

LIVER TRANSPLANTATION

CLINICAL ASSESSMENT AND MANAGEMENT



EDITED BY
JAMES NEUBERGER
JAMES FERGUSON
PHILIP N. NEWSOME
MICHAEL RONAN LUCEY

SECOND EDITION

WILEY Blackwell

Table of Contents

[Cover](#)

[Title Page](#)

[Copyright Page](#)

[List of Contributors](#)

[Foreword to the Second Edition](#)

[Foreword to the First Edition](#)

[Preface](#)

[Abbreviations](#)

[Part 1: When to Refer a Patient for Liver Transplantation](#)

[1 Overview on Organ Donation and Liver Transplantation](#)

[The global burden of liver disease](#)

[What causes death in patients with liver disease?](#)

[A global perspective on liver transplantation](#)

[The donor organ](#)

[What is the goal of liver transplantation?](#)

[Life after transplantation](#)

[Further reading](#)

[2 Predicting Outcomes and Use and Abuse of Prognostic Models](#)

[Background of liver allocation in the United States](#)

[The MELD score for liver allocation](#)

[United Kingdom Model for End-Stage Liver Disease score](#)

[Acute-on-chronic liver failure](#)

[Future directions](#)

[Further reading](#)

[Part 2: Selection, Assessment, and Management on the List](#)

[3 Assessment of the Potential Transplant Recipient](#)

[Criteria](#)

[Process](#)

[References](#)

[4 Frailty and the Potential Liver Transplant Candidate](#)

[Definition of physical frailty](#)

[Causes of physical frailty](#)

[Measurement of physical frailty](#)

[Further reading](#)

[5 Alcohol Use \(excluding Alcohol-Related Liver Disease\), Tobacco, Marijuana, and Illicit Drugs](#)

[Alcohol](#)

[Tobacco](#)

[Cannabis \(marijuana\)](#)

[Opioids](#)

[Other substances](#)

[Further reading](#)

[6 The Role of the Psychiatric Consultant in the Selection, Assessment, and Management of Liver Transplant Patients](#)

[Role of the transplant psychiatrist in transplant evaluation](#)

[Transplant psychiatric evaluation](#)

[Mistaken beliefs about transplant psychiatry](#)

[Motivational interviewing](#)

[Psychosocial assessment](#)

[Collateral history](#)

[Psychiatric contraindications for liver transplant](#)

[Treatment of psychiatric disorders in patients before or after liver transplantation](#)

[Role of the transplant psychiatrist in the perioperative period](#)

[Special considerations](#)

[Further reading](#)

[7 When Liver Transplant Patients Do Not Adhere to Therapeutic Plans](#)

[Understanding non-compliance](#)

[Liver disease and non-compliance](#)

[What should you do when one of your patients does not adhere to the therapeutic plan?](#)

[Further Reading](#)

[8 Liver Transplant Assessment for Young People: Addressing the Needs of Young People with Liver Disease](#)

[Adolescent development](#)

[Indications for liver transplantation in young people, including childhood liver diseases](#)

[Timing of listing for liver transplantation and listing criteria](#)

[Liver transplant assessment in young people with liver disease](#)

[Conclusion](#)

[Further reading](#)

9 Assessment and Management of the Patient with Hepatitis C

Screening for chronic hepatitis C virus infection

Pre-therapeutic assessment

Indications for hepatitis C virus treatment

Further reading

10 Management of Hepatitis B Virus Infection Pre Transplantation

Management of end-stage hepatitis B virus liver disease

Conclusion

Further reading

11 Transplantation for the Management of Malignancy

Liver transplantation and hepatocellular carcinoma

Liver transplantation and cholangiocarcinoma

Liver transplantation for treatment of uncommon hepatic malignancies

Further reading

12 Assessment and Management of the Liver Transplant Candidate with Acute-on-Chronic Liver Failure

Definition, diagnostic criteria, and ACLF grades

Epidemiology, health burden, and mortality

Precipitating illness

Clinical course

Prognostic score

Management and futility of intensive care support

Liver transplantation

References

13 Assessment and Management of the Transplant Candidate with Alcohol-Associated Liver Disease

Clinical pre-transplant evaluation of patients with alcohol-related liver disease

Pre-transplant evaluation of addiction in patients with alcohol-related liver disease

Alcoholic hepatitis as an emerging indication for liver transplantation

A team decision: an ethical perspective

Further reading

14 Non-alcoholic Fatty Liver Disease as an Indication for Liver Transplantation

Epidemiology and indication for liver transplantation in non-alcoholic fatty liver disease and non-alcoholic steatohepatitis

Obstacles to the diagnosis of non-alcoholic fatty liver disease and non-alcoholic steatohepatitis in end-stage liver disease

Special considerations prior to liver transplantation in patients with non-alcoholic fatty liver disease

Obesity and nutrition

Diabetes mellitus

Cardiovascular disease

Further reading

15 Consent

The principles of consent

Consent and transplantation

Timing of consent

What information should be given to the prospective transplant recipient?

What is risk and what should be discussed?

Explaining risk

Research

Further reading

16 Prehabilitation and General Management

Nutrition

Exercise

Lifestyle and optimization of non-liver co-morbidities

Psychologic support

Preventing complications of end-stage liver disorder

Further reading

17 Removal of Patients from the Liver Transplant Waiting List

Hepatocellular carcinoma

Hepatopulmonary syndrome

Alcohol-related liver disease

Hepatitis C

Cumulative co-morbidity

Further reading

18 Palliative Care and Liver Transplantation

What is palliative care?

Benefits of palliative care in advanced liver disease

Attitudes and barriers to palliative care

Palliative care and liver transplantation

[Special palliative care scenarios in liver transplantation](#)

[Conclusion](#)

[Further reading](#)

[Part 3: Transplantation for Acute Liver Failure](#)

[19 Assessment of the Patient with Acute Liver Failure](#)

[Prognosis and patient selection](#)

[Proceed to liver transplantation after organ allocation?](#)

[Graft allocation](#)

[Auxiliary liver transplantation](#)

[Further reading](#)

[20 Management of the Patient with Fulminant Hepatic Failure Awaiting Liver Transplantation](#)

[General management](#)

[Maintenance of hemodynamic stability](#)

[Infection](#)

[Bleeding](#)

[Assessment of bleeding risk](#)

[Renal function and renal replacement therapy](#)

[Intracranial hypertension and cerebral edema](#)

[Intracerebral pressure monitoring bolts](#)

[Jugular venous bulb oxygen saturation](#)

[Seizures](#)

[Management of intracranial pressure and ischemia](#)

[General management of patients with cerebral edema](#)

[Removal from the waiting list](#)

Other measures

Further reading

Part 4: Donation and Allocation

21 Ethical and Legal Aspects of Organ Donation

Legal issues in organ donation

Autonomy and organ donation

Beneficence and non-maleficence

Deceased from circulatory death donors

Hepatitis C-positive organ transplant in
hepatitis C-negative patients

Increased-risk organs

Conclusion

Further reading

22 Liver Allocation, Including Principles of Organ Allocation

Current liver donor organ allocation and
distribution system

Current liver organ allocation

Conclusion

Further reading

23 Living Donor Liver Transplant in Children

Historical background

Importance of living donor liver transplantation
in pediatrics

Indications for living donor liver transplantation
in children

Living donor liver transplant for metabolic
diseases

Advantages of living donor liver transplantation
in children

[Evaluation of the potential living donor](#)

[Special considerations in the pediatric recipient of living donor liver transplant](#)

[Choice of graft](#)

[The surgical approach](#)

[Patient survival/graft survival after living donor liver transplantation in children](#)

[Considerations and potential complications related to the living donor](#)

[Conclusion](#)

[Further reading](#)

[24 Living Liver Donation in Adults](#)

[History](#)

[Need for living donor liver transplantation](#)

[Ethical considerations](#)

[Donor evaluation](#)

[Donor evaluation algorithm](#)

[Living donor liver transplant recipient evaluation](#)

[Advances in living donor liver transplantation](#)

[Conclusion](#)

[Further reading](#)

[25 Deceased Liver Donors: Standard and Expanded Criteria](#)

[A metric of donor quality: the donor risk index](#)

[Donor and graft factors that pose increased risk of graft failure](#)

[Further reading](#)

[26 Donor-Transmitted Disease](#)

[Donor-transmitted cancer after liver transplantation](#)

[Donor-transmitted infections](#)

[Donor-transmitted metabolic disease](#)

[Other donor-transmitted diseases](#)

[Further reading](#)

[27 Liver Donation and Preservation](#)

[Deceased organ donation system in the UK](#)

[Donation after brain death](#)

[Donation after circulatory death](#)

[Organization of organ procurement in the UK](#)

[Donor liver selection and evaluation](#)

[Contraindications to organ donation](#)

[Abdominal multi-organ retrieval and liver evaluation](#)

[Organ preservation and machine perfusion](#)

[Conclusion](#)

[Further reading](#)

[28 Liver Retrieval and Preservation](#)

[Multi-organ retrieval from donation after brain death donors](#)

[Liver retrieval from deceased after circulatory death donors](#)

[Liver preservation](#)

[Further reading](#)

[29 Alternatives to Whole Graft Liver Transplantation](#)

[Acute liver failure](#)

[Heterotopic or orthotopic? This is the question](#)

[Technical aspects of auxiliary partial orthoptic liver transplantation in acute liver failure](#)

[Postoperative management](#)

[Donor and recipient selection](#)

[Auxiliary partial orthoptic liver transplantation for monogenic diseases](#)

[Domino and cross-domino auxiliary liver transplantation](#)

[Auxiliary liver transplantation in transplant oncology](#)

[Further reading](#)

[30 Surgical Aspects of Deceased Donor Transplantation](#)

[Preoperative workup](#)

[Surgical technique](#)

[Implantation technique](#)

[Future horizons](#)

[Further reading](#)

[Part 5: Care of the Liver Transplant Recipient](#)

[31 Outcomes after Liver Transplantation](#)

[Survival after transplantation](#)

[Factors affecting outcome](#)

[Reasons why survival is limited](#)

[Other outcomes after transplantation](#)

[Further reading](#)

[32 Outpatient Follow-Up of Liver Transplant Recipients](#)

[Complications post liver transplant](#)

[Immunosuppression post liver transplant](#)

[Prophylaxis post liver transplant](#)

[Cardiovascular risk and management post liver transplant](#)

[Renal dysfunction post liver transplant](#)

[Bone disease post liver transplant](#)

[Disease recurrence post liver transplant](#)

[Malignancies post liver transplant](#)

[Pregnancy post liver transplant](#)

[Immunization post liver transplant](#)

[Proposed clinic follow-up post liver transplant and checklist](#)

[Further reading](#)

[33 Medication Adherence](#)

[Defining medication adherence](#)

[Measuring adherence](#)

[Risk factors for non-adherence](#)

[Interventions targeting adherence](#)

[Conclusion](#)

[Further reading](#)

[34 Transitional Care](#)

[What is transition and why do we do it?](#)

[Principles of transition](#)

[Preparation for transition](#)

[Transfer of care](#)

[Further reading](#)

[35 Managing the Liver Transplant Recipient with Abnormal Liver Blood Tests](#)

[Interpretation of abnormal liver blood tests in the liver transplant recipient](#)

[Differential diagnosis in the liver transplant recipient with abnormal liver blood tests](#)

[Investigation of the liver transplant recipient with abnormal liver blood tests](#)

[Management of specific graft-related causes of abnormal liver blood tests in the liver transplant recipient](#)

[Further reading](#)

[36 The Immune System in Liver Transplantation: Rejection versus Tolerance](#)

[Molecular mechanisms of leucocyte recruitment](#)

[Antigen presentation and allorecognition](#)

[T-cell activation](#)

[T-cell differentiation](#)

[Natural mechanisms responsible for the induction and maintenance of tolerance](#)

[The liver as a tolerogenic organ: balancing immune tolerance and immune response](#)

[Tolerogenic properties of liver transplants](#)

[Potential barriers to developing tolerance and the immunobiology of rejection](#)

[Spontaneous operational tolerance](#)

[Further reading](#)

[37 Immunosuppressive Medications: Liver Transplantation](#)

[Induction](#)

[Maintenance](#)

[Conclusion](#)

[Further reading](#)

38 Immunosuppression in Liver Transplantation

Common regimens

Dose of immunosuppressive agents

Calcineurin inhibitors

Mycophenolate

mTOR inhibitors

Azathioprine

Corticosteroids

Drug-drug interactions

Disease-specific regimens

Tolerance

Conclusion

Further reading

39 Patterns of Liver Allograft Rejection

Pattern 1: acute T-cell-mediated rejection

Pattern 2: late acute T-cell-mediated rejection

Pattern 3: plasma cell hepatitis/plasma cell-rich allograft rejection

Pattern 4: acute antibody-mediated rejection

Pattern 5: chronic allograft rejection

Pattern 6: idiopathic chronic hepatitis

Pattern 7: operational tolerance

Further reading

40 De Novo Autoimmune Hepatitis

Epidemiology

Diagnosis

Risk factors for development of de novo autoimmune hepatitis

Pathogenesis

[Treatment](#)

[Further reading](#)

[41 Managing Rejection](#)

[Definitions](#)

[T-cell-mediated rejection](#)

[Antibody-mediated rejection](#)

[Chronic rejection](#)

[Special cases and diagnostic challenges](#)

[42 Withdrawal of Immunosuppression after Liver Transplantation](#)

[Tolerogenic features of the liver and first trials of immunosuppression withdrawal](#)

[Definition of operational tolerance](#)

[Immunosuppression withdrawal in clinical practice](#)

[Conclusion](#)

[Further reading](#)

[43 Liver Transplant Pathology](#)

[Scope of liver transplant pathology](#)

[Assessment of the native liver](#)

[Assessment of pre-implantation donor tissue](#)

[Assessment of post-implantation liver: the “time zero” allograft biopsy](#)

[Liver allograft biopsy](#)

[Further reading](#)

[44 Care of the Liver Transplant Recipient: Management of Renal Function](#)

[Definitions of acute kidney injury and chronic kidney disease](#)

[Renal dysfunction in liver transplant candidates and post-transplant consequences](#)

[Renal dysfunction in liver transplant recipients](#)

[Prevention and management of renal dysfunction in liver transplant recipients](#)

[Conclusion](#)

[Further reading](#)

[45 Managing Cardiovascular Risk in the Liver Transplant Recipient](#)

[Magnitude of the problem](#)

[Management of cardiovascular risk factors in the liver transplant recipient](#)

[Conclusions](#)

[Further reading](#)

[46 Bone Disease in Liver Transplantation](#)

[Prevalence](#)

[Pathogenesis of bone disease in liver transplantation](#)

[Glucocorticoids](#)

[Other immunosuppressive agents](#)

[Pre-existing bone disease](#)

[Other factors](#)

[Diagnostic assessment](#)

[Management of bone disease in liver transplantation](#)

[Conclusion](#)

[Further reading](#)

[47 Diagnosis and Management of Recurrent Autoimmune Liver Disease](#)

[Recurrence of autoimmune hepatitis](#)

[Recurrence of primary biliary cholangitis](#)

[Recurrence of primary sclerosing cholangitis](#)

[De novo autoimmune hepatitis/plasma cell-rich rejection](#)

[Conclusion](#)

[Further reading](#)

[48 NAFLD and NASH in the Patient after Liver Transplantation](#)

[Recurrent and *de novo* non-alcoholic fatty liver disease and non-alcoholic steatohepatitis after liver transplantation](#)

[Risk factors for non-alcoholic fatty liver disease and non-alcoholic steatohepatitis after liver transplantation](#)

[Diagnosis of non-alcoholic fatty liver disease and non-alcoholic steatohepatitis in the transplant recipient](#)

[Management of non-alcoholic steatohepatitis after liver transplantation](#)

[Further reading](#)

[49 Recurrent Metabolic Diseases](#)

[Amyloid](#)

[Porphyria](#)

[Cholestasis](#)

[Hemochromatosis](#)

[Propionic acidemia](#)

[Lysosomal acid lipase deficiency](#)

[Further reading](#)

[50 Treatment of Hepatitis C in the Transplant Setting](#)

[Natural history of untreated hepatitis C in the graft](#)

[Prevention of recurrent hepatitis C](#)

[Treatment of recurrent hepatitis C virus infection](#)

[Transplantation of livers from hepatitis C virus-positive donors](#)

[Further reading](#)

[51 Management of Hepatitis B Virus Infection Post Transplantation](#)

[Diagnosis, mechanisms and risk factors for hepatitis B virus recurrence after liver transplantation](#)

[Prevention of hepatitis B virus recurrence](#)

[Use of liver grafts from anti-HBc-positive donors](#)

[Management of hepatitis B virus infection post transplantation](#)

[Conclusion](#)

[Further reading](#)

[52 Antimicrobial Prophylaxis Following Liver Transplantation](#)

[Bacterial infections](#)

[Fungal infections](#)

[Tuberculosis](#)

[Antiviral prophylaxis](#)

[Vaccination](#)

[Conclusion](#)

[Further reading](#)

53 Cytomegalovirus and the Liver Transplant Recipient

The virus

Cytomegalovirus and liver transplantation

Definitions

Direct effects of cytomegalovirus

Indirect effects of cytomegalovirus

Diagnosis

Preventing cytomegalovirus disease

Treating cytomegalovirus disease

Cytomegalovirus resistance

Further reading

54 Post-Liver Transplant Infections

Hepatitis E virus

Epstein-Barr virus and post-transplant lymphoproliferative disorder

Varicella zoster virus

Herpes simplex virus

Human adenovirus infection

Human immunodeficiency virus

Tuberculosis

Selected fungal infections

Further reading

55 De Novo Malignancies after Liver Transplantation

De novo malignancy is increased in liver transplant recipients

Impact of immunosuppression on post-transplant malignancy

[Screening post-transplant patients for de novo malignancy](#)

[Interventions to reduce the risk of de novo malignancy in liver transplant recipients](#)

[Conclusion](#)

[Further reading](#)

[56 Post-Transplant Lymphoproliferative Disorders](#)

[Background](#)

[Risk factors](#)

[Clinical presentation](#)

[Diagnosis](#)

[Prognosis](#)

[Re-transplantation](#)

[Further reading](#)

[57 Quality of Life and Employment after Liver Transplantation](#)

[What is quality of life?](#)

[Variables that influence quality of life](#)

[Pediatric patients](#)

[Employment after liver transplantation](#)

[Conclusion](#)

[Further reading](#)

[58 Sexual Function, Fertility, and Pregnancy in Liver Disease and after Liver Transplantation](#)

[Overview](#)

[Sexual function after liver transplantation](#)

[Male recipients](#)

[Female recipients](#)

[Conclusion](#)

[Further reading](#)

[59 Common Drug Interactions](#)

[Tacrolimus, ciclosporin, and sirolimus](#)

[Tacrolimus](#)

[Ciclosporin](#)

[Azathioprine](#)

[Mycophenolate](#)

[Corticosteroids](#)

[Further reading](#)

[60 Immunization and Liver Transplantation](#)

[General principles](#)

[Liver transplant candidates](#)

[Liver transplant recipients](#)

[Healthcare workers and close contacts](#)

[Further reading](#)

[Postscript](#)

[Index](#)

[End User License Agreement](#)

List of Tables

Chapter 1

[Table 1.1 Global mortality related to liver disease and liver cancer, 2015.](#)

[Table 1.2 Worldwide comparison of liver transplantation practices.](#)

Chapter 2

[Table 2.1 Child-Turcotte-Pugh classification of the severity of liver disease...](#)

Chapter 3

[Table 3.1 Non-MELD-based indications for liver transplantation.](#)

Chapter 5

[Table 5.1 DSM-V diagnosis of alcohol use disorder.](#)

[Table 5.2 The AUDIT-C screening test.](#)

Chapter 6

[Table 6.1 Screening tools in use in liver transplant evaluation.](#)

[Table 6.2 Mistaken beliefs about psychiatry and liver transplantation.](#)

[Table 6.3 Psychiatric contraindications to liver transplantation.](#)

Chapter 7

[Table 7.1 Mental disorders that may interfere with concordance.](#)

[Table 7.2 5 key principles of motivational interviewing.](#)

[Table 7.3 Investigation of poor concordance.](#)

[Table 7.4 Local hepatology unit actions to address non-compliance.](#)

Chapter 8

[Table 8.1 Features associated with adolescent development and consequences fo...](#)

[Table 8.2 UK Listing criteria for liver transplantation in adults and childre...](#)

[Table 8.3 Indications for listing for liver transplantation in young people w...](#)

[Table 8.4 Checklist of topics for liver transplant assessment in young people...](#)

Chapter 10

[Table 10.1 Antiviral agents.](#)

[Table 10.2 Prevention of hepatitis B virus recurrence with antiviral\(s\) befor...](#)

[Table 10.3 Results of antiviral therapy in patients with decompensated hepati...](#)

Chapter 11

[Table 11.1 MELD exception points system models for hepatocellular carcinoma.](#)

Chapter 12

[Table 12.1 The Chronic Liver Failure-Organ Failure \(CLIF-OF\) score system.](#)

[Table 12.2 ACLF grades and mortality without liver transplant \(LT\).](#)

[Table 12.3 Acute-on-chronic liver failure, defined according to CLIF-C criter...](#)

Chapter 13

[Table 13.1 Co-morbid conditions common in patients with alcohol-related liver...](#)

[Table 13.2 Risk factors found in composite scores for predicting alcohol rela...](#)

[Table 13.3 National Institute for Alcohol Abuse and Alcoholism alcohol consum...](#)

Chapter 14

[Table 14.1 Co-morbidities associated with non-alcoholic fatty liver disease t...](#)

[Table 14.2 Correction of body weight based on the severity of ascites and ede...](#)

Chapter 15

[Table 15.1 The risks of transplantation.](#)

Chapter 16

[Table 16.1 Examples of protein supplementation and contents](#)

Chapter 18

[Table 18.1 Critical differences between palliative care and hospice for patie...](#)

[Table 18.2 Barriers to utilization of palliative care \(PC\) for patients with ...](#)

Chapter 19

[Table 19.1 Variables used in prognostic models in non-acetaminophen-related a...](#)

Chapter 20

[Table 20.1 Etiologies, treatments, and outcomes in acute liver failure.](#)

[Table 20.2 Use of recombinant factor VIIa for intracranial pressure monitor p...](#)

Chapter 23

[Table 23.1 Indications for liver transplantation in children.](#)

[Table 23.2 Living donor evaluation consults and workup.](#)

Chapter 24

[Table 24.1 Criteria for the selection of live donors](#)

[Table 24.2 Acceptable donors](#)

Chapter 26

[Table 26.1 Donor-transmitted cancers in liver recipients \(*associated with re...](#)

[Table 26.2 Some causes of donor-derived infections affecting liver allograft ...](#)

[Table 26.3 Metabolic and other diseases that may be transmitted by the allogr...](#)

Chapter 27

[Table 27.1 Specialist Nurse in Organ Donation \(SNOD\) early involvement and be...](#)

[Table 27.2 Liver donor risk factors associated with graft survival.](#)

[Table 27.3 Absolute contraindications to organ donation.](#)

Chapter 28

[Table 28.1 Maastricht classification of donors after circulatory death](#)

[Table 28.2 Comparison of preservation solutions used in liver transplantation...](#)

[Table 28.3 Overview and comparison of machine perfusion modalities in liver t...](#)

Chapter 29

[Table 29.1 The King's College Hospital Criteria for liver transplantation in ...](#)

[Table 29.2 Clichy criteria for liver transplantation in fulminant hepatic fai...](#)

[Table 29.3 Some indications for use of auxiliary partial orthotopic liver tra...](#)

Chapter 30

vaccination/immunization [525](#)-528

- antimicrobial prophylaxis following liver transplantation [473](#)
- de novo malignancies after liver transplantation [498](#)
- general principles and commonly offered vaccines [525](#)-526, [526](#)
- global perspective on liver transplantation [5](#)
- healthcare workers and close contacts [528](#)
- liver transplant candidates [526](#)
- liver transplant recipients [527](#)
- management of post-transplant hepatitis B [464](#)
- outpatient follow-up of liver transplant recipients [282](#)

valanciclovir [478](#)

VAP-1 *see* vascular adhesion protein-1

variant hepatic artery anatomy [228](#)

varicella zoster virus (VZV)

- clinical presentation and diagnosis [485](#)
- infection control in healthcare settings [486](#)
- post-exposure prophylaxis [486](#)
- post-liver transplant infections [485](#)-486
- treatment [485](#)
- vaccination/immunization [526](#)

varices [122](#)

vascular adhesion protein-1 (VAP-1) [319](#)

vascular cell adhesion molecule-1 (VCAM-1) [318](#), [320](#)

vascular complications

abnormal liver blood tests [308](#), [310](#), [314](#)

biopsy and liver transplant pathology [400](#)-401

vascular endotheliitis [368](#)-371, [369](#), [378](#)

VCAM-1 *see* vascular cell adhesion molecule-1

very low-density lipoprotein (VLDL) [413](#)-414

viral infections

biopsy and liver transplant pathology [401](#)

donor-transmitted disease [205](#)-207, [205](#)

immune system in liver transplantation [331](#)

see also individual viruses

vitamin D deficiency [421](#)-422, [497](#)-498

vitamin K deficiency [305](#), [421](#)

vitamin supplementation [119](#)

VLDL *see* [very low-density lipoprotein](#)

voriconazole [471](#), [491](#)

VZV *see* [varicella zoster virus](#)

W

wall press [120](#)

wall squats [120](#)

warm ischemia [199](#)-200, [210](#), [213](#), [229](#)

warm-phase dissection [224](#)-226, [225](#)

WHO *see* [World Health Organization](#)

Wilson's disease [57](#), [140](#), [142](#)

withdrawal of immunosuppression [386](#)-391
clinical practice flowcharts [390](#)-391, [390](#)-391
concepts and definitions [386](#)
immune system in liver transplantation [331](#)-333
operational tolerance [387](#), [388](#)-390
renal impairment [407](#)
tolerogenic features of the liver and first trials [386](#)-388,
[387](#)

World Health Organization (WHO)

alcohol use [33](#)-34
palliative care [126](#)
post-transplant lymphoproliferative disorders [502](#), [502](#)
quality of life [508](#)
tobacco use [35](#)-36

x

xenotransplantation [530](#)

y

young people [55](#)-63

- adherence to therapeutic plans [56](#)
- adolescent development [56](#)-57, [56](#)
- concepts and definitions [55](#)-56
- future directions [62](#)
- indications for liver transplantation [57](#)-58, [57](#)
- liver transplant assessment [60](#)-62, [61](#)
- peer support [62](#)
- psychosocial factors [60](#)-62
- timing of listing for transplantation and listing criteria [58](#)-60, [59](#)
- transitional care [299](#)-302
- waiting list [60](#)-61