COUNCIL FOR MEDICAL SCHEMES

Benefit Definition

Liver transplant

Contents

1. Background

Liver transplantation has had a profound impact on the care of patients with end stage liver disease and is the most effective treatment for many patients with acute or chronic liver failure resulting from a variety of causes. Prior to transplantation, patients with advanced liver disease usually died within months to years. These patients now have the opportunity for extended survival with excellent quality of life post liver transplantation.

Procedure code indicated here serve as a guideline and other applicable procedure codes may have been omitted. Managed care principles such as scheme formularies and DSP arrangements may apply in liver transplant.

2. Indications and contraindications for liver transplant

Unacceptable quality of life (because of liver disease) or anticipated length of life without transplantation that is shorter than that with transplantation. Patients should be offered a transplant only if the clinician feels that they have a greater than 50% probability of survival at 5 years after transplantation with a quality of life that is acceptable to the patient.

Patients with cirrhosis should be referred for transplantation when they develop evidence of hepatic dysfunction (Child-Turcotte-Pugh >7 and MELD >10) or when they experience their first major complication (ascites, variceal bleed, spontaneous bacterial peritonitis, hepatorenal syndrome or hepatic encephalopathy)

2.1 Indications

Table 1: Possible ICD10 codes for indications for liver transplant

ICD 10 Codes	WHO Description
Chronic noncholestatic liver disorders	
B18.2	Chronic Hepatitis C
B18.1 and B18.0	Chronic Hepatitis B with or without Delta agent
K75.4	Autoimmune Hepatitis
K70	Alcoholic liver disease
Cholestatic liver disorders	
K74.3	Primary biliary cirrhosis
K74.4	Secondary biliary cirrhosis
	Primary sclerosing cholangitis
	Secondary sclerosing cholangitis
Q44.2	Biliary atresia
Q44.7	Alagille syndrome
	Nonsyndromic paucity of the intrahepatic bile ducts
E84.8	Cystic fibrosis
Q44.3	Caroli's syndrome
	Progressive familial intrahepatic cholestasis
Metabolic disorders causing cirrhosis	
E88.0	Alpha-1-antitrypsin deficiency
E83.0	Wilson disease
K76.0	Nonalcoholic steatohepatitis and cryptogenic cirrhosis
E83.1	Hereditary hemochromatosis
E70.2	Tyrosinemia
E74.0	Glycogen storage disease type i.iii,iv
	Neonatal hemochromatosis
Metabolic disorders causing severe extrahepatic morbidity	
E85	Amyloidosis, esp mutations of the transthyretin, apolipoprotein A-1,

	and fibrinogen Aa amyloid precursors
E74.8	Hyperoxaluria
E72.2	Urea cycle defects
E72.3, E72.4,E72.5	Disorders of branch chain amino acids
Rare metabolic conditions	
E78.0	Familial homozygous hypercholesterolaemia
E78.8	Cholesterol ester storage disease/Wolman Disease
E80	Erythropoietic protoporphyria
D66, D67	Hemophilia
E80.7	Disorders of bile acid synthesis
E74.1	Hereditary Fructose intolerance
E74.2	Galactosemia
G71.3	Mitochondrial respiratory chain disorders
Primary malignancies of the liver	
C22	Hepatocellular carcinoma
C22.2	Hepatoblastoma
C22.7	Fibrolamellar hepatocellular carcinoma
	Epitheliod Hemangioendothelioma
	Fulminant liver failure
Miscellaneous conditions	
I82.0	Budd Chiari syndrome
K76.5	Veno occlusive disease
K74.0	Congenital hepatic fibrosis
Y83.2	Graft versus host disease
C75	Metastatic neuroendocrine tumors
Q61.2 and Q61.2	Polycystic disease
	Multiple adenomatosis
E80.5	Crigler-Najjar syndrome
	Niemann-Pick Type C
	Cardiac cirrhosis
	Inherited disorders of complement causing atypical haemolytic ureamic syndrome
	Organic acidaemias
	Retransplantation

Fulminant liver failure

(i) Paracetamol

pH<7.3(irrespective of grade of encephalopathy) or

Prothrombin time >100 seconds and serum creatinine > 300umol/l if in grade III or IV coma

(ii) Non Paracetamol

Prothrombin time > 100 seconds (irrespective of grade of encephalopathy) or

Any 3 of the following (irrespective of grade of encephalopathy)

1. aetiology: non-A, non-B (indeterminate)hepatitis, halothane hepatitis, idiosyncratic drug reactions
2. age <10 or > 40 years
3. jaundice to encephalopathy interval > 7 days
4. serum bilirubin > 300umol/l

(iii) Seronegative hepatitis, hepatitis A or hepatitis B or an idiosyncratic drug reaction. Any grade of encephalopathy, and any three from the following:

1. Unfavourable aetiology (idiosyncratic drug reaction, seronegative hepatitis)
2. Age >40 years
3. Jaundice to encephalopathy time > 7 days
4. Serum bilirubin >300umol/l
5. Prothrombin time >50 seconds or INR > 3.5

(iv) Acute presentation of Wilson's disease, or Budd Chiari syndrome. A combination of coagulopathy, and any grade of encephalopathy.
(v) Hepatic artery thrombosis on days 0 to 21 after liver transplantation.
(vi) Early graft dysfunction of days 0 to 7 after liver transplantation with at least two of the following: AST > 10 000, INR>3.0, serum lactate >3mmol, absence of bile production.
(vii) Liver failure after live liver donation.

Alcoholic liver disease

Acute or Emergency cases
Not eligible for transplant unless abstinence for a period of at least 6 months.

Chronic cases
6 months of abstinence.
Psychology review.
Rehabilitation if required (as per PMB benefit code 182 T).
Treatment of underlying mental health as needed as per Prescribed Minimum Benefit Regulations.

Hepatocellular carcinoma

Eligibility for transplantation provided either Milan or UCSF criteria are met.
Milan criteria : the presence on imaging of a single liver lesion less than 5cm (stage 1) or no more than 3 tumours, all less than 3cm (stage 2) with no evidence of vascular invasion or extrahepatic disease.
UCSF criteria : the presence on imaging of a single liver tumour 6.5cm in diameter or smaller or three or fewer tumours with the largest being 4.5cm or less in diameter and a total tumour burden of 8.0cm or less.
Transplantation for early stage HCC is well accepted as it can be curative, minimise the risk of recurrence and avoid complications of cirrhosis. The 5 year survival rate after transplantation for patients fulfilling these criteria is 75%, comparable to the expected survival of patients who do not have HCC.

2.2 Contraindications to liver transplantation

Absolute contraindications

- Brain death. May require special investigations in the acute hepatic failure setting to establish this.
- Extrahepatic malignancy
- Active uncontrolled infection
- Active alcoholism and substance abuse
- AIDS
- Severe cardiopulmonary disease
- Uncontrolled sepsis
- Inability to comply with medical regimen
- Lack of psychosocial support
- Anatomic abnormalities precluding liver transplantation
- Compensated cirrhosis without complications (Child-Turcotte-Pugh score, 5-6)

Relative contraindications

- Advanced age
- Cholangiocarcinoma
- HIV infection
- Portal vein thrombosis
- Psychological instability
- Previous non-hepatic malignancies (5 years of remission). See general principals of solid organ transplantation benefit definition

3. Assessment or Pre-transplant workup

As soon as it has been determined that a patient is sick enough to require consideration for transplantation and that no other alternative treatments are available, a careful evaluation should be performed to address the following fundamental questions:

(i) Can the patient survive the operation and the immediate postoperative period?
(ii) Can the patient be expected to comply with the complex medical regimen required after liver transplantation?
(iii) Does the patient have other comorbid conditions that could so severely compromise graft or patient survival that transplantation would be futile and an inappropriate use of a scarce donor organ?

Generally transplant involves the following:

- Consultation with multidisciplinary team
- Review of specific medical/surgical problems
- Laboratory investigations
- Cardiopulmonary assessment
- Psychosocial assessment
- Radiology and endoscopies
- Screening of Malignancy
- Immunisations

3.1 Multidisciplinary consultation

Hepatologist or internist review

- Review of baseline liver disease/confirm liver disease see table 2
- Ascertain need for liver transplant and confirm all necessary treatment has been exhausted.
- Ascertain general well being of the patient and exclude comorbidities
- Order necessary blood tests and investigation depending on clinical circumstances

Surgical review

- Fitness for surgery
- Confirm liver disease
- Informed consent
- Patency of Portal vein and inferior vena cava for surgical viability of transplant

ICU Specialist or anaesthetist review in anaesthetic high risk patients

(i) To assess pre-operative anaesthetic risk and for further management in ICU
(ii) Full lung functions

Dental evaluation

A potential source of infection post-liver transplant is extensive dental decay, and formal evaluation by a dentist is necessary and critical for all liver transplant candidates. Dental extractions, if deemed necessary, should be performed with close attention to haemostasis.

Cardiology/ Pulmonologist review

To assess for hepatopulmonary and portopulmonary hypertension

Transplant co-ordinator:

Liver transplant is a multidisciplinary process. A transplant co-ordinator coordinates care between multidisciplinary providers; ensure that there is no duplication of tests and assist in centralising patient notes. He/she is a patient's first port of call. She plays an important role in communicating with schemes etc.

Dietician review

Protein-energy malnutrition is common in patients with end-stage liver disease. [1, 2]

Cause for malnutrition in liver cirrhosis includes reduction in oral intake, increased protein catabolism, insufficient protein catabolism, insufficient and malabsorption/maldigestion associated with portal hypertension

Anthropometry, laboratory values, body composition analysis, subjective global assessment, and handgrip strength are tools that the Clinician can use to help determine a patient's nutritional status. Based on the findings of the clinical assessment, the dietician must develop a suitable diet to optimise diet and muscle mass prior to surgery.

Educators (not claimable)
Education regarding the transplant process, the medication, what to do when they are unwell, etc
Psychologist/social worker assessment/mental health nurse/psychiatrist
To screen for psychological issues and manage co-existing mental health issues

Table 2: NHRPL codes for pre-transplant workup

	NHRPL code	Procedure	Frequency
Consultation			
Hepatology evaluation	190-192	Medical consultation Assess disease severity and prognosis, confirm diagnosis and optimise management	Depends on clinical circumstances
Surgical evaluation	190-192	Confirm need for transplant, identify technical challenges (e.g. prior abdominal surgery, portal vein thrombosis etc.), discuss donor options (deceased, living, extended)	Depends on clinical circumstances
Cardiac evaluation	190-192	Initial non-invasive evaluation with echocardiography. Non-invasive stress testing and cardiology evaluation if cardiac risk factors are present	
Dental assessment	8101-8104; 8181;8176	Identify dental caries, buried roots and dental Abscesses. Coordinate dental extractions if necessary. Care should be taken into consideration bleeding risk associated with liver disease.	
Anaesthetic evaluation	0151-0153	Required if unusually high operative risk, i.e., patient has portopulmonary hypertension, hypertrophic obstructive cardiomyopathy, previous anesthesia complications	
Psychiatry	0161-0164	Determine if history of substance abuse, psychiatric illness, or adjustment difficulties	
Psychologist	200-211	Determine if history of substance abuse, psychiatric illness, or adjustment difficulties	
Social work	200-211	Address potential psychosocial issues, adequacy of support, and possible effect of transplantation on patient's personal and social system	
Dietician	200-211	Assess nutritional status, recommend dietary intervention to improve nutritional status and muscle mass.	

Table 3: Procedure codes for further diagnostic work-up of liver disease

Procedure code	Procedure	Frequency
316	Fine needle aspiration for soft tissue (all areas)	
1632	H2 breath test (intestines)	
1743	Needle biopsy of liver	
1745	Biopsy of liver by laparotomy	
1765	Exploration of common bile duct: Secondary operation	
1778	Endoscopic Retrograde Cholangiopancreatography (ERCP): Endoscopy + catheterisation of pancreas duct or choledochus	
3627	Ultrasound examination includes whole abdomen and pelvic organs, where pelvic organs are clinically indicated (including liver, gall bladder, spleen, pancreas, abdominal vascular anatomy, para-aortic area, renal tract, pelvic organs)	
3637	+ Colour Doppler (may be added onto any other regional exam, but not to be added to items 3605, 5110, 5111, 5112, 5113 or 5114)	
5082	Transjugular liver biopsy	
5094	Cutting needle biopsy with image guidance	

3.2 Assessment of specific medical conditions

3.2.1 Hepatopulmonary syndrome

End-stage liver disease has a causal role in two main pulmonary syndromes: hepatopulmonary syndrome (HPS) and portopulmonary hypertension (POPH). Both this syndromes can affect survival post transplant.[3]

Hepatopulmonary syndrome is characterised by abnormal intrapulmonary vascular dilation in patients with liver disease, leading to physiologic shunting, ventilation-perfusion mismatch, and hypoxemia. Patients with HPS typically have normal or only mildly elevated pulmonary artery pressures, and LT may be curative.[4].

Hepatopulmonary syndrome is screened using pulse oximetry, arterial blood gases and confirmed on transthoracic echocardiogram.

3.2.2 Portopulmonary hypertension

Portopulmonary hypertension is the elevation of pulmonary artery pressure due to increased resistance to pulmonary blood flow in the setting of portal hypertension. Increased mortality has occurred with attempted liver transplantation in such patients and thus, screening for portopulmonary hypertension is advised in all patients being listed for liver transplant. [4, 5]

Transthoracic echocardiography should be used to screen all patients for POPH. Only patients with increased right ventricular systolic pressure should get right cardiac catheterisation which frequently identifies the cause of portopulmonary hypertension.[4]

Doppler Echocardiography is a recommended screening tests and confirmatory test should be done with right heart catheterisation. [4, 5]. Severe portopulmonary hypertension is a contraindication to liver transplant. Liver transplant maybe considered in patients with mild POPH and preserved right ventricular function. Patients with severe POPH liver transplant must be deferred until the member has received medical vasodilator treatment.[4]

3.2.3 Cardiac failure

Patients with cirrhosis requiring liver transplant usually demonstrate increased cardiac output and a compromised ventricular response to stress. The cardiac disturbances are likely mediated by decreased beta-agonist transduction, increased circulating inflammatory mediators with cardiodepressant properties, and repolarisation changes. Low systemic vascular

resistance and bradycardia are also commonly seen in cirrhosis. These physiologic changes all contribute to the potential for cardiovascular complications, particularly with the altered hemodynamic stresses that liver transplant patients face in the immediate post-operative period.[4] [6]
Post-transplant reperfusion may result in cardiac death due to a multitude of causes, including arrhythmia, acute heart failure, and myocardial infarction.
It is therefore important to identify the cardiovascular risk factors prior to transplantation, to determine the probability of survival as well as to optimise medical therapy to improve outcomes.
All patients undergoing liver transplant must be evaluated for cardiac failure using clinical symptoms to screen and echocardiography in patients with positive history. All patients with cirrhotic liver disease must be offered echocardiography.

3.2.4 Coronary artery disease (CAD)

CAD has been shown to be a major cause of morbidity and mortality in transplant recipients. Identification of CAD in solid organ transplant candidates allows for stratification of short and long-term risk, ensuring proper use of valuable allograft resources while guiding further patient management.
Liver transplant candidates with high risk for coronary events must undergo non-invasive testing first with ECG and echocardiogram/dobutamine stress echocardiogram. [7] Only those patients with positive tests should undergo further evaluation with angiogram.[4]

3.2.5 Pulmonary evaluation

Pulmonary disorders impact prognosis and are common in patients evaluated for LT candidacy. Postoperative pulmonary complication is one of the major factors affecting mortality. Therefore, in order to increase the success of the transplant operation, a thorough preoperative pulmonary evaluation is of paramount importance.
Pulmonary evaluation is generally assessed with lung function tests, chests-xray and pulse oximetry to assess saturation levels.

3.2.6 Pulmonary artery pressure

Pulmonary artery systolic pressure should first be evaluated by TTE in all LT candidates. If pulmonary artery systolic pressure is elevated or if there is right ventricular dysfunction, right-side heart catheterisation should be performed. If the mPAP is ≥35 mm Hg, but the pulmonary capillary wedge pressure is high (>15 mm Hg), repeat right-side heart catheterisation should be performed after diuresis. If the mPAP is ≥35 mm Hg and the pulmonary vascular resistance is >3 Wood units in the setting of a pulmonary capillary wedge pressure of ≤15 mm Hg, clinically significant pulmonary arterial hypertension is present. In the absence of underlying lung disease (or other risk factors for pulmonary arterial hypertension) in a patient with ESLD, this should be considered moderate to severe POPH.[4]

3.3 Psychosocial evaluation

Due to demand of livers exceeding supply, it is very important that the candidate for liver transplant is selected appropriately.
Psychosocial evaluation can be done by the trained nurse practitioner (e.g. nurse with mental health training), psychologist or social worker depending on the experience and transplant team make up. Generally psychosocial evaluation includes:

- Adherence to medications, follow-up consults and laboratory tests
- Alcohol and substances use and/or dependence
- Screening for co-existing psychiatric disorders
- Personal characteristics such as coping abilities
- Socioeconomic assessment to determine barriers to accessing treatment such as transportation and most importantly means to indirect healthcare costs such as loss of earnings due to prolonged illness and access to centralised transplant centres.

3.3.1 Adherence to medication

Non-compliance to medication and clinic attendance has been associated with acute and chronic graft failure. The purpose of psychosocial assessment is to ensure that candidates are educated of the importance and adverse events associated with immunosuppressants. Schemes may help the providers from the chronic database to identify patients who have not been compliant with chronic treatment.

3.3.2 Alcohol use, abuse and dependence

All patients with alcoholic liver disease (ALD) must be assessed by a psychiatrist for a correct and definitive diagnosis of alcohol related disorder (e.g. to differentiate abuse from dependence). [8] The medical schemes may request for such report.

Liver transplants must be deferred in patients with ALD who are diagnosed with alcohol abuse or dependency until patients are fully rehabilitated. The schemes may request the psychiatrist report to confirm rehabilitation.

Because short term sobriety is not a guarantee for long term sobriety post-transplant; all patients with an ALD must be referred for rehabilitation during the listing process and continue to attend a supportive group post-transplant to reduce risk of relapse in line with the PMB for alcohol use. Patients must also use community-based support groups such as Alcohol Anonymous etc; as this intervention have been shown to reduce relapses.

3.3.3 Narcotics and prescription drug abuse and dependence

Hepatitis C infection is one of the causes of end stage liver disease. Narcotic use can result in hepatitis C infection resulting in liver failure.

Patients must be screened with questionnaire for Narcotics use and referred to psychiatrist for further assessment. Patients with drug addiction must be offered treatment and this treatment must be funded as per PMB legislation. Additional support can be obtained from community based programmes. All patients with a history of narcotic use must undergo random drug screening to verify adherence.

All patients with a history of drug addiction must continue with supportive therapy post-transplant as to reduce the risk of relapse. Liver transplant must be deferred in all patients who are actively using narcotics. Rehabilitation must be provided for in line with PMBs for substance abuse.

3.3.4 Assessment of co-existing mental illness

All liver transplant patients must undergo psychological screening for mental health illness. Patients with diagnosis of any mental health illness must be referred to a psychiatrist for further evaluation management. Many patients with end-stage liver disease have signs and symptoms of depression. The helplessness and sense of futility has a potential to interfere with adherence. In order to improve adherence, these patients must be referred to a psychiatrist for treatment. Successful treatment of underlying depression will subsequently improve self-esteem which will have a positive impact on adherence and self-care therefore prolonging survival of the allograft.

Any mental illness diagnosis and treatment must be funded for in line with the prescribed minimum benefits.

3.4 Malignancy screening

Women older than 40 years must be offered a mammogram. Patients with family history of breast cancer may be offered mammogram earlier.

All women must be offered Pap smear on listing and then annually if the suitable donor has not been found. Precursor lesions are not a contraindication for transplant as they can be treated successfully. All patients with cancer must be referred for proper staging and treatment and the decision to transplant revised.

All men above the age of 50 years must be offered PSA screening. PSA screening can be offered earlier in men who are symptomatic. All patients with liver cirrhosis must be screened for possible liver cancer with alphafetoprotein. Cancer antigen 19-9 must be used to screen for cholangiocarcinoma.

3.5 Endoscopy

The role of endoscopy is to indentify co-morbidities that might affect the outcome of liver transplant. Patients diagnosed with end-stage liver disease being evaluated and considered for LT are at risk for severe upper gastrointestinal bleeding from oesophageal varices, gastric varices, and portal hypertensive gastropathy[9]. Diagnosis and treatment of oesophageal and gastric varices will improve survival whilst patient is awaiting liver transplant.

Asymptomatic peptic ulcer screening can be detected and treated therefore avoiding potential complications due to immunosuppressive therapy.

Colonoscopy is indicated in patients who are at high risk of colon cancer to exclude malignancy; and in patients with cirrhosis and hepatitis B and C as there is high risk of adenomas in this group. [10] Precancerous lesions must be treated appropriately. If cancerous lesions are detected, patients must be worked up for colon cancer and survival estimated. The decision to transplant must be reviewed.

Endoscopic retrograde cholangiopancreatography (ERCP) maybe indicated in the presence of pancreotobiliary disease in patients awaiting transplant

3.6 Radiology prior to transplant

Bone density scan: It is being increasingly recognised that patients with liver disease develop bone loss that can be severe enough to lead to atraumatic fractures and thus markedly diminish life quality and expectancy. The estimated prevalence for liver-related osteoporosis is between 20-420/100000 of the general population, and fractures between 60-880/100000.[11] Pre-liver transplant bone scan is intended to diagnose osteoporosis and facilitate treatment therefore reducing risk of fractures which can be increased by use of immunosuppressants post-transplant.

Abdominal ultrasound (duplex and colour Doppler) is used for screening and assessment of the abdomen for vessel patency, suspicious liver lesions**,** ascites, and size of the liver.

CT scan is useful in determining clinically relevant information for recipients such as the anatomy and size of the liver, exclusion of advanced hepatocellular carcinoma and other malignancy, patency of the venous system, presence of perihepatic varices, patency of the celiac artery, exclusion of splenic artery aneurysm, and position of iatrogenic venous shunts. A combination of ultrasound and CT scan has better sensitivity than of either tests alone.

MRI scan is not commonly used however maybe indicated in few complicated cases. The provider must therefore supply the scheme with motivation.

Chest X-ray is used to determine cardiopulmonary abnormalities and assess for possible metastatic disease.

Computed Tomography angiography is not routinely used due to increased risk, however may be indicated for the assessment of splenic, mesenteric or portal thrombus and in the assessment of arterial abnormalities.

3.7 Laboratory tests

Various blood tests are often requested to assess general health of the patient, assess severity of liver disease and for ABO and HLA typing. See table 4

Table 4: Procedures and Codes for work-up and evaluation of recipient

	Procedure code	Procedure	Frequency
Screening for infectious disease and malignancy			
HIV	3932	Antibodies to human immunodeficiency virus (HIV): ELISA	Finger prick tests may be used
Exclusion of hepatitis infection	4531	Hepatitis: Per antigen or antibody	
	3942	Hepatitis Rapid Viral Ab	
Cytomegallo virus screening	4439	Quantitative PCR - viral load (not HIV) - hepatitis C, hepatitis B, CMV, etc.	
Syphilis	3951	Quantitative Kahn, VDRL or other flocculation	
Epstein-barr virus	3970	Epstein-Barr virus antibody titer	
ESR	3743	Erythrocyte sedimentation rate	
Tuberculosis screening and diagnosis	3915	Mycobacterium culture	
	4657	Mycobacteria: Liquefied, consentrated, fluorochrome stain	
Full Blood Count and Platelets	3755	Full blood count (including items 3739, 3762, 3783, 3785, 3791)	
	3797	Platelet count	
Clotting profile	3805	Prothrombin index	
	3837	Partial thromboplastin time	

Renal assessment	4171	Urea and electrolytes	
	4032 or 4221	Creatinine/eGFR	
	4223	Creatinine clearance	
Cholesterol	4025	Chol/HDL/LDL/Trig	
	4027	Cholesterol total	
Diabetes screening and management	4057	Glucose: Quantitative	
	4064	HbA1C	
Pancreatic functioning	4485	Insulin	
	4005	Alpha-1-antitrypsin: Total	
Urine drug screening	4081	Drug level-biological fluid: Quantitative	
Liver function tests assessment	4134 4130 3999, 4001, 4009, 4010, 4117, 4131, 4133		
Cooper levels	4098	Copper: Atomic absorption	
	1633	Complete test using lactose or lactulose	
Iron studies	4071	Iron	
	4073	Iron-binding capacity	
		Ceruloplasmin	
	4109	Phosphate	
	4094 or 4095	Magnesium	
	4016 or 4017 or 4018	Calcium	
Lung function tests	1186	Flow volume test: Inspiration/expiration	
3764; 4763; 4426 3; 4427 * 2	HLA tissue typing (deceased and living donor)	Once at listing	4426 may be charged 3 times and 3327 maybe charged twice

3.8 Vaccination

Primary vaccination must be provided for as early as possible during the course of the disease as the response to immunisation is poor in patients with end organ damage. [12] Due to impaired response patients may require repeated dosages or higher dosages than normally required.

It is important to verify that patients are up to date with the extended programme of Immunisation as provided for by the state. Patients must be referred for state supplied immunisation as prescribed by the transplant team as some immunisations are contraindicated shortly before transplant. This is more applicable in children.

Adults who have not been provided with up to date EPI may not qualify for immunisation in the public sector. Therefore those immunisations must be funded for by medical schemes.
Vaccine must be provided for by the primary health care nurse and EPI must be obtainable at the state or private facilities receiving state stock.

The following vaccines are recommended and funded for as PMB in adult recipients:

i. Hepatitis & Hepatitis B
ii. Flu vaccine
iii. Pneumococcal vaccine
iv. HPV vaccine in adolescent females should be provided as per state protocol due to possible lack of cost-effectiveness at current SEP prices.

Table 2: Possible procedure codes applicable for pre-transplant work-up (cancer screening, cardiology assessment, endoscopies and imaging)

Malignancy			
Cervical cancer	4566	Pap-smear	Applicable to all sexually active females
Breast cancer		Clinical breast examination	Women < 40
Cholangiocarcinima	4460	Carbohydrate Antigen 19-9	To screen for cholangiocarcinoma
Prostate ca	4525	Prostate specific antigen in men > 50 years	
Liver cancer screening and baseline for HCC	4522	Alpha-feto protein	
Cardiology assessment			
	3620-3626; 3636-3637	Cardiac examinations + Doppler	
	1253	Right heart catheterisation (with or without biopsy)	
	1228/12291230-1233 1236	ECG or stress ECG	
	3636	Trans-oesophageal echocardiography including passing the device	
Endoscopic assessment			
Colonoscopy	1653	Total colonoscopy: With hospital equipment (including biopsy)	
	1656	Left-sided colonoscopy	
	1654	Plus removal of polyps: ADD to colonoscopy (Item 1653)	Only if polyps were diagnosed
	1778	Endoscopic Retrograde Cholangiopancreatography (ERCP): Endoscopy + catheterisation of pancreas duct or choledochus	When indicated
Upper GIT endoscopy	1587	Upper gastro-intestinal endoscopy: Hospital equipment	
	1552	Injection and/or ligation of oesophageal varices (endoscopy inclusive)	
Endoscopic modifiers	0074	Endoscopic procedures performed with own equipment: The basic procedure fee plus 33.33% (1/3) of that fee	

		("+" codes excluded) will apply where endoscopic procedures are performed with own equipment.	
	0075	Endoscopic procedures performed in own procedure room: The fee plus 21,00 clinical procedure units will apply where endoscopic procedures are performed in rooms with own equipment. This fee is chargeable by medical practitioners who own or rent the facility. Please note: Modifier 0075 is not applicable to any of the items for diagnostic procedures in the otorhinolaryngology sections of the tariff.	
Radiology			
Mammography	175 or 3606	Mammography: Unilateral or bilateral	Breast cancer screening
Chest X-ray	1241	X-ray Screening: Chest	Pre-operative and cormobid screening
Computed Tomography	6448	CT abdomen uncontrasted	To determine GIT anatomy and portal vein patency
	6449	CT abdomen with contrast	Please verify if contrasted or not
	6450	CT abdomen pre AND post contrast	
Ultrasound	3627	Ultrasound examination includes whole abdomen and pelvic organs, where pelvic organs are clinically indicated (including liver, gall bladder, spleen, pancreas, abdominal vascular anatomy, para-aortic area, renal tract, pelvic organs)	
	3635	+ Doppler	
	3637	+ Colour Doppler (may be added onto any other regional exam, but not to be added to items 3605, 5110, 5111, 5112, 5113 or 5114)	
Magnetic resonance Imaging	0090, 6100-6104	Refer to NHRPL for definition of codes (depend on the sites)	For further assessment of liver lesions and further staging of malignancy if required.

4. Work-up and evaluation of the donor

Evaluation of donor includes 3 phases: psychological assessment; compatibility assessment; medical assessment and fitness for surgery

Table 5: Possible procedure codes for donor work-up and evaluation

NHRPL codes	Procedure
Medical and psychosocial assessment	
190-192	Medical consultation
	Psychosocial assessment
	Education on transplant (especially for paediatric patients with parent donors)

Screening for infectious disease and malignancy	
Infectious diseases	
3932	Antibodies to human immunodeficiency virus (HIV): ELISA
4531	Hepatitis: Per antigen or antibody
3942	Hepatitis Rapid Viral Ab
4439	Quantitative PCR - viral load (not HIV) - hepatitis C, hepatitis B, CMV, etc.
3951	Quantitative Kahn, VDRL or other flocculation
3970	Epstein-Barr virus antibody titer
3743	Erythrocyte sedimentation rate
3915	Mycobacterium culture
4657	Mycobacteria: Liquefied, concentrated, fluorochrome stain
Malignancy	
4566	Pap-smear
175/3606	Mammography: Unilateral or bilateral
	Clinical breast examination
4460	Carbohydrate Antigen 19-9
4525	Prostate specific antigen in men > 50 years
4522	Alpha-feto protein
Fitness for surgery and suitability of organs	
3755	FBC
3805	PI/INR
4081	Drug level-biological fluid: Quantitative
1228/1229-1230-1233 1236	ECG
4171	Urea and electrolytes
4025 or 4027	Cholesterol or lipogram
4109	Phosphate
4094 or 4095	Magnesium
4016 or 4017 or 4018	Calcium
1241	Chest X-ray

4130-4134 4009-4010	LFT
3627	Abdominal ultrasound
	MRCP
	CT triple phase OF ABDOMEN AND PELVIS
1743	Needle biopsy of liver
Compatibility assessment	
4607-4609 3764 3765 3756	Blood grouping a

5. Operation for liver transplant

Operation for liver transplant consist of the following stages:

- Donor harvesting (partial or complete hepatomy)
- Back table preparation which include dissecting excess, blood vessels anastomosis and histological assessment of the liver
- Recipient hepatectomy and
- Transplant into the recipient. The process may require more than one surgical team.

Investigations intraoperatively generally include liver biopsy, liver function assessment, clotting profile, electrolytes, renal function and histology.

On average the operation last six to 9 hours.[13]

Table 3: Surgical codes for liver transplant operation (this may change as the surgical approach change)

NHRPL	DEFINITION	Comments
Organ procurement		
0175	Consultation and donor suitability z00.5, z51.4, z52.8	
1750	Donor hepatectomy	
1743	Liver biopsy	
0007	own equipment	
0008	Specialist assistant	
0009	assistant	
0011	After hour fees (where applicable)	
Back table preparation of organ		

1749	equivalent to right hemi hepatectomy (Whole live)	
1753	equivalent to segmental hepatectomy (Split / reduced liver)	
0007	own equipment	
0008	Specialist assistant	
0009	assistant	
0011	After hour fees (where applicable)	
Recipient hepatectomy		
0173	Recipient consultation	
1733	Equivalent to segmental hepatectomy / liver explant	
0007	own equipment	
0008	Specialist assistant	
0009	assistant	
0011	After hour fees (where applicable)	
Liver transplant codes		
1755	Liver transplant z94.4, y83.0,	
1767	Reconstruction of bile duct	
1754	Hepatico-jejunostomy	
1761	Cholycystectomy of donor liver	
0007	Own equipment	
0008	Specialist assistant	
0009	assistant	
0011	After hour fees (where applicable)	
Peri-operative care		
1205-1210		
Histology codes for explanted liver		
4567	Histology per sample	Maybe charged several times depending on the number of samples
4571	Histology per additional block, each	Maybe charged several times depending on the number of blocks done per sample.
4589	Special stains	Maybe charged several times depending on the number of samples and types of stains used.
4575	Histology and frozen section in laboratory	

4577	Histology and frozen section in theatre	

Table 4: Intraoperative blood tests (Generally repeated every 30 minutes during operation)

NHRPL	TEST
3755	FBC
3797	Platelets
4171	U&E
4032	Creatinine
3805	PI/INR
3837	PTT
4045	Fibrinogin
3999	Albumin
4017	Calcium
4057	Glucose
3820	Thromboelastogram
4086	Lactate
4076	ABG Profile
3762	Hb
3791	PCV
4112	Potassium
4316	Sodium
4093	Osmolality

6. Post-operative care of Liver transplant patients

ICU care

Early post-operative management is highly demanding as significant changes may occur in both the allograft and the other critical organs. Strict monitoring and sustainment of cardiorespiratory function, frequent assessment of graft performance, timely recognition of unexpected complications and the institution of prophylactic measures to prevent extrahepatic organ system dysfunction are mandatory in the immediate post-operative period.[14]. It is therefore mandatory that post-operatively patients be admitted in ICU. Following liver transplant, the patient is monitored closely in an ICU setting for anaesthetic, acute surgical complication and liver functioning. Generally the care ICU aims at maintaining airway and haemodynamic status, monitoring for graft rejection, coagulopathy and possible surgical bleeds.

Intensive monitoring of the patient may result in repetitive blood tests being collected. Table 7 list commonly requested blood tests. In the event of infection additional blood tests maybe requested.

General ward

After a period of stabilisation patients are generally referred to general ward. The patient should be closely followed by the surgical and medical team, as well as by pharmacists, dietician, and physiotherapists. Renal function, liver function, electrolytes, full blood count and platelets need to be monitored at least daily. Any abnormalities should be investigated further.

It might be appropriate to admit some patients in a high-care facility. The care includes continuous monitoring of the surgical wound, liver function and close observation for possible graft failure as well as aggressive identification and management of infection.

Complications are investigated and treated when the need arise. Abdominal ultrasound is generally conducted to review the transplanted liver. If any abnormalities are detected, further investigations may be requested. Throughout the hospital stay the patient will require a number of repeated blood tests to assess functioning of the liver.

In an uneventful recovery, the patient is discharged within 7 to 14 days. [15]

Table 5: Possible blood tests routinely requested post-operatively

NHRPL	Test	Comments
3755	Full blood count and differential	Maybe repeated every 4 hours
3797	Platelet Count	Maybe repeated every 4 hours
3805	Prothrombin index	To assess liver function
3837	Partial thromboplastin time	To assess liver function
4171	Sodium + potassium + chloride + CO2 + urea	To assess renal toxicity
4032	Creatinine	To assess renal toxicity
4117	Protein: Total	To assess liver function
3999	Albumin	To assess liver function
4009	Bilirubin: Total	To assess liver function
4010	Bilirubin: Conjugated	To assess liver function
4130	Aspartate aminotransferase (AST)	To assess liver function

4131	Alanine aminotransferase (ALT)	To assess liver function
4132	Creatine kinase (CK)	To assess liver function
4134	Gamma glutamyl transferase (GGT)	To assess liver function
4133	LDH	
4182	Quantitative protein estimation: Nephelometer or Turbidometeric method	To assess renal function
4045	Fibrinogin	
4539	Procalcitonin: Quantitative	
4321	Uric acid	
3959	Rose Waaler agglutination test (Rheumatoid factor)	
4082	Tacrolimus assay	To estimate drug levels
4173	Sirolimus Assay	To estimate drug levels
4173	Everolimus Assay	To estimate drug levels
3921	Antibiotic synergistic study	To assess for sensitivity to multiple antimicrobials
4057	Glucose: Quantitative	To screen for diabetes mellitus and assess liver function
4109	Phosphate	
4094 or 4095	Magnesium	
4016 or 4017 or 4018	Calcium	
Infection diagnosis		
3902	C-Diff Toxin	
3895	Culture Aerobic	
3895	Culture Campylobacter Fetus	
3867	Microscopy only wet prep	
3883	Bld Parasites Concentration	
4651	Blood Cult Aerobic Growth	

3923	Biochem ID Bacterium Abridged	
3867	Microscopy Only Stained Prep	
3887	Disc Sensitivity - per organism	
4401	CSF cell count	
O201	Bactec MGIT Bottle	
4651	Aerobic Blood Culture	
4651	Anaerobic Blood Culture	
3911	Beta Lactamase Assay	

Table 6: In-hospital procedure codes

NHRPL code	Description	Comments
Hospital codes		
201	Intensive Care Unit: per day.	
215	High Care Ward: per day.	
001	Surgical cases: per day.	
Physiotherapy services		
0014	Physiotherapy services rendered in a nursing home or hospital. Modifier 0014 must be quoted after each code.	
901	Treatment at a nursing home : Relevant fee plus (to be charged only once per day and not with every hospital visit	
301	Percussion	For pulmonary rehabilitation
300	Vibration	For pulmonary rehabilitation
319	Nebulisation	For pulmonary rehabilitation
323	Suction: Level 1 (including sputum specimen taken by suction)	
325	Suction: Level 2 (Suction with involvement of lavage as a treatment in a special unit situation or in the respiratory compromised patient)	For pulmonary rehabilitation
305	Re-education of movement/Exercises (excluding ante- and post-natal exercises)	
307	Pre- and post-operative exercises and/or breathing exercises	
Doctors Codes		
1204	Intensive care: Category 1 (High Care) : Cases requiring intensive monitoring (to include cases where	

	physiological instability is anticipated e.g. diabetic pre-coma, asthma, gastro-intestinal haemorrhage, etc.): Per day	
1205	Intensive care: Category 2 (ICU): Cases requiring active system support (where active specialised intervention is required in cases such as acute myocardial infarction, diabetic coma, head injury, severe asthma, acute pancreatitis, eclampsia, flail chest, etc. Ventilation may or may not be part of the active system support): First day	
1206	Intensive care: Category 2 (ICU): Cases requiring active system support (where active specialised intervention is required in cases such as acute myocardial infarction, diabetic coma, head injury, severe asthma, acute pancreatitis, eclampsia, flail chest, etc. Ventilation may or may not be part of the active system support): Subsequent days, per day	
1207	Intensive care: Category 2(ICU): Cases requiring active system support (where active specialised intervention is required in cases such as acute myocardial infarction, diabetic coma, head injury, severe asthma, acute pancreatitis, eclampsia, flail chest, etc. Ventilation may or may not be part of the active system support): After two weeks, per day	
1209	Intensive care: Category 3 (ICU): Cases with multiple organ failure or Category 2 patients which may require multidisciplinary intervention: First day (per involved practitioner)	
0109	hospital follow-up visit to patient in ward or nursing facility	
Dieticians		

7. Pharmacotherapy

The MSA allows schemes to develop evidence based formulary and make allowances for patients in whom formulary was shown to be harmful. Immunosuppressant therapy should therefore be based on scheme formulary and allowances made for exceptions as per 15H regulation.

7.1 Immunosuppressive induction therapy for recipient per scheme formulary:

i. Steroids
ii. Immunosuppressant induction therapy (Monoclonal antibody , Anti-thymocyte globulin (ATG), or Thymoglobulin or Retuximab)

7.2 Immunosuppressant maintenance

i. Steroids
ii. Antimetabolites
iii. Calcineurin inhibitors
iv. Others = TOR Inhibitors: (Rapamycin, Certican)

7.3 Prophylactic treatment for the recipient

i. Pneumococcal vaccine

ii. Annual Flu vaccine
iii. Bactrim for PCP
iv. CMV prophylaxis (Valgancyclovir; 3 Months if donor/recipient +/+ or -,+, 6 months if donor/recipient +/-, and not required if donor/recipient -/-)
v. Isoniazid prophylaxis therapy in patients with latent TB infection as per
Analgesia for both recipient and donor in ICU, general ward and to continue on outpatient basis

7.4 Pharmacological management of immunotherapy side effects:

i. Infections: Antibiotics, antifungal and antiviral as per scheme formulary/ national protocol or as per microscopy and sensitivity results
ii. Upper GIT protection: Proton Pump inhibitors as per scheme's formulary
iii. Anaemia: Iron and folic acid
iv. Vitamin and mineral deficiencies: Supplements
v. Osteoporosis: Biophosphonates
vi. Diabetes mellitus: screening with fasting blood glucose, or Hb A1c (annually) and management a per MSA algorithm
vii. Statins in patients with risk factors for CAD

8. Post-discharge care

This period is immediately following discharge up to 3 months. The patient needs to be followed up closely by a transplant team. The aim of the follow-up is to assess liver function, monitor for acute rejection and drug toxicity. Table 8 list some of the procedure codes that maybe billed in the first 3 months post discharge. Patients are followed up weekly up until 6 weeks and then once or twice a month

9. Long term follow-up

In the first year it is important for the patient to attend transplant clinic at least once a month and thereafter a patient may be seen quarterly. The purpose of long term follow-up is to monitor for the following

- Acute or chronic allograft rejection
- Complications of immunosuppression including hypertension, renal insufficiency, infection, malignancy, a variety of dermatologic conditions, and metabolic diseases such as diabetes mellitus, obesity, hyperlipidemia, and bone disease[16]; [17]; [18]
- Biliary complications
- Recurrence of the primary liver disease

It is mandatory for all the patients to be followed up by the transplant team in the first couple of months until the liver functions are restored and the patient has stabilised. Where there are barriers to access a suitably trained clinician may follow-up the patients in the earlier months under support of the transplant team. Depending on the location of the patient, continuity of care can be provided by the transplant team or a clinician (preferably a specialist or well trained general practitioner), supported by the transplant team. In this instance the primary provider shall bill the patient. The transplant team cannot claim for supporting peripheral doctors as it is considered an essential part of medicine to impart skills.

9.1 Allograft rejection

Acute rejection

Acute cellular rejection following liver transplantation has decreased in incidence with the use of potent immunosuppressive agents, but it still affects 15 to 25 percent of liver transplantation recipients [19, 20]. Most episodes occur within one month post transplantation, although acute cellular rejection may present later. [21]

Chronic rejection

Chronic liver Allograft rejection can be defined as an immunologic injury to the allograft, which usually evolves from severe or persistent acute rejection and results in potentially irreversible damage to the bile ducts, arteries, and veins. [22]

Chronic rejection after the operation is a relatively uncommon complication of liver transplantation with a variable clinical course and unpredictable outcome.[23]

Diagnosis of rejection

Liver function tests, full blood count and differential are first line of treatment to screen for rejection however these tests are not sensitive or specific.[24] Liver biopsy and histological assessments plays an important role in the diagnosis and management of liver transplant rejection and remains the 'gold standard' for diagnosing acute and chronic rejection. [25]

Management of rejection requires in-hospital admission and high dose corticosteroids. Patients with steroid resistance rejection will require Monoclonal antibody, Anti-thymocyte globulin (ATG), or Thymoglobulin or Retuximab. If there is failure of improvement patient may require liver transplant.

Table 7: Investigations to diagnose allograft rejection

NHRPL code	Description	Comments
4130	Aspartate aminotransferase	
4131	Alanine aminotransferase	
4132	Creatine kinase	
4133	Lactate dehidrogenase	
4009	Bilirubin: Total	
4010	Bilirubin: Conjugated	
4134	Gamma glutamyl transferase	
3805	PI/INR	
3837	PTT	
4109	Phosphate	
4094 or 4095	Magnesium	
4016 or 4017 or 4018	Calcium	
3999	Albumin	
4057	Glucose	
3755	Full blood count and differential (including items 3739, 3762, 3783, 3785, 3791)	
3797	Platelets	
1743	Needle biopsy of liver	
3627	Ultrasound examination includes whole abdomen and pelvic organs, where pelvic organs are clinically indicated (including liver, gall bladder, spleen, pancreas, abdominal vascular anatomy, para-aortic area, renal tract, pelvic organs)	
3635	+ Doppler	

3637	+ Colour Doppler (may be added onto any other regional exam, but not to be added to items 3605, 5110, 5111, 5112, 5113 or 5114)	
4567	Histology 1 Block	Liver Biopsy may be repeated upto 6 times depending on the clinical condition
4589	Special stains	Maybe charged several times per block depending on the number of blocks and types of stains

9.2 Metabolic diseases screening

Diabetes mellitus: fasting glucose screening

Hypertension: Regular BP review (unbillable separately)

Cholesterol: Total cholesterol unless corm bid metabolic disease in this instance Lipogram is necessary.

9.3 Assessment of effects of long term immunosuppressive therapy

Infections

Positive signs and symptoms are followed by necessary investigations to ascertain the source of infection. Test to identify and confirm infection are guided by clinical presentations and may include the following:

- FBC and differential
- Cultures and drug sensitivity for various body fluids
- Chest-x-ray.
- Ultrasonography etc.

Patients may be admitted or treated out-of hospital for infections depending on the severity, pathogen and choice of antimicrobial.

Toxicity monitoring

Tests include drug level monitoring and urea, electrolytes and creatinine.

Malignancy screening

Patients with transplant are at risk of developing the following cancers: Colorectal; Non-Hodgkins lymphoma; Nonmelanoma skin cancer, virus associated cancers such as HPV associated (anorectal, vaginal and cervical) Epstein Bar virus (Hodgkins and non-hodgkin's lymphoma), Hepatitis (liver Ca) and HHV8 (Kaposi's sarcoma). Data on prostate and breast cancer is non-conclusive**.**

All transplant patients should be screened for malignancy in line with prescribed minimum benefit screening or Scheme benefits. This generally includes:

Cervical cancer screening (PMB): Despite the lack of evidence from screening trials in transplant recipients, current recommendations suggested more frequent cytologic screening (annual instead of biannual) because of the belief that precancerous lesions may progress more rapidly under the influence of immunosuppression. [26]. Liquid based cytology and HPV vaccination in HPV naive women is not recommended as it is not cost-effective.[27]The Department of health Cervical cancer screening guidelines provides for annual cervical cancer screening in HIV positive and high risk women vs. Once every 10 years in general population. HPV vaccination in adults is probably not cost-effective as the women should first be tested for HPV infection. All children undergoing liver transplant must be provided with HPV vaccine provided they meet the entry criteria for EPI.

Breast cancer screening: Biennial mammographic screening for breast cancer is standard practice in the general population. The American Transplant Society (AST) and the European Best Practice Guidelines (EBPG) recommend

breast cancer screening in all female transplant recipients between 50 and 69 years of age.[26] In South Africa mammography is not offered routinely in public sector and it is offered as a discretionary benefit for general medical scheme population. For this reason Mammography is not considered PMB level of care post-transplant but may be offered at the discretion of the scheme. Clinical breast examination is PMB level of care for all transplant recipients.

Gastrointestinal cancer screening: recommendations for screening bowel cancer are far from being standardised across the various different transplant practice guidelines groups. There is now consistent evidence showing an increased risk of colorectal cancer by at least two- to threefold among those with renal allografts. However, recommendations for screening bowel cancer are far from being standardised across the various different transplant practice guidelines groups. The Americans Transplant society recommends annual faecal occult blood testing (FOBT) and flexible sigmoidoscopy every 5 years in the United States (In Australia, biennial screening using the immunochemical FOBT is the recommended screening tool by the National Health and Medical Research Council (NHMRC). In Europe, the EBPG suggested annual screening for all transplant recipients using faecal occult blood test.[26] All positive screening tests need to be followed by diagnostic colonoscopies. FOBT is relatively an affordable tests, non-invasive, easy to accept and generally available in the Public Sector and therefore considered to be at PMB level of care.

Colonoscopy as a screening test in asymptomatic patients should be provided at the discretion of the scheme. All patients with positive faecal occult blood test must be offered colposcopy as a prescribed minimum benefit.

Skin cancers: regular examination of the skin and lesion biopsy in line with PMB management of skin cancers.

9.4 Biliary complications

Due to a vulnerable blood supply of the bile ducts, biliary complications are a major source of morbidity after liver transplantation. Biliary complications remain a substantial cause of morbidity following liver transplantation. They have been reported to occur in a rate of 10-15% of full-size transplantations. [28]. Common biliary complications include

- Bile leak
- Anastomotic stricture
- Non-anastomotic - stricture
- Ampulary dysfunction

9.4.1 An overall approach to diagnosis of biliary complications

Once a biliary complication is suspected, a Doppler abdominal ultrasound is warranted to evaluate the biliary tree as well as the hepatic vasculature. If the ultrasound suggests the presence of hepatic artery thrombosis, a hepatic angiogram is warranted. Abdominal ultrasound carries a high positive predictive value only in the presence of dilated bile ducts. In the absence of biliary dilatation, it has a poor sensitivity (38–68%) for detection biliary obstruction. Endoscopic retrograde cholangiopancreatography (ERCP) is the next step in evaluation if ultrasound does not reveal biliary duct dilation despite clinical suspicion.[29]

ERCP has an added advantage of concurrent management of lesion, however MRCP has an added advantage of low surgical risk to the member, with potential cost savings if there is no lesion. Therefore in patients with high surgical risk for ERCP, MRCP may be considered an investigation of choice.

Percutaneous transhepatic cholangiography is recommended in patients with Roux –en-Y reconstruction.[29]

Scintigraphy using 99-technetium-labeled iminodiacetic acid has 75 and 100% sensitivity and specificity, respectively, for detecting biliary strictures. Due to limited diagnostic and interventional value it is therefore not recommended in management of biliary complications.[29, 30]

9.4.2 Management of biliary complications

Biliary strictures can be divided into two types: Anastomic and non-anastomotic type. Anastomotic type is as a result of technical issues during anastomosis whilst non anastomosis one is as a result on ischaemia or immunological reaction. ERCP is the gold standard in the diagnosis of biliary stricture.

Anastomotic strictures endoscopic treatment consists of identification of the mouth of the stricture followed by cannulation by the guidewire, balloon dilatation of the stricture, and subsequent placement of plastic stents. The stents are generally replaced by larger stents every 3 months to prevent the complication of clogging, cholangitis, or stone formation. [31]

Surgical revision is indicated when endoscopic therapy fails. About 10–20% of patients with anastomotic stricture (AS) require surgical revision. [32] Prolonged biliary obstruction and cholangitis during interventional treatment might be

associated with progressing graft fibrosis. Early conversion to surgical therapy is indicated, since delay might be accompanied with persistent allograft dysfunction.[33]

Non-anastomotic stricture (NAS) is difficult to treat. NAS secondary to early hepatic artery thrombosis usually require urgent revascularisation or retransplantation, whereas late hepatic artery thrombosis causing NAS can be salvaged by endoscopic means. As a group, they require more endoscopic procedures, balloon dilatation, stents, and a longer duration of treatment.[30]

Bile duct leaks usually occur immediately post operatively or after removal of t-tubes. Some patients are asymptomatic with mild elevation of serum aminotransferases, serum alkaline phosphatase, serum bilirubin and/or gamma glutamyl transferase levels while others present with fever, abdominal pain, and anorexia.[28] Treatment may include endoscopic treatment with stenting. Occasionally a coexisting obstruction is removed through sphincterectomy and removal of the stone or insertion of secondary stenting. [34]

Table 8: Possible procedure codes for long term follow up of patients post liver transplant

NHRPL	Test	Comments
3755	Full blood count and differential	Maybe repeated every 4 hours
3797	Platelet Count	
3805	Prothrombin index	To assess liver function
3837	Partial thromboplastin time	To assess liver function
4171	Sodium + potassium + chloride + CO2 + urea	To assess renal toxicity
4032	Creatinine	To assess renal toxicity
4117	Protein: Tota	To assess liver function
3999	Albumin	To assess liver function
4009	Bilirubin: Total	To assess liver function
4010	Bilirubin: Conjugated	To assess liver function
4130	Aspartate aminotransferase (AST)	To assess liver function
4131	Alanine aminotransferase (ALT)	To assess liver function
4132	Creatine kinase (CK)	To assess liver function
4134	Gamma glutamyl transferase (GGT)	To assess liver function
4133	LDH	
4182	Quantitative protein estimation: Nephelometer or Turbidometeric method	To assess renal function
4539	Procalcitonin: Quantitative	
4321	Uric acid	
3959	Rose Waaler agglutination test (Rheumatoid factor)	
4082	Tacrolimus assay	To estimate drug levels
4173	Everolimus Assay	To estimate drug levels
3921	Antibiotic synergistic study	To assess for sensitivity to multiple antimicrobials
Screening of metabolic syndrome		

	Total Cholesterol or Lipogram	Only once a year
4057	Glucose: Quantitative	To screen for diabetes mellitus and assess liver function
Malignancy screening		
4566	Pap-smear	
4351	Occult blood: Chemical test	
1653	Total colonoscopy: With hospital equipment (including biopsy)	Colonoscopy only fundable as PMB with a proof of positive Occult blood test
1656	Left-sided colonoscopy	
1654	Plus removal of polyps: ADD to colonoscopy (Item 1653)	Only if polyps were diagnosed
POST OP LIVER BIOPSY		
	Liver Biopsy	
4567	Histology 1 Block	Liver Biopsy may be repeated upto 6 times depending on the clinical condition
4589	Special stains	Maybe charged several times per block depending on the number of blocks and types of stains
Infection diagnosis		
3902	C-Diff Toxin	
3895	Culture Aerobic	
3895	Culture Campylobacter Fetus	
3867	Microscopy only wet prep	
3883	Bld Parasites Concentration	
4651	Blood Cult Aerobic Growth	
3923	Biochem ID Bacterium Abridged	
3867	Microscopy Only Stained Prep	
3887	Disc Sensitivity - per organism	
4401	CSF cell count	
O201	Bactec MGIT Bottle	
4651	Aerobic Blood Culture	
4651	Anaerobic Blood Culture	
3911	Beta Lactamase Assay	

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