2.1 Risk factors

- Age (65% of patients are over 65 years old).
- Primary sclerosing cholangitis (PSC), with or without ulcerative colitis, is the commonest known predisposing factor for cholangiocarcinoma in the UK (lifetime risk 5–15%).
- Chronic intrahepatic gall stones.
- Bile duct adenoma and biliary papillomatosis.
- Caroli’s disease (cystic dilatation of ducts, lifetime risk 7%).
- Choledochal cysts (about 5% will transform, risk increases with age).
- Thorotrast (a radiological agent no longer licensed for use, although the risk of cholangiocarcinoma lasts several decades).
- Smoking (increased risk in association with PSC).
- In SE Asia, where the tumour is quite common, the associated risk factors are:
  - liver flukes—Opisthorchis viverrini and Clonorchis sinensis,
  - chronic typhoid carriers—sixfold increased risk of all hepatobiliary malignancy.

2.2 Anatomical classification

“Cholangiocarcinoma” originally referred only to primary tumours of the intrahepatic bile ducts and was not used for extrahepatic bile duct tumours but the term is now regarded as inclusive of intrahepatic, perihilar, and distal extrahepatic tumours of the bile ducts (fig 1).

- 20–25% are intrahepatic.
- 50–60% of all cases of cholangiocarcinoma are perihilar tumours (those involving the bifurcation of the ducts are “Klatskin” tumours).
- Most Klatskin tumours may have been coded as intrahepatic tumours for purposes of death certification.
- 20–25% are distal extrahepatic tumours.
- About 5% of tumours may be multifocal.
- The extent of duct involvement by perihilar tumours may be classified as suggested by Bismuth:
  - type I: tumours below the confluence of the left and right hepatic ducts;
  - type II: tumours reaching the confluence but not involving the left or right hepatic ducts;
  - type III: tumours beyond the confluence involving the right or left ducts;
  - type IV: tumours involving both ducts.

Abbreviations: BASL, British Association for the Study of the Liver; BSG, British Society of Gastroenterology; PSC, primary sclerosing cholangitis; CEA, carcinoembryonic antigen; US, ultrasonography; CT, computed tomography; MRI, magnetic resonance imaging; MRCP, MR cholangiopancreatography; ERCP, endoscopic retrograde cholangiopancreatography; PTC, percutaneous transhepatic cholangiography; TNM, tumour-node-metastasis; IDH, lactate dehydrogenase; 5-FU, 5-fluorouracil.
Most studies have demonstrated a relation between histological grade and postoperative outcome although stage is more important.

2.3.4 Molecular diagnosis

- Cholangiocarcinoma is often associated with inactivation of tumour suppressor genes—for example, p53, APC, Smad-4, bcl-2, and p16.
- Mutations in oncogenes have also been described—for example, K-ras, c-myc, c-erbB-2, and c-neu.
- Chromosomal aneuploidy has been reported in up to 25% of periampullary tumours.
- Although these mutations can lead to detectable phenotypic changes, the diagnostic or prognostic usefulness of these developments is unclear and molecular profiling does not, as yet, have an established clinical role in patients with cholangiocarcinoma.

2.4 Levels of evidence

Studies used as a basis for these guidelines are graded in relation to the quality of evidence according to the Oxford Centre for Evidence-based Medicine Levels of Evidence (May 2001). These are summarised in the appendix with explanatory notes, and have been reproduced with the permission of the Centre for Evidence-based Medicine.

Levels of evidence lead to subsequent grading of recommendations as:

A=consistent level 1 studies;
B=consistent level 2 or 3 studies or extrapolations from level 1 studies;
C=level 4 studies or extrapolations from level 2 or 3 studies;
D=level 5 evidence or inconsistent or inconclusive studies of any level.

www.gutjnl.com
Intrahepatic cholangiocarcinoma may be seen as a mass

- Remains the first-line investigation for suspected biliary obstruction.
- Diagnosis should be suspected when intrahepatic, but not extrahepatic, ducts are dilated.
- Intrahepatic cholangiocarcinoma may be seen as a mass lesion but this is unusual.

With advanced disease, systemic non-specific markers of malignancy may be altered—for example, reduced albumin, haemoglobin, and lactate dehydrogenase (LDH).

### 3.2.1 Serum tumour markers

There are no tumour markers specific for cholangiocarcinoma. Overall, the sensitivity and specificity of tumour marker measurements are low but may be useful in conjunction with other diagnostic modalities where diagnostic doubt exists. There is no evidence that measurement of tumour markers is useful for monitoring tumour progression. CA 19-9, carcinoembryonic antigen (CEA), and CA-125 are currently the most widely used serum tumour markers.

**CA 19-9**

- The value of CA 19-9 in patients with suspected cholangiocarcinoma is unclear. However:
  - CA 19-9 is elevated in up to 85% of patients with cholangiocarcinoma;
  - it has been reported that a CA 19-9 value greater than 100 U/ml has a sensitivity of 75% and specificity of 80% in patients with PSC;
  - CA 19-9 elevation can occur in obstructive jaundice without malignancy but persistently raised levels of CA 19-9 after biliary decompression suggest malignancy;
  - CA 19-9 does not discriminate between cholangiocarcinoma, pancreatic, or gastric malignancy and may also be elevated in severe hepatic injury from any cause;
  - the value of CA 19-9 for detecting cholangiocarcinoma in patients without PSC is unknown;
  - CA 19-9 may be useful for the differential diagnosis of cholangiocarcinoma but further studies are needed.

**CEA**

- Carcinoembryonic antigen (CEA) is raised in approximately 30% of patients with cholangiocarcinoma.
- CEA can also be elevated in inflammatory bowel disease, biliary obstruction, other tumours, and severe liver injury.

**CA-125**

- This is elevated in 40–50% of cholangiocarcinoma patients.
- It may signify the presence of peritoneal involvement but further studies are needed.

### Other serum tumour markers

Several other potential serum tumour markers have been linked to cholangiocarcinoma including CA-195, CA-242, DU-PAN-2, IL-6, and trypsinogen-2. Their clinical role is currently unclear.

### 3.3 Imaging

#### 3.3.1 Ultrasonography (US)

- Remains the first-line investigation for suspected biliary obstruction.
- Diagnosis should be suspected when intrahepatic, but not extrahepatic, ducts are dilated.
- Intrahepatic cholangiocarcinoma may be seen as a mass lesion but this is unusual.

- Gall stones excluded.
- Often misses small perihilar, extrahepatic, and periampullary tumours and not good at defining the extent of the tumour.
- Colour Doppler can detect tumour induced compression/thrombosis of the portal vein or hepatic artery.

#### 3.3.2 Computed tomography (CT)

CT may provide good views of intrahepatic mass lesion, dilated intrahepatic ducts, and localised lymphadenopathy, however:

- CT does not usually define the extent of cholangiocarcinoma,
- abdominal lymphadenopathy is common in cholangiocarcinoma,
- suspected perihilar tumours or those involving the portal venous/arterial system should be studied by contrast enhanced spiral/helical CT.

#### 3.3.3 Magnetic resonance imaging (MRI)

At present good quality MR is the optimal initial investigation for suspected cholangiocarcinoma, providing information on:

- liver and biliary anatomy and local extent of the tumour,
- extent of duct involvement by tumour with MR cholangiopancreatography (MRCP),
- hepatic parenchymal abnormalities and presence of liver metastases,
- hilar vascular involvement by MR angiography.

#### 3.3.4 Cholangiography (MRCP, ERCP, and PTC)

- Essential for early diagnosis of cholangiocarcinoma and assessing resectability.
- MRCP is non-invasive and determines the extent of duct involvement by tumour without the risks of endoscopic retrograde cholangiopancreatography (ERCP) or percutaneous transhepatic cholangiography (PTC).
- ERCP, when available, is usually favoured above PTC. However, ideally, facilities for PTC should always be available to deal with cases where attempts at ERCP have failed.
- There is no clear evidence that PTC should generally be favoured over ERCP on the basis of the level of obstruction. However, PTC may be the modality of choice depending on local expertise and anatomical considerations.
- ERCP or PTC allows bile sampling for cytology, which is positive in about 30% of cholangiocarcinoma cases. The yield may be improved by the use of thin preparations and cytospin.
- Combined brush cytology and biopsy specimens increase yield to 40–70%.
- Negative cytology from brushings does not exclude malignancy.
- ERCP and PTC also allow stent insertion for palliative purposes in irresectable tumours (section 4.2).
- Angiography in combination with cholangiography predicts resectability.

#### 3.3.5 New techniques

- Allows good view of distal extrahepatic biliary tree, gall bladder, regional lymph nodes, and vasculature.

Endoscopic ultrasound
Patients should have:

- an initial US screening (recommendation grade C),
- combined MRI and MRCP (recommendation grade B) (where MRI/MRCP is not available, patients should have contrast enhanced spiral/helical CT; recommendation grade C),
- Invasive cholangiography should be reserved for tissue diagnosis or therapeutic decompression where there is cholangitis, or stent insertion in irresectable cases.
- The above techniques may be complementary and sometimes all are necessary as part of a surgical assessment depending on the clinical situation.

**Recommendations**

The role of these new imaging techniques in the diagnosis and staging of cholangiocarcinoma remains poorly defined, and they should best be performed within the context of clinical trials.

- Facilitates guided fine needle aspiration/biopsy of lesions and lymph nodes.
- Positron emission tomography with $^{18}$F-2-deoxy-D-glucose
  - Cholangiocarcinoma cells have high glucose uptake, like most malignancies.
  - Biliary epithelial cell metabolism is assessed in vivo via the glucose analogue $^{18}$F-2-deoxy-D-glucose.
  - Glucose and $^{18}$F-2-deoxy-D-glucose are both phosphorylated but the latter is not further metabolised and accumulates in cholangiocarcinoma cells giving rise to “hot” spots.

Other new techniques

- Intraductal US, endoscopic/percutaneous flexible cholangiography, and radiolabelled ligand imaging.

**3.3.6 Staging**

Cholangiocarcinoma staging is based on the tumour-node-metastasis (TNM) system or alternatively:

- stage I: tumour invasion limited to the mucosa or muscle layer;
- stage II: local invasion;
- stage III: as stages I and II but involving regional and hepatoduodenal lymph nodes or invasion of adjacent tissues;
- stage IV: extensive invasion of the liver, adjacent structures, or lymph nodes, and/or distant metastases.

Once cholangiocarcinoma is suspected, comprehensive staging must be carried out to screen for metastatic disease. Up to 50% of patients are lymph node positive, and 10–20% have peritoneal involvement, at presentation. Clearly, previous imaging of US, CT, and MR are also part of staging. Spread to distant parts of the body is late and uncommon. Nevertheless, the following should be carried out:

- chest radiography,
- CT abdomen (unless abdominal MRI/MRCP already performed),
- laparoscopy (most centres perform laparoscopy to determine the presence of peritoneal or superficial liver metastases in those considered resectable on imaging).

**3.4 Confirmatory histology**

Although positive histology and cytology are often difficult to obtain at ERCP, they are recommended for confirmation of a diagnosis of cholangiocarcinoma. Histology is also important for planning clinical trials. An adenocarcinoma is the usual histological subtype seen (see section 2.3.3 above). The only histological feature that allows a definite diagnosis of cholangiocarcinoma to be made is the presence of coexisting carcinoma in situ and this is uncommon. However, for patients with potentially curable (resectable) disease, open or percutaneous biopsy is not recommended due to the risk of tumour seeding.

**3.5 Excluding metastatic disease**

Cholangiocarcinoma is sometimes very difficult to differentiate from metastatic adenocarcinoma, particularly if the pathological diagnosis is obtained from outside the biliary tree—for example, porta hepatitis lymph node/mass or from liver metastases. Thorough clinical examination and other investigations are necessary to exclude a primary from elsewhere. The extent to which another possible primary is pursued and investigations done (some suggested below) will depend on the clinical situation in each individual case. Metastatic adenocarcinoma mimicking cholangiocarcinoma may arise from several organs, particularly:

1. pancreas—axial imaging (for example, MR, CT, EUS) (evidence levels 2b, 3a; recommendation grade B);
2. stomach—axial imaging, endoscopy (evidence levels 2b, 3a; recommendation grade B);
3. breast—clinical examination, mammography only if breast mass (evidence level 1b; recommendation grade A);
4. lung—chest radiography (evidence levels 2b, 3a; recommendation grade B);
5. colon—colonoscopy or spiral CT (evidence level 3a; recommendation grade B).

Serum tumour markers may also be useful—for example, LDH, α-fetoprotein (evidence level 3b; recommendation grade B).

**4.0 TREATMENT**

**4.1 Surgery**

Surgery is the only curative treatment for patients with cholangiocarcinoma. Surgery cures the minority of patients with cholangiocarcinoma, with a 9–18% five year survival for proximal bile duct lesions and 20–30% for distal lesions.

- Bile duct cancers may be multifocal (5%).
- Lymph node involvement is present in 50% of all patients at presentation and is associated with poor surgical outcome.
- Peritoneal and distant metastases are present in 10–20% of all patients at presentation.

**4.1.1 Resectable tumours**

- Patients’ suitability for major surgery should be guided by medical risk factors rather than age.
Irradiation (for example, brachytherapy or external beam)

Surgical resection with palliative, rather than curative,

4.1.3 Palliative procedures

Liver transplantation is currently contraindicated (rec-

Median survival for patients with intrahepatic cholangi-

4.1.2 Liver transplantation for unresectable tumours (evidence level 3a, b)

Liver transplantation is currently contraindicated (rec-

4.1.3 Palliative procedures

Surgical resection with palliative, rather than curative,

Symptoms related to biliary obstruction in unresectable
disease may be palliated by insertion of a biliary endopros-

Irradiation (for example, brachytherapy or external beam
radiation therapy, unproved in cholangiocarcinoma).

Intraoperative coeliac plexus block for pain control (un-

Close liaison between oncological and surgical teams is

• Resection involves a major operative procedure and requires appropriate surgical and anaesthetic experience.

• Inadequate biliary drainage may increase the risk of sepsis and therefore surgery.

• Surgical treatment principally depends on the site and extent of bile duct involvement by the tumour.

Survival depends on stage with tumour free margins with the absence of lymphadenopathy being the most important positive prognostic indicator.

• Median survival for patients with intrahepatic cholangi-

• Intraoperative coeliac plexus block for pain control (evidence level 3a).

• The use of MRCP to plan endoscopic stent placement in complex hilar tumours may reduce the risk of postproce-

4.2 Biliary decompression and stents

4.2.1 Stenting prior to surgery (evidence level 1a)

• Stents ideally should not be inserted prior to assessing resectability.

• Although the routine use of preoperative biliary drainage is not recommended, in certain patients who are severely malnourished, or who are suffering from acute supplicative cholangitis, preoperative drainage may be beneficial.

• Preoperative placement of biliary catheters may be a useful technical aid in patients requiring a difficult hilar dissection for proximal biliary diseases.

4.2.2 Stents alone for palliation of jaundice (evidence levels 2a–c, 4)

• Stents are used to maintain adequate biliary drainage and relieve symptoms.

• Most stents are inserted endoscopically and are initially plastic.

• The use of MRCP to plan endoscopic stent placement in complex hilar tumours may reduce the risk of postproce-

• In patients with complex hilar lesions, retrospective case control studies suggest that bilateral versus unilateral
endoscopic/percutaneous biliary drainage may result in improved jaundice, postprocedure cholangitis, and survival, although this was not confirmed in a recent randomised trial.

Plastic versus metal stents

- Cost analysis has demonstrated that metallic stents are advantageous in patients surviving more than six months whereas a plastic stent is satisfactory for patients surviving six months or less.
- Placement of metal stents may be associated with shorter hospital stay and lower hospital costs overall.
- Tumour growth through the mesh of metal stents may lead to further problems with biliary obstruction. This may be overcome by inserting plastic (Cotton-Leung) stents through the lumen of the metal stent or placement of a further mesh metal stent where technically possible.
- Mesh metal stent occlusion may give rise to complex biliary obstruction and sepsis.
- Alternatively, semicovered stents have been recently developed which reduce tumour ingrowth but are as yet unproved to have superior long term patency.

4.2.3 Complications of stenting

- Complications of endoscopy.
- It should be noted that following palliative stenting, patients can die from recurrent sepsis, biliary obstruction, and stent occlusion as well as disease progression.

4.3 Oncological approaches

Surgery is the only curative treatment for patients with cholangiocarcinoma but it is only effective in a minority of cases. At presentation, half of all cholangiocarcinomas have lymph node metastases. Thus successful non-surgical oncological approaches could have a significant beneficial impact on this disease, on the majority of patients if efficacy could be demonstrated. However, to date, the level of evidence for the majority of published studies is 2a or less.

To date, a review of over 65 disparate studies using chemotherapy and/or radiation suggests that there was no strong evidence of survival benefit. However, most studies were small, lacked control groups (phase II), and were difficult to interpret, particularly as radiological responses for cholangiocarcinoma are not easy to document.

As a general guide from published trials:

- (i) patients who are relatively healthy, stable, and not deteriorating rapidly should be treated early in their course of disease rather than wait for their disease to progress. The performance status is generally the most important prognostic factor (patients with a Karnofsky status of 50 or more that are not rapidly deteriorating are usually suitable);
- (ii) good symptom control is paramount throughout and requires multidisciplinary team input;
- (iii) in those patients on treatment in whom quality of life is preserved or improved, a survival benefit is more likely. Thus quality of life should probably be the primary focus and survival a secondary end point in disease management;
- (iv) achieving stable disease (or lack of objective progression) in patients on therapy has value that can be translated into both length and quality of life, and so should not be underestimated as a surrogate end point. This is particularly important because of the frequent difficulty in confirming objective radiological responses, particularly in the perihilar area.

Trial approaches may involve chemotherapy, radiotherapy (external beam, intraoperative, intraluminal brachytherapy), or combinations of the above with or without surgery. Presurgical approaches attempting down staging are classified as “neoadjuvant” and immediately postsurgical as “adjuvant”.

4.3.1 Chemotherapy

- In advanced disease, one randomised study of combination chemotherapy versus best supportive care reported a significantly improved survival (four months of benefit) and quality of life to the chemotherapy arm. (The study also included pancreatic cancers with a positive result although the analysis was separate.)
- There is currently no evidence to support postsurgical adjuvant therapy outside a trial setting.
- Conclusions from predominately phase II studies suggest:
  - (i) cholangiocarcinomas are relatively chemosensitive, with most studies being 5-fluorouracil (5-FU) based, and 10–20% partial response rates to (older) single agents;
  - (ii) partial response rates to newer single agents, such as gemcitabine, vary from 20% to 30%;
  - (iii) partial response rates to recent phase II combinations vary from 20 to 40%.
  - Gemcitabine in combination with cisplatin shows 30–50% partial response rates. It is encouraging that several patients have been clearly documented as being down staged and converted to operability in some phase II studies, with occasional long term survivors.
- the chance of responding appears to be correlated with performance status at the outset. Quality of life is significantly improved, particularly in responders.

Currently, a European study of infusional 5-FU with cisplatin compared with infusional 5-FU (EORTC-GITCCG randomised phase II) is recruiting. Oral 5-FU analogues are also now available (UFT-tegafur or capecitabine).

Targeted chemotherapy through the hepatic artery or portal vein has been shown to achieve greater local drug concentrations and improved response rates (44% in one phase II study) but because of the patterns of relapse, it is unlikely to replace systemic chemotherapy entirely.

4.3.2 Radiotherapy

(a) External beam radiotherapy and chemoradiation

- There is currently no evidence to support adjuvant postoperative radiation therapy. Radiotherapy did not improve survival or the quality of life in patients with resected perihilar cholangiocarcinoma when assessed prospectively.
- There is no evidence for radiotherapy improving survival or the quality of life in advanced disease. There is significant toxicity from current methods of delivery and no evidence of disease sterilising effects without significant morbidity.
- The role of chemoradiation (chemotherapy combined with local radiation) remains to be established in randomised clinical trials as local and systemic toxicity is also concomitantly increased.
- Radiation alone still has potential important palliative value for painful localisable metastases, uncontrolled bleeding, etc.
**Recommendations**

- All patients who have inoperable tumours, or who are operable but have not been rendered disease free, or those patients with recurrences should be actively encouraged to participate in chemotherapy and/or radiotherapy clinical trials (recommendation grade B).

**(b) Local radiation techniques: intraoperative or intraluminal brachytherapy**

- A few uncontrolled studies using intraluminal brachytherapy (iridium implants), combined with external beam irradiation, have suggested a benefit. In one study, median survival rates reached about 10 months compared with seven months in patients managed by stenting alone.
- Median survival using a combination of external beam irradiation, transcatheter iridium, and chemotherapy (fluorouracil) was 13 months in another uncontrolled study.
- In advanced disease, liver and abdominal cavity relapse were the major causes of progression in these and other radiotherapy studies.

Thus although intraoperative radiotherapy and intraluminal brachytherapy appear promising, the studies do not support their use in isolation and there are no controlled data confirming their value in comparison with standard chemotherapy, chemoradiation, or stenting alone.

**Oncology conclusion**

Definitive evidence from large randomised studies for a survival benefit of non-surgical oncological intervention compared with best supportive care is still lacking. Patients with advanced cholangiocarcinoma should therefore be actively offered the opportunity to participate in clinical trials as there are many new promising agents and combinations with potential improved efficacies and tolerability. In chemotherapy trials, good performance status patients appear to have the most significant benefit in terms of quality of life.

### 4.4 Recurrent bile duct cancer

The prognosis for any treated patient with progressing, recurring, or relapsing bile duct cancer is poor. Further treatment depends on several factors, including prior treatment and site of recurrence, as well as individual patient considerations. Relief of recurrent jaundice usually improves quality of life. Clinical trials of chemotherapy in particular, may be appropriate and should be considered when possible.

A management algorithm for cholangiocarcinoma is shown in figure 2.

### 5.0 REVISION OF GUIDELINES

We recommend that these guidelines are regularly audited and we request feedback from all users. These guidelines should be formally revised within three years of publication or sooner in light of new evidence.

### 6.0 APPENDIX: LEVELS OF EVIDENCE

Levels of evidence are shown in table A1.

---

**Figure 2** Management algorithm for cholangiocarcinoma. US, ultrasonography; MRCP, MR cholangiopancreatography; MRA, MR angiography; ERCP, endoscopic retrograde cholangiopancreatography; PTC, percutaneous transhepatic cholangiography. *Where magnetic resonance imaging/MRCP is not possible, patients should have contrast enhanced spiral/helical computed tomography. **Fine needle biopsy or biopsy is ideally avoided until resectability has been assessed by a specialist surgeon.

---

**Accepted for publication 15 May 2002**

---

**7.0 REFERENCES**

### Table A1: Levels of evidence

<table>
<thead>
<tr>
<th>Level</th>
<th>Therapy/prevention</th>
<th>Prognosis</th>
<th>Diagnosis</th>
<th>DDX/symptom prevalence study</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>SR (with homogeneity*) of RCTs (randomised control trial)</td>
<td>SR (with homogeneity*) of inception cohort studies; CDR† validated in different populations</td>
<td>SR (with homogeneity*) of level 1 diagnostic studies; CDR† with 1b studies from different clinical centres</td>
<td>SR (with homogeneity*) of prospective cohort studies</td>
</tr>
<tr>
<td>1b</td>
<td>Individual RCT (with narrow confidence interval)</td>
<td>Individual inception cohort study with &gt;80% follow up; CDR† validated in a single population</td>
<td>Validating ** cohort study with good††† reference standards; or CDR† tested within one clinical centre</td>
<td>Prospective cohort study with good follow up****</td>
</tr>
<tr>
<td>1c</td>
<td>All or none§</td>
<td>All or none case series</td>
<td>All or none case series</td>
<td>All or none case series</td>
</tr>
<tr>
<td>2a</td>
<td>SR (with homogeneity*) of cohort studies</td>
<td>SR (with homogeneity*) of either retrospective cohort studies or untreated control groups in RCTs</td>
<td>SR (with homogeneity*) of level &gt;2 diagnostic studies</td>
<td>SR (with homogeneity*) of 2b and better studies</td>
</tr>
<tr>
<td>2b</td>
<td>Individual cohort study (including low quality RCT; eg, &lt;80% follow up)</td>
<td>Retrospective cohort study or follow up of untreated control patients in an RCT; Derivation of CDR† or validated on split sample§§§ only</td>
<td>Exploratory** cohort study with good††† reference standards; CDR† after derivation, or validated only on split sample§§§ or databases</td>
<td>Retrospective cohort study or poor follow up</td>
</tr>
<tr>
<td>2c</td>
<td>“Outcomes” research; ecological studies</td>
<td>“Outcomes” research</td>
<td>Ecological studies</td>
<td>Ecological studies</td>
</tr>
<tr>
<td>3a</td>
<td>SR (with homogeneity*) of case control studies</td>
<td>SR (with homogeneity*) of 3b and better studies</td>
<td>SR (with homogeneity*) of 3b and better studies</td>
<td>SR (with homogeneity*) of 3b and better studies</td>
</tr>
<tr>
<td>3b</td>
<td>Individual case control study</td>
<td>Non-consecutive study; or without consistently applied reference standards</td>
<td>Non-consecutive cohort study or very limited population</td>
<td>Non-consecutive cohort study or very limited population</td>
</tr>
<tr>
<td>4</td>
<td>Case series (and poor quality cohort and case control studies§§)</td>
<td>Case series (and poor quality prognostic cohort studies***</td>
<td>Case control study, poor or non-independent reference standard</td>
<td>Case series or superseded reference standards</td>
</tr>
<tr>
<td>5</td>
<td>Expert opinion without explicit critical appraisal, or based on physiology, bench research, or “first principles”</td>
<td>Expert opinion without explicit critical appraisal, or based on physiology, bench research, or “first principles”</td>
<td>Expert opinion without explicit critical appraisal, or based on physiology, bench research, or “first principles”</td>
<td>Expert opinion without explicit critical appraisal, or based on physiology, bench research, or “first principles”</td>
</tr>
</tbody>
</table>

*Homogeneity means a systematic review (SR) that is free of worrisome variations (heterogeneity) in the directions and degrees of results between individual studies. Not all SRs with statistically significant heterogeneity need be worrisome, and not all worrisome heterogeneity need be statistically significant.

§Met when all patients died before the treatment became available, but some now survive on it; or when some patients died before the treatment became available, but none now die on it.

§§Poor quality cohort study: one that failed to clearly define comparison groups and/or failed to measure exposures and outcomes in the same (preferably blinded), objective way in both exposed and non-exposed individuals and/or failed to identify or appropriately control known confounders and/or failed to carry out a sufficiently long and complete follow up of patients. Poor quality case control study: one that failed to clearly define comparison groups and/or failed to measure exposures and outcomes in the same (preferably blinded), objective way in both cases and controls and/or failed to identify or appropriately control known confounders.

§§§Split sample validation is achieved by collecting all the information in a single tranche, then artificially dividing this into “derivation” and “validation” samples.

†††An “Absolute SpPin”: a diagnostic finding whose specificity is so high that a positive result rules in the diagnosis. An “Absolute SnNout”: a diagnostic finding whose Sensitivity is so high that a Negative result rules out the diagnosis.

**Clinical decision rule. (Algorithms or scoring systems which lead to a diagnostic estimation or a diagnostic category.)

††††Good reference standards are independent of the test, and applied blindly or objectively to all patients. Poor reference standards are haphazardly applied, but still independent of the test. Use of a non-independent reference standard (where the “test” is included in the “reference”, or where the “testing” affects the “reference”) implies a level 4 study.

***Validating studies test the quality of a specific diagnostic test, based on prior evidence. An exploratory study collects information and trawls the data (for example, using a regression analysis) to find which factors are “significant”

**Poor quality prognostic cohort study: one in which sampling was biased in favour of patients who already had the target outcome, or the measurement of outcomes was accomplished in <80% of study patients, or outcomes were determined in an unblinded, non-objective way, or there was no correction for confounding factors.

****Good follow up is a differential diagnosis study is >80%, with adequate time for alternative diagnoses to emerge [for example, 1–6 months acute, 1–5 years chronic].
Cholangiocarcinoma guidelines


