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## 19.1 Indications for Laparoscopic Approach to Liver Biopsy

Liver biopsy provides histopathologic diagnosis, as well as a method to track progression of fibrosis, in a variety of neonatal and pediatric liver diseases. Tissue can be obtained via one of three approaches: open, transcutaneous, and transvenous biopsy methods. In an era of evolving minimally invasive techniques, laparoscopic liver biopsy is gaining traction. Studies have used laparoscopic guided cholecystocholangiography and liver biopsy in neonates in their first few days of life.

Pediatric liver diseases typically present with persistent jaundice, and their underlying diagnoses include cholestasis, biliary atresia (BA), metabolic disorders, viral hepatitis, autoimmune hepatitis, fatty liver disease, and drug-induced liver injury. Liver biopsies are also used in monitoring fibrosis in the transplanted liver and aiding in the diagnosis of a liver mass. The above differential is narrowed with labs and imaging, but the gold standard of tissue diagnosis is required to proceed with treatment.

## 19.2 Preoperative Workup and Considerations

In the neonatal and pediatric population, persistent hyperbilirubinemia triggers a laboratory workup including hepatitis panel, fractionated bilirubin, and coagulation profiles. This is

**Supplementary Information** The online version contains supplementary material available at [https://doi.org/10.1007/978-3-030-58043-8\\_19](https://doi.org/10.1007/978-3-030-58043-8_19). The videos can be accessed individually by clicking the DOI link in the accompanying figure caption or by scanning this link with the SN More Media App.

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often followed by imaging with an abdominal ultrasound. In cases of liver masses, a computed tomography (CT) or magnetic resonance imaging (MRI) may further characterize the mass. When there is concern for biliary atresia, a hepatobiliary dimethyl-iminodiacetic acid (HIDA) scan is obtained. If test results support our suspicion, we may choose to proceed with a biopsy. In select institutions, the cholangiogram is obtained using an endoscopic retrograde cholangiopancreatography (ERCP).

## 19.3 Anesthetic Considerations

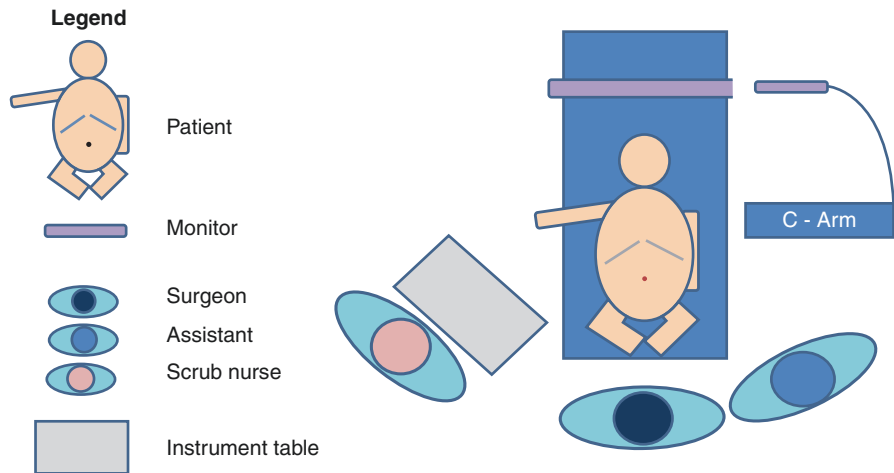
In both the laparoscopic and open approach, general anesthesia is used. During laparoscopy, neonates may require lower insufflation pressures (8–10 mmHg) if at risk for reopening the left to right shunt. Adequate venous access should be obtained and perioperative antibiotics should be administered. Normothermia, normoglycemia, and judicious amounts of intravenous fluids should be used.

## 19.4 Operative Technique and Equipment

### 19.4.1 Equipment

- 3 or 5 mm instruments and trocars
- 3 or 5 mm 30° laparoscope
- 3 or 5 mm Maryland dissector
- 3 or 5 mm atraumatic grasper
- 3 or 5 mm Metzenbaum scissors
- 3 or 5 mm hook monopolar cautery (grounding pad)
- 3-0 monofilament polydioxanone suture (to suspend the gall bladder transabdominally)
- 4F micropuncture kit or:
  - 18-gauge needle (to puncture the gallbladder transcutaneously)
  - 0.038 glide wire

**Fig. 19.1** Positioning of patient, surgeons and monitors



- 14 or 16 gauge flexible cannula
- Extension tubing
- Three way stop-cock
- 10cc of 50% dilute iohexol contrast solution
- 30cc injectable saline
- Endopeanut/Kittner
- 4-0 polydioxanone or polyglactin 910 suture (to close needle cholecystotomy)
- 18-gauge core needle biopsy gun



### 19.4.2 Positioning

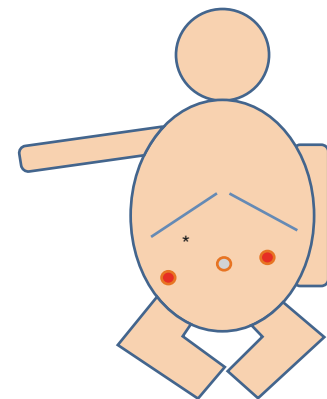
The patient is positioned supine frogleg-positioning at the foot end of the bed with one arm extended sideways and one tucked to the side. The surgeon stands at the foot end of the bed, the monitor is at the head of the bed in-line with surgeon and patient (Fig. 19.1). The assistant stands to the right side of the surgeon, the scrub nurse on the left. The abdomen is prepped and draped from the nipples to the symphysis. The C-arm will come in via the right side of the table with the monitor preferably being near the head of the table.

### 19.4.3 Trocar Placement

The size of the ports typically depends on the age and size of the patient; 3 mm ports are preferred for infants and 5 mm ports in older children. The optical port is placed in the umbilicus. An appropriately sized 30-degree camera is inserted to inspect the abdomen, and two additional trocars are placed (one on each side of the navel) along the mid clavicular line at the level of the umbilicus or slightly higher (Fig. 19.2).

### Legend

-  Working trocar
-  Endoscope trocar
- \* Percutaneous entry site



**Fig. 19.2** Positioning of the trocars

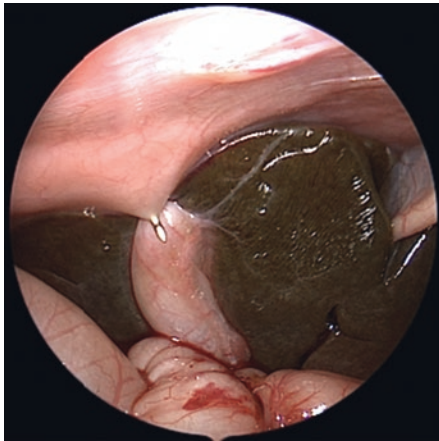
### 19.4.4 Operative Milestones

After placement of the trocars, the abdomen is explored to clearly visualize the patient's visceral anatomy. In cases of BA where a gallbladder is not visualized, the surgeon may choose to forego the cholangiogram and proceed with the Kasai portoenterostomy by either an open or laparoscopic method.

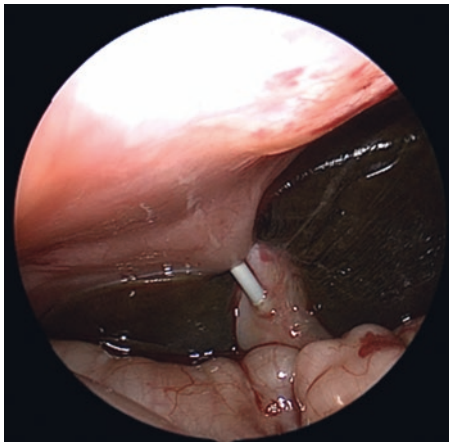
If a cholangiogram is required after the gallbladder is visualized, a 3-0 monofilament polydioxanone suture is placed transcutaneously to the dome of the liver to suspend the gallbladder to the anterior abdominal wall (Milestone 19.1). Under direct vision, the gallbladder is percutaneously punctured with a needle (Milestone 19.2), a guidewire is inserted, and subsequently a 14- or 16-gauge flexible cannula is advanced into the gallbladder over the guidewire for the cholangiogram (Milestone 19.3). The cannula is connected to an extension tubing and three-way stopcock. Diluted water-soluble contrast (iohexol) is used for the cholangiogram (Milestone 19.4). In order to delineate the intrahepatic ducts, the distal common bile duct is laparoscopically occluded using direct pressure with a cotton applicator



**Milestone 19.1** Transcutaneous suspension of gall bladder (Video 19.1 Laparoscopic liver biopsy and intra-operative cholangiogram). (► <https://doi.org/10.1007/000-2vc>)

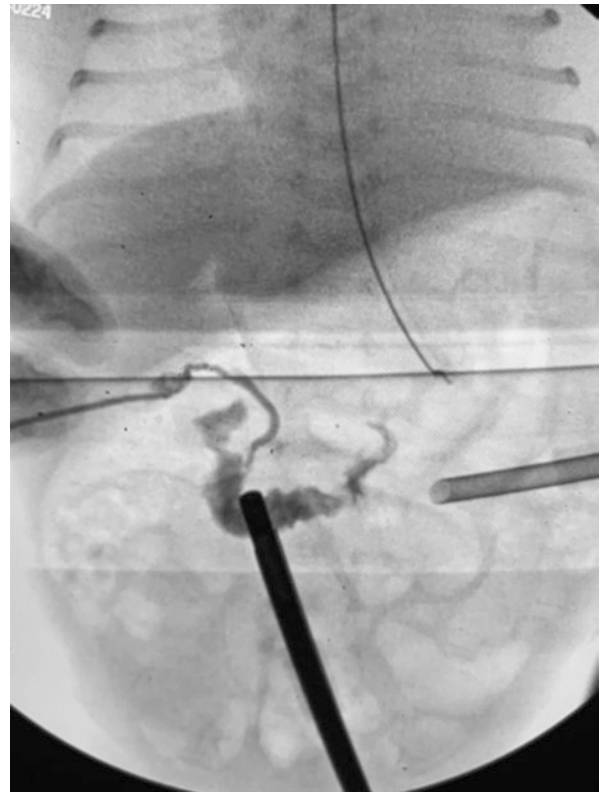


**Milestone 19.2** Percutaneous access to fundus



**Milestone 19.3** Insertion of 4F sheath/angiocath over wire

(Milestone 19.5). Depending on the size of the patient, a cholangiogram catheter set can be used as well. The cholecystotomy is then closed using intracorporeal suturing (Milestone 19.6).



**Milestone 19.4** Intraoperative cholangiogram

After completing the cholangiogram, either a core or wedge liver biopsy is obtained by sampling from the anterior lip of the liver under direct laparoscopic vision (Milestone 19.7). Suction and cautery should be in place in case of bleeding.

#### Core Biopsy

Several devices exist to obtain a core biopsy. The authors recommend utilization of the device that is locally accessible and following the manufacturers guidelines for the procedure. This technique does not require the additional trocars be placed.

#### Wedge Biopsy

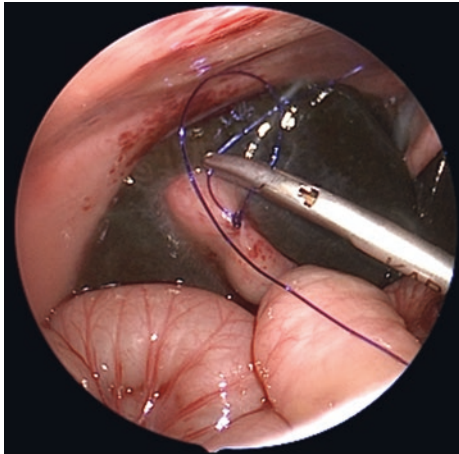
Two additional ports will need to be placed to facilitate this. A 1 cm<sup>3</sup> wedge of liver parenchyma is obtained sharply. The raw surface is cauterized extensively after obtaining the biopsy.

Others describe using a biopsy forceps and using coagulation after sampling for hemostasis.

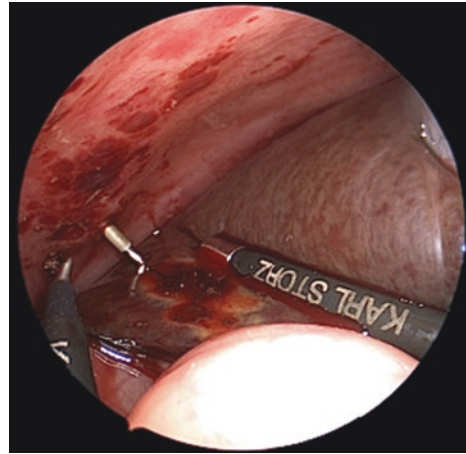
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### 19.5 Postoperative Care

There are no restrictions to activity postoperatively.

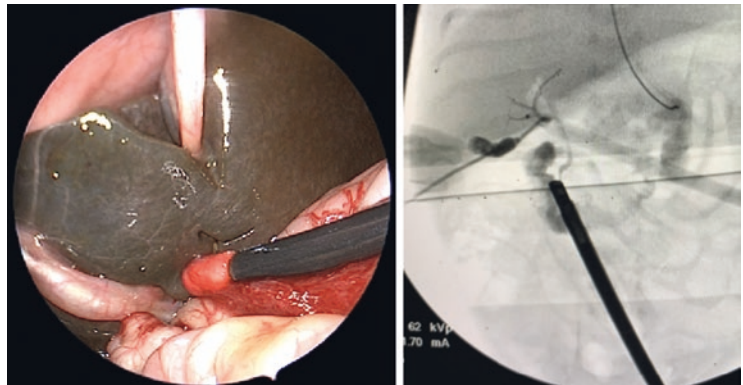


**Milestone 19.6** Suture closure of cholecystostomy



**Milestone 19.7** Percutaneous core needle biopsy

**Milestone 19.5** Atraumatic instrument compressing distal CBD



## 19.6 Pearls/Tips & Tricks

1. Using laparoscopic scissors or other sharp instruments avoids leaving a charred edge of the liver in your biopsy specimen
2. Hemostatic agents and cautery can be used in a focused fashion after biopsy
3. If a core needle technique is used, typically a minimum of two passes are needed to provide an adequate amount of tissue

## 19.7 Pitfalls & How to Avoid

1. Complications include hemorrhage, abdominal pain, injury to other organs in the abdomen, bile leak, and cardiopulmonary or neurologic effects related to general anesthesia. Meticulous laparoscopic technique that would be used under any other circumstance should be followed during what may be considered a minor procedure such as a liver biopsy.

2. An adequate sample is required; a preoperative conversation with the pathologist will help in ensuring that you obtain the necessary amount needed for diagnosis (Video 19.1).

## References

1. Dezsofi A, Knisely AS. Liver biopsy in children 2014: who, whom, what, when where, why? *Clin Res Hepatol Gastroenterol.* 2014;38:395–8.
2. Lee JYJ, Sullivan L, El Demellawy D, Nasr A. The value of preoperative liver biopsy in the diagnosis of extrahepatic biliary atresia: a systematic review and meta-analysis. *J Ped Surg.* 2016;51:753–61.
3. Mogahed EA, Mansy YA, Al Hawi Y, El-Sayed R, El-Raziky M, El-Karakasy H. Blind percutaneous liver biopsy in infants and children: comparison of safety and efficacy of percussion technique and ultrasound assisted technique. *Arab J Gastroenterol.* 2016;17:168–75.
4. Schady DA, Finegold MJ. Contemporary evaluation of the pediatric liver biopsy. *Gastroenterol Clin N Am.* 2017;46:233–52.
5. Shreef K, Alhelal A. Evaluation of the use of laparoscopic-guided cholecystocholangiography and liver biopsy in definitive diagnosis of neonatal cholestatic jaundice. *Air J Paediatr Surg.* 2016;13(4):181–4.