UNIVERSITY OF CINCINNATI CHOLANGIOCARCINOMA TRANSPLANT PROTOCOL

Inclusion criteria:
- unresectable hilar (perihilar) cholangiocarcinoma after review at University of Cincinnati Medical Center Hepato-Biliary conference
- hilar (perihilar) cholangiocarcinoma in the setting of primary sclerosing cholangitis (PSC)

Diagnosis of cholangiocarcinoma\textsuperscript{1-3}: at least 1 of the following:
- intraluminal brush cytology or biopsy positive for adenocarcinoma
- radiographic malignant stricture and serum CA 19.9 > 100 ng/ml
- radiographic malignant stricture in setting of PSC
- biliary aneuploidy in fluorescent in situ hybridization (FISH)

Staging:
- CT chest, abdomen
- Bone scan
- Endoscopic ultrasound (EUS) with fine needle aspiration of suspicious lymph nodes
- Laparoscopy for staging if suspicion of extrahepatic disease

Exclusion criteria:
- mass > 3cm \textsuperscript{4,5}
- extrahepatic disease (including regional lymph node involvement)
- previous operation or attempted resection of the tumor
- uncontrolled infection

Neoadjuvant Therapy
- Fractionated chemoradiation will be provided to the primary tumor and regional lymphatics to a dose of 45 Gy at 1.8 Gy per fraction with a concurrent fluoropyrimidine based sensitizer.
- This will be followed by a conformal, hypofractionated 20 Gy boost to the primary tumor (4Gy x 5 fractions)

Staging operation
- performed 4 weeks after completion of neoadjuvant therapy.
- laparoscopy or laparotomy
- biopsy of lymph nodes overlying common hepatic artery and common bile duct (GDA and BD node)
- biopsy of any abnormal lymph nodes/mass
- Patients with negative staging will be listed for transplant.

Maintenance Chemotherapy
- Patients will receive 3 cycles Cisplatin/gemcitabine based chemotherapy.
- Patients will go on to receive additional maintenance Capecitabine until the time of transplant.

**Imaging Surveillance:**
- Contrast CT scans of the chest, abdomen, and pelvis will be obtained every 3 months after the time of restaging operation until transplant or the development of metastatic disease.

**Transplant**
- Hilar structures are divided as low as possible close to the duodenum
- Frozen section of the bile duct margin
- Pancreatoduodenectomy in case of bile duct involvement
- Caval-sparing hepatectomy and piggy-back implantation unless caudate involvement is suspected (caval interposition with bicaval anastomosis in case of caudate involvement)
- Aorto-hepatic jump graft with conduit
- Roux-en-Y hepatico-jejunostomy

**Schedule**

<table>
<thead>
<tr>
<th>Start time</th>
<th>Description</th>
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<tbody>
<tr>
<td>0</td>
<td>Staging: CT or MRI abdomen/pelvis, CT chest, EUS, DSE, Social worker</td>
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<tr>
<td>0</td>
<td>Neoadjuvant chemoradiation</td>
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<td>11th week</td>
<td>Staging laparoscopy or laparotomy, MultiD clinic and listing for liver transplant</td>
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<tr>
<td>13th week</td>
<td>Initiate 3 cycles of Gemcitabine/cisplatin</td>
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<td>19th week</td>
<td>Maintenance capecitabine chemotherapy</td>
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**Post-transplant follow-up**
- CT chest non-contrast, CT biphasic abdomen, Ca 19.9 every 6 months for years 1 and 2
- CT chest non-contrast, CT biphasic abdomen, Ca 19.9 annually for years 3, 4, and 5

**Reported Outcomes**
- Survival rate after liver transplantation: 91% at 1 year, 82% at 5 years
- Recurrence-free survival after transplantation: 78% at 2 years, 65% at 5 years
- Recurrence rate: 12% at 5 years
- Mean time to recurrence: 40 months
- Drop-out rate (from enrollment to transplantation): 25%

**References**


