HEPATIC PANCREATIC AND BILIARY (HPB) FACULTY CLINICAL GUIDELINE

Management of Patients with Hepatocellular Carcinoma (HCC)

SEPTEMBER 2014

This operational policy is agreed and accepted by:

Designated individuals	**Signed**	**Date**
HPB Pathway Director		
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Hepatocellular Carcinoma Tumour Specific Group		
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Tim Meyer (oncologist)		
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1. Background

In April 2011, NHS London published outline specification for an Integrated Cancer System (ICS) for the capital to delivery seamless cancer care. The North Central London & West Essex Cancer Network and North East *London Cancer* Network merged to become the *London Cancer* ICS.

London Cancer ICS began operation on 1 April 2012. It is designed to empower our dedicated and talented clinicians to drive improvements by implementing a coordinated cancer service via integrated patient pathways. It also brings together providers from across the health community, academia and the voluntary sector to drive step change improvements in outcomes and experience for the patients and population we serve.

There are two HPB Specialist MDTs (SMDT) in *London Cancer*, based at the Royal London Hospital (part of Barts Health NHS Trust) and Royal Free Hampstead NHS Foundation Trust.

1.1. Introduction

The purpose of this guideline is to outline the integrated investigation and management of patients with suspected and confirmed Hepatocellular Carcinoma (HCC) and to serve as a clinical guideline for the referral and management of patients with suspected HCC in addition to serving as a statement of expected standards, which will then be subject to continuous audit.

The incidence of HCC is increasing in the UK and many other countries. In the Far East and Africa HBV and HCV infection are the major reasons for this increased whereas in the UK the increased prevalence of cirrhosis from Alcohol related liver disease, non-alcoholic fatty liver disease and hepatitis C are the major causes. Indeed deaths from liver disease including HCC are now the 5th commonest cause of death and the leading cause of death in males under 65 years of age.

Treatment of HCC is an active area of research and the last decade has seen an increase in the number of treatment strategies that can be applied in this disease. These range from surgical techniques such as liver transplantation and resection to locoregional therapies such as transarterial embolisation and radiofrequency ablation. Additionally patients are now able to access systemic therapy with Sorafenib which is now the standard of care for systemic therapy of HCC. It is clear that more patients with HCC are now in a position to benefit from treatment. As this treatment is complex, patients should be assessed by a multidisciplinary team and treated in centres with access to all treatment modalities.

The Royal Free Hospital (RFH) has an international reputation in the management of liver disease and liver surgery including transplantation. The RFH HPB MDT is the central MDT for the North London Cancer Network and the Mount Vernon Cancer Network. Additionally patients with HCC are referred from other trusts outside these networks such as Portsmouth, Bristol and Oxford. The RFH is one of only 7 liver transplant centres in the UK and performs between around 100 liver transplants per year of which up to 25% are for HCC. The liver transplant service is supported by 7 hepatobiliary surgeons who are able to resect primary liver tumours and perform intraoperative radiofrequency ablation. Locoregional therapy is performed by a team of dedicated hepatobiliary radiologists skilled in transarterial (chemo)embolisation with particles or spheres, radiofrequency ablation and alcohol injection. The HPB radiology team also perform the majority of the diagnostic MRI, CT and invasive diagnostic procedures such as biopsy. The care of patients with HCC is coordinated and supported by

a joint Hepatology / Oncology clinical team comprising a medical Oncologist, Hepatologist and Clinical Nurse Specialist in HCC. This joint clinic is supported by the HPB surgery team, Hepatologists and liver transplant coordinators. Pathological specimens and biopsies are reviewed by Prof. Dhillon and his team who are present at every MDT meeting.

Our vision is to provide patients who are referred with suspected or confirmed HCC with a rapid diagnosis and easy access to the specialist services of the Royal Free Hospital in partnership with referring hospitals. We aim to provide seamless management of all stages of disease underpinned by excellent communication with referrers and patients.

1.2. Royal Free Hampstead (RFH) SMDT

The Royal Free HPB SMDT receives referral from the Mount Vernon Cancer Network and the North Central part of *London Cancer*, serving a population of over 3.4 million.

CCG name	**ADS registered population adjusted to new ONS13 projections**
NHS Barnet CCG	374,434
NHS Camden CCG	243,707
NHS Enfield CCG	306,891
NHS Haringey CCG	274,286
NHS Islington CCG	211,870
NHS West Essex CCG	280,158
NHS Bedfordshire CCG	429,384
NHS Luton CCG	206,245
NHS East and North Hertfordshire CCG	560,129
NHS Herts Valleys CCG	577,721
Total	**3,464,825**

The referring MDTs are:

- Hemel Hempstead Hospital (West Hertfordshire Hospitals NHS Trust)
- Luton and Dunstable Hospital (Luton and Dunstable Hospital NHS Foundation Trust)
- Lister Hospital (East &North Hertfordshire NHS Trust)
- Watford General Hospital (West Hertfordshire Hospitals NHS Trust)
- QEII (East &North Hertfordshire NHS Trust)
- Barnet General Hospital (Barnet & Chase Farm Hospitals NHS Trust)
- Chase Farm Hospital (Barnet & Chase Farm Hospitals NHS Trust)
- North Middlesex University Hospital (North Middlesex Hospital NHS Trust)

- Princess Alexandra Hospital (Princess Alexandra Hospital NHS Trust)
- Whittington Hospital (Whittington Hospital NHS Trust)
- University College Hospital (University College London Hospitals NHS Foundation Trust)
- Royal Free Hospital (Royal Free Hampstead NHS Foundation Trust)

1.3. Royal London Hospital SMDT

The Royal London Hospital HPB SMDT receives referral from North East part of *London Cancer*, South Essex and East Sussex, serving a population of 3.4 million.

CCG name	**ADS registered population adjusted to new ONS13 projections**
NHS Barking & Dagenham CCG	193,736
NHS City and Hackney CCG	261,712
NHS Havering CCG	252,238
NHS Newham CCG	320,748
NHS Redbridge CCG	277,717
NHS Tower Hamlets CCG	265,181
NHS Waltham Forest CCG	272,648
NHS Basildon and Brentwood CCG	255,603
NHS Castle Point, Rayleigh and Rochford CCG	171,942
NHS Southend CCG	178,029
NHS Thurrock CCG	163,848
NHS Brighton & Hove CCG	282,892
NHS Eastbourne, Hailsham and Seaford CCG	181,704
NHS Hastings & Rother CCG	180,258
NHS High Weald Lewes Havens CCG	162,714
Total	**3,420,970**

The referring MDTs are:

- The Royal London Hospital (Barts Health NHS Trust)
- Newham Hospital (Barts Health NHS Trust)
- Whipps Cross Hospital (Barts Health NHS Trust)
- Homerton Hospital (Homerton University Hospital NHS Trust)
- Queen's Hospital (Barking, Havering and Redbridge University Hospitals NHS Trust)
- Southend Hospital (Southend University Hospital NHS Foundation Trust)
- Basildon Hospital (Basildon and Thurrock University Hospitals NHS Foundation Trust)

- Colchester Hospital (Colchester Hospital University NHS Foundation Trust)
- Royal Sussex County Hospital (Brighton and Sussex University Hospitals NHS Trust)
- Conquest Hospital (East Sussex Healthcare NHS Trust)
- Eastbourne District General Hospital (East Sussex Healthcare NHS Trust)

2. The Multidisciplinary Team Meeting

The multidisciplinary team meets every Tuesday between 8 am and 11 am. All MDT meetings are held in the seminar room in histopathology on the Royal Free Site. Video links exist with University College Hospital, The North Middlesex Hospital, The Luton and Dunstable and Mount Vernon Hospitals.

The MDT aims to

- Identify and review the images and/or histology of all patients with proven or suspected HCC referred to the Royal Free Hospital
- To confirm the diagnosis and stage of the disease
- Recommend further investigations to achieve diagnosis and or staging where appropriate
- To recommend the appropriate follow up of indeterminate lesions
- Plan treatment including referral on to the surgical clinic or joint HCC clinic where appropriate
- Document the outcome of the MDT on the electronic database and ensure rapid communication of MDT outcomes to referrers, general practitioners and clinical nurse specialists involved in the patients care
- To review the follow up imaging of patients under treatment and document treatment response and/or need to re treat or change modality of treatment
- To identify patients that may benefit from inclusion in clinical trials

2.1. Referral to the MDT

The majority of patients with HCC will be suitable for some form of treatment therefore all patients with suspected HCC should be referred to the MDT in order to maximize access to treatment. Current guidelines recommend that all patients with suspected HCC should be discussed in a centre with access to liver transplantation although it is acknowledged that subsequent management may be in the referring centre if the patient is not suitable for transplantation. Patients presented to the MDT must be presented by or on behalf of a named Consultant who then takes responsibility for enacting the recommendations of the MDT.

Referrals to the MDT should be directed to the MDT Coordinator via email or faxed using the existing proforma.

HPB SMDT	MDT Co-ordinator
Royal Free	**Scott Green** **Tel** 0207 794 0500 **ext:** 31409 **Bleep**: 71-2159 **Email:** scotgreen@nhs.net **Referral to be sent to Rfh.hpbsmdt@nhs.net**

Referrals can also be made directly to the core members of the MDT via email or letter, for rapid assessment however it is recommended that new cases are directed to the MDT coordinator.

The appropriate imaging should be sent on CD to the MDT coordinator or uploaded via the image exchange portal (work is underway to ensure that all referring trusts are able to upload images via IEP). It is expected that any images uploaded via IEP and discussed at the MDT will be permanently incorporated into the RFH PACS system to enable review in the future.

Core information that should be supplied with any new case submitted to the MDT:

- Demographics
- Brief clinical history
- Aetiology of underlying liver disease if any,
- Presence or absence of cirrhosis (if previous liver biopsy)
- Childs Pugh Score and/or MELD
- Performance status
- Alpha fetoprotein levels

Whether the patient is abstinent from alcohol and if so for how long as this is of particular importance to the transplant assessment process.

Histology slides and blocks to support the MDT discussion should be sent to the histopathology department at the Royal Free Hospital and at the same time a note to the MDT coordinator should be sent so that the MDT coordinator can ensure that the histology is flagged for review at the MDT. All patients with known or suspected HCC will be reviewed at the regional HPB MDT.

2.2. Multidisciplinary team structure – Core Members

	Name	Email
Surgical Team	Prof. Max Malago	m.malago@ucl.ac.uk
	Prof. Brian Davidson	bdavidson@medsch.ucl.ac.uk
	Mr. Dinesh Sharma	Dinesh.sharma@nhs.net
	Mr. Kito Fusai	g.fusai@nhs.net
	Mr. Charles Imber	Charles.imber@nhs.net
HPB Physicians	Dr. James O'Beirne	jobeirne@nhs.net
	Dr. David Patch	david.patch@nhs.net
	Dr. Douglas Thorburn	Douglas.thorburn@nhs.net
	Prof. Andrew Burroughs	Andrew.burroughs@nhs.net

	Prof. Geoff Dusheiko	g.dusheiko@ucl.ac.uk
	Dr. Tim Meyer	t.meyer@ucl.ac.uk
Medical Oncologists	Dr. Roopinder Gilmore	Roopinder.gillmore@nhs.net
	Dr. John Bridgewater	John.bridgewater@uclh.nhs.uk
	Dr. Dominic Yu	Dominic.yu@nhs.net
Radiologists	Dr. Neil Davies	Neil.davies2@nhs.net
	Dr. Nick Woodward	Nick.woodward@nhs.net
	Dr. Anthony Goode	Antonygoode1@nhs.net
Histopathology	Dr. Tu Vinh Luong	Tuvinh.luong@nhs.net
	Dr. Ian Clark	Ian.clark@nhs.net
Clinical Nurse Specialist	Sister Pamela O'Donoghue	Pam.o'donoghue@nhs.net
MDT Coordinator	Mr Scott Green	scottgreen@nhs.net

2.3. MDT Outcome

At the MDT the diagnosis and management plan for the patient will be discussed and agreed. The outcome will be recorded in the electronic proforma in real time and stored on the computerised database. To ensure that the outcome recorded on the database is accurate a paper copy will be circulated following the meeting to the named consultant responsible for presenting the case. The responsible consultant will then review the proforma and if the information is accurate the proforma signed. The outcome of the MDT will be communicated to referring clinicians outside the trust by letter which should be dictated on the day of the MDT. The relevant CNS is responsible for organizing the relevant outpatient appointment (surgical, joint HCC clinic) and will liaise with the responsible Consultant regarding the organization of further imaging or investigations. The MDT outcome proforma should be placed in the patients notes as soon as possible after the MDT decision.

3. Surveillance of High Risk Groups for HCC within the Network

Given that the majority of the referrals to the MDT come from within the cancer network it would be ideal if all referring trusts within the network had a common approach to the surveillance and imaging of high risk patients and those with suspected HCC. This will facilitate diagnosis and referral at an earlier stage thus allowing consideration of more treatment options. Currently the majority of patients referred with HCC are unsuitable for curative therapy.

Based on the available evidence the following surveillance strategy is proposed:

1. Ultrasound scan of liver every six months in identified high risk groups (listed below).

2. Six monthly measurement of alpha-fetoprotein – should be undertaken but will only be used as supporting evidence for image based diagnosis.

Surveillance with AFP alone is not recommended

NB. Ultrasound scans, wherever possible should be undertaken by a dedicated ultrasonographer (either by a radiologist or radiographer) who is experienced in the imaging of cirrhotic livers. The distinction between neoplastic nodules and regenerative nodules can be extremely difficult. The finding of any new nodule should be regarded as suspicious and further cross sectional imaging should be recommended.

The large volume of cirrhotic patients makes organization of a surveillance program difficult and ideally clinical nurse specialists associated with cancer services are the most appropriate individuals to call patients for surveillance and screen the initial results, identifying concerning ones for review by medical staff. Surveillance programs should undergo continual audit to ensure that appropriate individuals are identified for surveillance and importantly that abnormal results are actioned in a timely fashion. Referrers within the network should work towards the appointment of a specialist nurse to co-ordinate the investigation and treatment of potential/suspected HCC.

A robust mechanism should be identified for the results to feed directly back to the consultant with responsibility for the patient. In the Royal Free Hospital this may by the use of the CERNER Message Centre Inbox or by direct contact by the scanning radiographer/ radiologist to the referring consultant. Where possible a "surveillance clinic", which may be a combination of a virtual and actual clinic, should be established and run by a specialist nurse. This would avoid delay in referral after an investigation has highlighted a possible diagnosis of hepatoma.

3.1. High Risk Surveillance Groups

Patients with chronic hepatitis B/chronic hepatitis B carriers
Asian males >40 years
Asian females >50 years
All cirrhotic hepatitis B carriers
Family history of HCC
All African hepatitis B carriers > 20 years.

There is an argument for surveying all non-cirrhotic chronic hepatitis B carriers not included in the above.

This recommendation is particularly pertinent for patients with high HBVDNA concentrations (> 2000 IU/ml) and those with ongoing hepatic inflammatory activity, as these are at highest risk and should also be screened regardless of age.

All patients with hepatitis B and HIV co-infection and hepatitis C and hepatitis B co-infection should be screened.

Non-hepatitis B cirrhotics
Hepatitis C

Alcoholic cirrhotics (Surveillance should be undertaken in all patients who are able/willing to cooperate with surveillance and management. Treatment decision should be influenced only by evidence of active drinking);

Haemochromatosis
Primary biliary cirrhosis (evidence stronger for males than females)
Alpha-1 antitrypsin deficiency
Non-alcoholic steatohepatitis;

Autoimmune hepatitis (although evidence is small the relatively small numbers with this condition should probably be surveyed if only to provide more substantive data on the relative risk of hepatoma development in this condition.

3.2. Surveillance of Patients post-antiviral treatment

This area is still contentious for both hepatitis B and hepatitis C, although studies suggest that the risk of HCC is reduced by interferon or other antiviral drug treatment. On the basis of current evidence and reviews it is suggested that patients with cirrhosis who have been treated with antivirals, whether successful or not (in terms of sero-conversion) should probably continue to be surveyed.

Surveillance should also be undertaken on those patients who are on a transplant waiting list.

Where a nodule has been found on surveillance imaging and subsequently been characterized as a regenerative, dysplastic or indeterminate lesion the patient should enter period of enhanced surveillance. The patient should be reimaged preferably with MRI (lower exposure to ionizing radiation) on a 3 monthly basis for at least 6 months to ensure the nodule is stable and the imaging characteristics do not change. If a nodule is stable then the 6 monthly imaging protocol can be reinstituted.

4. Diagnosis of HCC

The diagnostic modalities used to confirm HCC are dynamic contrast enhanced CT and dynamic MRI (enhanced with gadolimium). For the accurate diagnosis of HCC whichever technique is used an arterial and venous phase should be present. There is currently no role for contrast enhanced US in the diagnosis of HCC at the Royal Free Hospital. All patients should undergo contemporaneous imaging of the chest and consideration should be given to bone scanning. There is no role currently for PET in the diagnosis or staging of HCC.

4.1. Proposed Recommendations for Diagnosis

The new EASL/EORTC guidelines for the diagnosis of HCC recommend that lesions greater than 1 cm with a typical vascular pattern (arterial enhancement with portal venous washout) on either dynamic contrast enhanced CT or MRI can be treated as HCC.

Lesions > 1 cm with an atypical vascular pattern on either CT or MRI should undergo imaging with the complementary technique to confirm HCC

If HCC is not confirmed i.e. vascular enhancement pattern is atypical then the lesion should either undergo biopsy or enhanced surveillance with MRI or CT. This decision should only be made after work up by hepatologist, hepatobiliary radiologist and hepatobiliary surgeon and following discussion at the MDT

For lesions greater than 2 cm with atypical vascular findings the lesion should be treated as HCC if the AFP is elevated greater than 200 ng/ml

Lesions <1cm in diameter may be investigated with dynamic imaging but these lesions can be very difficult to separate from regenerative nodules (30% of arterially enhancing nodules <1cm are not HCC).

LESIONS LESS THAN 1 CM SHOULD NOT BE CONSIDERED IN THE CONTEXT OF ASSESSING A PATIENTS SUITABILITY FOR LIVER TRANSPLANTATION

Even if these (<1cm) lesions show a classic "vascular pattern" it is suggested that the appropriate management should be to repeat the MRI or CT at three-monthly intervals and determine whether these nodules are enlarging.

Nodules showing evidence of enlargement should then be managed (more actively) as described above. If the nodules are static or regressive then the patient can re-enter a six monthly surveillance programme.

NB. In the context of regenerative nodules such as hepatitis B and hepatitis C, alpha-fetoprotein may be raised to a level of above 100iu.

4.2. The role of alpha-fetoprotein measurement

Alpha-fetoprotein is not entirely redundant in the management of HCC. Alpha-fetoprotein may be raised in association with regenerative activity but a very high alpha-fetoprotein (>200) is strongly indicative of a hepatocellular carcinoma particularly in the context of an isolated nodule >2cm diameter. In addition, regardless of the absolute level, a relentlessly rising alpha-fetoprotein on serial measurements is concerning and should prompt a vigorous and thorough radiological investigation with CT or MRI.

5. Management of Confirmed HCC

The management of the patient with HCC is complex and requires the involvement of the entire multidisciplinary team. There are a number of therapeutic options available to HCC patients and the suitability of a patient for treatment depends on a number of factors including but not limited to

- Size and number of nodules
- Presence of metastases
- Presence or absence of underlying cirrhosis
- Presence of metastases
- Severity of underlying liver disease and presence or absence of complications
- Presence of portal vein thrombosis
- AFP levels
- Performance status of the patient

The most convenient way of assessing the suitability of patients based on these factors is to use the BCLC classification. (Appendix 1)

Specific approaches to the management of HCC are outlined in the following section.

5.1. Surgical resection

Surgical resection should be considered in any patient with a single lesion who is non cirrhotic or has Child Pugh Class A cirrhosis depending on the size and or position of the lesion.

Patients who are considered for resection should have up to date biochemistry, CT chest and MRI/CT liver imaging available for review at the MDT and should undergo detailed review by a hepatologist to exclude adverse hepatological factors such as uncontrolled Hepatitis B.

The work up for resection in a cirrhotic patient includes:

- Anaesthetic review – organized by CNS
- Hepatology review – this can be done in the joint HCC clinic
- Indocyanine Green Clearance study – booked with Dr James O'Beirne
- Hepatic Venous Wedge Pressure Gradient measurement – booked with Dr James O'Beirne
- Volumetry of liver remnant if major resection planned, Portal vein and possible hepatic vein embolisation to be considered if appropriate

To be considered as a standard risk resection patients with Childs Pugh A cirrhosis should ideally have an hepatic wedge pressure gradient of 10 mmHg or less AND

A good ICG clearance with a PDR of > 15 with an R15 of < 15, with adequate liver remnant ideally >40% - especially for major resections.

All patients including those who are thought suitable for resection should be referred from the MDT to the joint HCC clinic via Pam O'Donoghue (HCC CNS) at the time of the MDT. They will be seen in the next clinic (usually the Friday following the MDT). Surgical colleagues are part of the joint clinic to discuss surgery with the patient at that time.

Following the joint clinic appointment the patient will be booked for the next available slot for ICG clearance and wedge pressure studies. It is also possible to perform transvenous biopsy of the liver at the same time if needed (not for right hepatic lobe lesions). These procedures can usually be done as a day case to facilitate a rapid turnaround. Following the procedure the results are recorded in the notes and also on CERNER and the patient's details added for the next MDT list.

Patient can then be triaged to the surgical pathway as appropriate.

Patients who are not within the standard risk category for resection (as specified above) will be considered for Liver Transplantation if appropriate (details below).

Radiofrequency Ablation will be considered as a possibly curative treatment modality if neither resection nor transplantation is feasible or appropriate with standard risk.

In patients for whom a low or standard risk resection, liver transplantation or Radiofrequency Ablation (in that order of consideration) are NOT feasible or appropriate, then a higher risk resection (for instance with multiple nodules or with some portal hypertension or poor liver function) may be considered as long as the size of resection is thought to be compatible with the impairment of liver synthetic function or portal hypertension. This will be discussed on a case-by-case basis in the MDT with appropriate surgical input.

5.2. Liver Transplantation

Liver transplantation should be considered for any patient with cirrhosis and complicating HCC who fulfils the following criteria AND in whom resection with standard risk cannot be safely performed (due to poor liver reserve or remnant or significant portal hypertension):

Definite HCC
1 nodule 5 cm or less
(or >5 and < 7 cm where the lesion has been stable (i.e. remains less than 7 cm and no or less than 20% increase in size over 6 months – the 6 month period counts from the first diagnostic scan and adjuvant treatments are allowed)

OR

5 nodules – all 3cm or less in size

Absence of macrovascular tumour involvement (Portal vein thrombus, Arteriovenous shunting in the area of the tumour)

No evidence of metastatic disease

No evidence of advanced cardiorespiratory disease

AFP < 1,000 ng/ml

Patients who are actively drinking alcohol should not be referred for liver transplantation immediately – complete abstinence should be advised.

All other patients should be considered for liver transplantation and initially referred to the joint clinic for assessment. If thought to be suitable candidates then a member of the liver transplant coordination team will meet the patient in the joint clinic.

Patients with a history of excess alcohol ingestion should be encouraged to maintain abstinence and may benefit from early referral to Liz Shepherd (CNS in Alcohol and liver transplantation) in order to be assessed for risk to return to drinking and to enable any supportive work regarding alcohol/substance misuse to start whilst the patient is undergoing interval TAE.

Patients thought suitable for work up for transplantation will be admitted for 5 days to 10 N ward for assessment. Ideally, the patient should be reviewed by the oncology team whilst an inpatient and

where possible patients who are suitable for TAE as a bridging therapy should receive this during the assessment period. If listed patients should undergo 3 monthly assessment with CT /MRI to ensure that the HCC remains within transplant criteria. These scans will also determine the need for further TAE and should be reviewed at the MDT meeting.

If a patient is not listed for Liver Transplantation the patient should be rediscussed at the MDT as further therapeutic options other than TAE may be more suitable if transplantation is not an option – specifically the patient can be considered for enrollment in the TACE-2 trial.

If a patient's disease progresses outside Milan criteria whilst on the list they will be taken of the list. The responsibility for communicating this to the patient rests with the transplant team. Following delisting the patient should be referred back to the joint HCC clinic for further management and the case rediscussed at the MDT.

5.3. Transarterial (Chemo) –embolisation (TAE)

Patients who are not suitable for resection or transplantation may be offered therapy with transarterial embolisation. Alternatively patients who are candidates for other treatment such as transplantation or rarely resection may also be offered transarterial embolisation in an attempt to maintain to prevent tumour growth outside transplant criteria or make surgical resection more favourable.

Candidates for TAE are usually identified via the MDT and suitability for the procedure agreed with the radiologist.

There are few absolute contraindications to TAE but the presence of the following characteristics make TAE an unsuitable treatment modality.

Advanced liver disease (Bilirubin > 50 micromole/L, INR >1.5, History of encephalopathy, ascites, Childs Pugh C or > B7)

Main portal vein thrombosis

Renal function > 1.5 x ULN

Performance status > 1

Patients who are suitable for TAE are assessed in the joint HCC clinic and given appropriate information regarding the risks and benefits of the procedure. Following this assessment the procedure is requested on CERNER. Sister O'Dononghue is responsible for arranging a bed on the oncology ward and liaising with the IRCU regarding a suitable time and date for the procedure.

Patients for TAE are usually admitted for 2 nights for the procedure.

Patients who are not candidates for liver transplantation will be given information regarding the TACE-2 study.

Following TAE patients undergo repeat cross sectional imaging to determine the need for further embolisation based on residual vascularity. If residual vascularity is noted then a further TAE is performed. In cases of unsuccessful embolisation with persistent vascularity it is useful to review the imaging in the MDT to ensure that the appropriate vessels have been targeted.

Patients with stable disease post TAE will have repeat imaging on a 3 monthly basis.