



Bile Duct Ligation-surgery protocol

By:

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after a protocol of Dr.Graziano Oldani (Division of Abdominal and Transplantation Surgery, Department of Surgery, Faculty of Medicine, Geneva University Hospitals, Geneva, Switzerland; Faculty of Medicine, Hepato-pancreato-biliary Centre, Geneva University Hospitals, Geneva, Switzerland)

Materials:

- stereo microscope
- heating pad
- white light system (cold light)
- video camera (mounted in microscope)
- PBS 1x or NaCl 0.9% heated on the heating pad
- 2-3X 1 ml syringes
- cotton swabs
- a pillow made of rolled gauze
- Buprenorphine (Conc 0.03mg/ml) (dosage 1ul/g)
- Silk sutures for bile duct ligation (8/0 pups; 6/0 adults)
- Vycril sutures (5/0 pups; 3/0 adults)

Surgical instruments

- small scissors with round tip



- serrated normal forceps

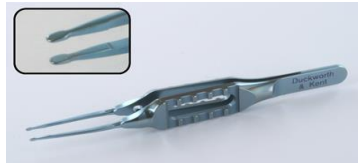
-curved fine forceps.



-fine forceps



- Flat tying forceps



- Barraquer needle holder



- Fine normal scissors (round tip)

- Ecarteurs (2x)

Surgery (a video showing the ligation can be found here [10.5281/zenodo.10652104](https://zenodo.org/record/10652104)):

- rats (adults or pups) will be put under anesthesia by induction with isoflurane 4% with oxygen 50% and air flow of 0,5 L/min
- shave the abdominal fur of the rat with an electric fur shaver and protect the eyes from drying out by usage of eye ointment.
- place the rat dorsal on a 37 °C heating pad, insert the rat nose in the anesthesia mask
- maintain anesthesia of the rat by inhalation of 1.5-3 vol% isoflurane in 50% oxygen at a flow rate of 0.5 L/min and induct analgesia by subcutaneous injection of Buprenorphine 0.03mg/ml at a dosage of 1ul/gr which will be repeated 3-4 times/day
- sterilize the shaved abdominal skin with a gauze swab and alcohol 70% then Betadine 10%
- open the abdomen with a midline laparotomy of the skin under the sternum aprox. 2-3 cm and dissect the connective tissue on top of the peritoneum by using a round tip scissor as a spreader
- cut the peritoneum along the linea alba to open the peritoneal cavity
- lift the back of the rat with a pillow at the level of the diaphragm

- lift the liver with a moisturized (PBS 1x) cotton swab so it sticks to the diaphragm and the hilum is clearly visible
- carefully separate the bile duct from the connective tissue making sure the separation is beyond any ramification of the bile duct
- place a silk suture caudal around the bile duct (8/0 pups ;6/0 adults). When tying the knots increase the tractive force continuously to ensure effective obstruction without severing the bile duct
- add a second and a third cranial ligation in the same manner
- cut the ends of the suture
- cut in between the caudal suture and the cranial ones and after if possible cut a little part of the free bile duct remains in both cranial and caudal ways
- rinse the peritoneal cavity with PBS and replace the abdominal organs in the physiological position
- close the peritoneum and the abdominal muscles with continuous suture (Vycril 5/0 pups,3/0 adults)
- close the skin with separate running sutures (Vycril 5/0 pups,3/0 adults)
- disinfect the surgery area with Betadine (also Bepanthene Plus can be added and continue with it twice a day for the next 7 days)

Postoperative treatment and follow-up

- allow the rat to recover on the heating pad until it is totally awake with an airflow of 0.5 L/min and an oxygen flow of 1L/min
- place it in the cage and provide ad libitum access to water and food
- perform analgesic therapy after 6-8 hours and the next 2 days 3-4 times a day with Buprenorphine.
- weight the rats daily while under analgesic therapy and after once every two days.

Published manuscripts

[Neurometabolic changes in a rat pup model of type C hepatic encephalopathy depend on age at liver disease onset - PubMed \(nih.gov\)](#)

[Abnormal brain oxygen homeostasis in an animal model of liver disease - PubMed \(nih.gov\)](#)

[PET CMRglc mapping and 1H-MRS show altered glucose uptake and neurometabolic profiles in BDL rats - PubMed \(nih.gov\)](#)

[Central nervous system and systemic oxidative stress interplay with inflammation in a bile duct ligation rat model of type C hepatic encephalopathy - PubMed \(nih.gov\)](#)

[Probiotics combined with rifaximin influence the neurometabolic changes in a rat model of type C HE - PubMed \(nih.gov\)](#)

[Probiotics improve the neurometabolic profile of rats with chronic cholestatic liver disease - PubMed \(nih.gov\)](#)

[Longitudinal osmotic and neurometabolic changes in young rats with chronic cholestatic liver disease - PubMed \(nih.gov\)](#)

[Longitudinal neurometabolic changes in the hippocampus of a rat model of chronic hepatic encephalopathy - PubMed \(nih.gov\)](#)

[¹H and ³¹P magnetic resonance spectroscopy in a rat model of chronic hepatic encephalopathy: in vivo longitudinal measurements of brain energy metabolism - PubMed \(nih.gov\)](#)

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