenguer, Valencia, Spain, Shahi Abdul Ghani, London, UK and Ka Siu Fan, London, UK

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REVIEW ARTICLE

Optimizing pre-donation physiologic evaluation for enhanced recovery after living liver donation—Systematic review and

Conclusion: Advancing age (60-69 years) is not a contraindication for liver donation. There is insufficient evidence for a specific predonation BMI cut-off. Abbreviated predonation physiologic testing is recommended in all candidates. Comprehensive testing is recommended in high-risk candidates while considering the pretest probability in various populations (Quality of evidence; Low to Very Low | Grade of Recommendation; Strong).

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ORIGINAL ARTICLE

When is it safe for the liver donor to be discharged home and prevent unnecessary re-hospitalizations? – A systematic review of the literature and expert panel recommendations

Alessandra Mazzola[1] | Gabriella Pittau[2] | Suk Kyun Hong[3] | Srinath Chinnakotla[4] | Hans-Michael Tautenhahn[5] | Daniel G. Maluf[6] | Utz Settmacher[5] | Michael Spiro[8,9] | Dimitri Aristotle Raptis[9,10] | Ali Jafarian[7] | Daniel Cherqui[2] | On behalf of the ERAS4OLT.org Working Group: Claus Niemann, San Francisco, CA, USA, Joerg-Matthias Pollok, London, UK, Marina Berenguer, Valencia, Spain, Pascale Tinguely, London, UK, Jonathan Potts, London, UK, Carlo Flora, London, UK. Arun Mahay, London, UK, Zakee Abdi, London, UK

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ORIGINAL ARTICLE

Conclusions: Monitoring and prevention of donor complications should be crucial in decision making of discharge. Pain and diet control, removal of all drains and catheters, deep venous thrombosis prophylaxis, and use routine imaging (CT scan or liver ultrasound) before discharge should be included as fit for discharge checklist *(QoE; Low | GRADE of recommendation; Strong)*. Transient Impaired liver function (defined by elevated bilirubin and INR), a prognostic marker of outcome after liver resection, usually occurs after donor right hepatectomy and should be monitored. Improving trends for bilirubin and INR value should be observed by day 5 post hepatectomy and be included in the fit for discharge checklist. (*QoE; Very-Low | GRADE; Strong*).

Manay, London, UK, Zakee Abdi, London, UK

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ORIGINAL ARTICLE

What is the optimal prophylaxis against postoperative deep vein thrombosis in the living donor to avoid complications and enhance recovery? – A systematic review of the literature and expert panel recommendations

Luis I. Ruffolo[1] | Mark Levstik[1] | Jen Boehly[1] | Michael Spiro[2,4] | Dimitri A. Raptis[3,4] | Linda Liu[5] | Roberto Hernandez-Alejandro[1] | On behalf of the ERAS4OLT.org Working Group: Claus Niemann, San Francisco, CA, USA, Joerg-Matthias Pollok, London, UK, Marina Berenguer, Valencia, Spain, Pascale Tinguely, London, UK, Carlo Frola, London, UK. Jonathan Potts, London, UK, Aditya Borakati, London, UK, Lam Sze Tung, Singapore.

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ORIGINAL ARTICLE

What is the optimal prophylaxis against postoperative deep vein thrombosis in the living donor to avoid complications and

Conclusions: Chemoprophylaxis for DVT following living donor hepatectomy is associated with reduced adverse thrombotic events, (Quality of Evidence; Low | Grade of Recommendation; Strong).

Dimitri A. Raptis | Linda Liu | Roberto Hernandez-Alejandro | On behalf of the ERAS4OLT.org Working Group: Claus Niemann, San Francisco, CA, USA, Joerg-Matthias Pollok, London, UK, Marina Berenguer, Valencia, Spain, Pascale Tinguely, London, UK, Carlo Frola, London, UK. Jonathan Potts, London, UK, Aditya Borakati, London, UK, Lam Sze Tung, Singapore.

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ORIGINAL ARTICLE

Optimal surgical workup to ensure safe recovery of the donor after living liver donation – A systematic review of the literature and expert panel recommendations

Giuliano Testa[1] | Silvio Nadalin[2] | Tarunjeet Klair[3] | Sander Florman[4] | Deniz Balci[5] | Carlo Frola[6] | Michael Spiro[7,8] | Dimitri Aristotle Raptis[6,8] | D. Markus Selzner[9] | On behalf of the ERAS4OLT.org Working Group: Claus Niemann, San Francisco, CA, USA, Joerg-Matthias Pollok, London, UK, Marina Berenguer, Valencia, Spain, Shahi Abdul Ghani, London, UK and Ka Siu Fan, London, UK

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ORIGINAL ARTICLE

Optimal surgical workup to ensure safe recovery of the donor

Conclusions: A donor liver biopsy is indicated if abnormalities are present in serological or imaging tests. Both MRI and CT imaging appear to be adequate methodologies. The routine use of catheter angiography is not supported in view of the adequacy of CT angiography in delineating liver vascular anatomy. No imaging modality available to quantify liver volume is superior to another. Biliary anatomy is better defined with MRI, although poor definition can be expected, particularly for abnormal ducts.

Shahi Abdul Ghani, London, UK and Ka Siu Fan, London, UK

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Summary

- ERAS is highly applicable to LDLT
- Marginal gains of multiple interventions may aggregate to make a larger benefit
- There is time on the waiting list to optimise
- ERAS should be cost and resource saving as well as reducing complications and improve outcomes
- There is scope for national protocols and pathways based on the best available evidence

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Questions?

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