

### Overview

#### Useful For

Providing prognostic information and guiding treatment for patients with cholangiocarcinomas and other tumor types including bladder, thyroid, oral cavity, and brain

#### Reflex Tests

Test Id	Reporting Name	Available Separately	Always Performed
_PBCT	Probe, +2	No, (Bill Only)	No
_PADD	Probe, +1	No, (Bill Only)	No
_PB02	Probe, +2	No, (Bill Only)	No
_PB03	Probe, +3	No, (Bill Only)	No
_IL25	Interphases, <25	No, (Bill Only)	No
_I099	Interphases, 25-99	No, (Bill Only)	No
_I300	Interphases, >=100	No, (Bill Only)	No

#### Testing Algorithm

This test includes a charge for the probe application, analysis, and professional interpretation of results for one probe set (2 individual fluorescence in situ hybridization probes). No analysis charges will be incurred if an insufficient number of representative cells are available for analysis.

Appropriate ancillary probes may be performed at consultant discretion to render comprehensive assessment. Any additional probes will have the results included within the final report and will be performed at an additional charge.

#### Method Name

Fluorescence In Situ Hybridization (FISH)

#### NY State Available

Yes

### Specimen

#### Specimen Type

Tissue

#### Ordering Guidance

[This test does not include a pathology consultation. If a pathology consultation is requested, order PATHC / Pathology Consultation, and appropriate testing will be added at the discretion of the pathologist and performed at an additional charge.](#)

Multiple oncology (cancer) gene panels are also available. For more information see [Hematology, Oncology, and Hereditary Test Selection Guide](#)

**Shipping Instructions**

Advise Express Mail or equivalent if not on courier service.

**Necessary Information**

**1. A pathology report is required for testing to be performed. If not provided, appropriate testing or interpretation may be compromised or delayed. Acceptable pathology reports include working drafts, preliminary pathology, or surgical pathology reports.**

**2. The following information must be included in the report provided.**

1. Patient name
2. Block number - must be on all blocks, slides, and paperwork
3. Date of collection
4. Tissue source

**3. A reason for testing must be provided.** If this information is not provided, an appropriate indication for testing may be entered by Mayo Clinic Laboratories.

**Specimen Required**

**Submit only 1 of the following specimens:**

**Preferred**

Specimen Type: Tissue block

Collection Instructions: Submit a formalin-fixed, paraffin-embedded tumor tissue block. Blocks prepared with alternative fixation methods may be acceptable; provide fixation method used.

Additional Information:

1. Paraffin-embedded specimens can be from any anatomic location (skin, soft tissue, lymph node, etc).
2. Bone specimens that have been decalcified will be attempted for testing, but the success rate is approximately 50%.

**Acceptable**

Specimen Type: Tissue slides

Slides: 1 Hematoxylin and eosin stained and 4 unstained

Collection Instructions: Submit 1 slide stained with hematoxylin and eosin and 4 consecutive unstained, positively charged, unbaked slides with 5 micron thick sections of the tumor tissue

**Forms**

If not ordering electronically, complete, print, and send an [Oncology Test Request](#) (T729) with the specimen.

**Specimen Minimum Volume**

Slides: 1 Hematoxylin and eosin stained and 2 unstained

**Reject Due To**

All specimens will be evaluated at Mayo Clinic Laboratories for test suitability.

**Specimen Stability Information**

Specimen Type	Temperature	Time	Special Container
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Tissue	Ambient (preferred)		
	Refrigerated		

## Clinical & Interpretive

### Clinical Information

Cholangiocarcinoma is a malignancy arising from the biliary tract epithelium. These tumors are often clinically advanced at the time of presentation, and the prognosis is very poor with a short overall survival. Treatment is generally limited to surgical resection, which is associated with a high degree of morbidity, and palliative chemotherapy regimens. Therefore, additional treatment options are eagerly sought.

Rearrangement of the *FGFR2* gene region has been identified in a subset of cholangiocarcinomas. These rearrangements result in overexpression of *FGFR2*, which offers the possibility of using targeted *FGFR2*-inhibitor therapy for treatment. *FGFR2* rearrangements have also been identified in a number of other cancers including bladder, thyroid, oral cavity, and brain.

### Reference Values

An interpretive report will be provided.

### Interpretation

A neoplastic clone is detected when the percent of cells with an abnormality exceeds the normal cutoff for the *FGFR2* fluorescence in situ hybridization (FISH) probe set.

A positive result is consistent with the presence of an *FGFR2* rearrangement and likely reflects *FGFR2* fusion with a partner gene. The significance of this FISH result is dependent on additional clinical and pathologic features.

A negative result does not exclude the presence of a neoplastic disorder.

### Cautions

This test is not approved by the US Food and Drug Administration and is best used as an adjunct to existing clinical and pathologic information.

Fixatives other than formalin (eg, Prefer, Bouin's) may not be successful for fluorescence in situ hybridization (FISH) assays. Non-formalin fixed specimens will not be rejected.

Paraffin-embedded tissues that have been decalcified may not be successful for FISH analysis. The success rate of FISH studies on decalcified tissue is approximately 50%.

FISH studies will be attempted if sufficient tumor is present for analysis. If insufficient tissue/tumor is available for testing, the pathologist reviewing the hematoxylin and eosin-stained slide may find it necessary to cancel testing.

If no FISH signals are observed post-hybridization, the case will be released indicating a lack of FISH results.

### Supportive Data

FISH analysis was performed on 38 paraffin-embedded tissue samples and 25 noncancerous lymph node control

specimens. Rearrangement of *FGFR2* was identified in 13 cholangiocarcinoma tumors. The normal controls were used to generate a normal cutoff for this assay.

**Clinical Reference**

1. Mitesh BJ, Champion MD, Egan JB, et al. Integrated Genomic Characterization Reveals Novel, Therapeutically Relevant Drug Targets in FGFR and EGFR Pathways in Sporadic Intrahepatic Cholangiocarcinoma. *PLOS Genetics*. 2014;10(2):e1004135
2. Graham RP, Barr Fritcher EG, Pestova E, et al. Fibroblast growth factor receptor 2 translocations in intrahepatic cholangiocarcinoma. *Hum Pathol*. 2014;45(8):1630-1638
3. Arai Y, Totoki Y, Hosoda F, et al. Fibroblast growth factor receptor 2 tyrosine kinase fusions define a unique molecular subtype of cholangiocarcinoma. *Hepatology*. 2014;59(4):1427-1434
4. Wu YM, Su F, Kalyana-Sundaram S, et al. Identification of targetable FGFR gene fusions in diverse cancers. *Cancer Discov*. 2013;3(6):636-647
5. Zou Y, Zhu K, Pang Y, et al. Molecular detection of FGFR2 rearrangements in resected intrahepatic cholangiocarcinomas: FISH could be an ideal method in patients with histological small duct subtype. *J Clin Transl Hepatol*. 2023;11(6):1355-1367

**Performance****Method Description**

The test is performed using an FGFR2 (10q26.1) dual-color, break-apart strategy probe (BAP). Paraffin-embedded tissue samples are cut at 5 microns and mounted on positively charged glass slides. The selection of tissue and the identification of target areas on the hematoxylin and eosin (H and E)-stained slide are performed by a pathologist. Using the H and E-stained slide as a reference, target areas are etched with a diamond-tipped engraving tool on the back of the unstained slide to be assayed. The probe set is hybridized to the appropriate target areas, and 2 technologists each independently analyze 50 interphase nuclei (100 total) with the results expressed as the percent of abnormal nuclei. (Unpublished Mayo method)

**PDF Report**

No

**Day(s) Performed**

Monday through Friday

**Report Available**

7 to 10 days

**Specimen Retention Time**

Slides and H and E used for analysis are retained by the laboratory in accordance with regulatory requirements. Client provided paraffin blocks and extra unstained slides will be returned after testing is complete.

**Performing Laboratory Location**

Mayo Clinic Laboratories - Rochester Main Campus

## Fees & Codes

### Fees

- Authorized users can sign in to [Test Prices](#) for detailed fee information.
- Clients without access to Test Prices can contact [Customer Service](#) 24 hours a day, seven days a week.
- Prospective clients should contact their account representative. For assistance, contact [Customer Service](#).

### Test Classification

This test was developed and its performance characteristics determined by Mayo Clinic in a manner consistent with CLIA requirements. It has not been cleared or approved by the US Food and Drug Administration.

### CPT Code Information

- 88271x2, 88291 - DNA probe, each (first probe set), Interpretation and report
- 88271x2 - DNA probe, each; each additional probe set (if appropriate)
- 88271x1 - DNA probe, each; coverage for sets containing 3 probes (if appropriate)
- 88271x2 - DNA probe, each; coverage for sets containing 4 probes (if appropriate)
- 88271x3 - DNA probe, each; coverage for sets containing 5 probes (if appropriate)
- 88274 w/modifier 52 - Interphase in situ hybridization, <25 cells, each probe set (if appropriate)
- 88274 - Interphase in situ hybridization, 25 to 99 cells, each probe set (if appropriate)
- 88275 - Interphase in situ hybridization, 100 to 300 cells, each probe set (if appropriate)

### LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
FGFR2	FGFR2 (10q26.1), FISH, Ts	95784-5

Result ID	Test Result Name	Result LOINC® Value
38094	Result Summary	50397-9
38095	Interpretation	69965-2
38096	Result	62356-1
38097	Reason For Referral	42349-1
38098	Specimen	31208-2
38099	Source	31208-2
38100	Tissue ID	80398-1
38101	Method	85069-3
38102	Additional Information	48767-8
38103	Disclaimer	62364-5
38104	Released By	18771-6