

Ultrasound-guided Menghini biopsy was recommended in 1983 as an alternative to percussion-guided biopsy. (52) • *Today, it is deemed the method of choice.* (19, 25, 35, 54, 56, 72, 88, 115, 158, 169, 172, 174) (s. tab. 7.2)

Ultrasound-guided fine-needle biopsy was introduced by A. LUNDQUIST in 1971. It is deemed to be a low-risk method for the sampling of cytological material and is almost indispensable for differential diagnosis between benign and malignant foci. (10) Its sensitivity is 60–80% and its specificity higher than 90%. This form of biopsy can also be applied in the treatment of abscesses. The use of cutting biopsy needles (involving greater risks) even makes it possible to sample liver tissue for histological assessment. There are many reports on the biopsy technique as well as on the results and complications involved. (9, 17, 28, 36, 39, 61, 74, 145, 166, 257) Up to now, reports have been received on 10 fatal cases subsequent to fine-needle puncture of abdominal organs – six of them as a result of liver biopsy. • Spreading of tumour cells via the bloodstream or lymphatic system can be more or less ignored. The genesis of vaccination metastases and spreading of tumour cells or infectious material into the biopsy canal is considered rare. • Even if the commonly used fine needle with a cutting surface of 22 G only has a diameter of 0.7 mm (cf. Menghini needle with 17 G and Jamshidi needle with 15 G), the possibility of afterbleeding, though seldom, must still be considered. (58; quot. 166) • The evaluation of 11,700 abdominal fine-needle biopsies by T. LIVRAGHI et al. (1983) yielded a complication rate of 0.55%; serious complications occurred in 0.05% of patients. The frequency of pronounced bleeding given by M. GEBEL et al. (1986) was 1.5–2.5%, depending on the tumour type. (quot. in 166) (s. p. 133)

CT-guided liver biopsy was reported for the first time by J.R. HAAGA et al. in 1976. Biopsy of *focal lesions of the liver* may also be carried out with the help of CT guidance. (19, 55, 74, 159, 167)

2 Laparoscopy

2.1 Historical development

► The first laparoscopy following a pneumoperitoneum was reported by the surgeon GEORG KELLING from Dresden at a lecture given in Hamburg on 23.9.1901. He presented this method of examination, using the term **coelioscopy**. (quot. 235) In the same year (1901), DIMITRI EDLER VON OTT also described this technique in St. Petersburg, calling it **ventroscopy**. (269) • The name **laparoscopy** originates from HANS CHRISTIAN JACOBÆUS, who in 1910 reported on the examination of the abdominal cavity using Nitze’s cystoscope following pneumoperitoneum placement. (226) In the USA, this method was termed **organoscopy** (B.M. BERNHEIM, 1991) (182), **peritoneoscopy** (B.H. ORNDOFF, 1920) (268), and **abdominoscopy** (O. STEINER, 1924) (292). The first atlas of laparoscopy was published by R. KORBSCH in 1927, based on his own experience since 1921. (238) Following these publications, laparoscopy was adopted in numerous countries as a new method of examination. (s. tab. 7.10)

► The 3rd developmental stage of laparoscopy is linked to the name of H. KALK, who (commencing in 1923/1924) systematically revised the technique of laparoscopy in Frankfurt and brought out the first publication on the subject in 1929. (229) His experience has been documented in papers dating back to the years 1935 (Indications and dangers) (230), 1942 (Introduction to photolaparoscopy), 1943 (Directed liver biopsy under laparoscopic vision) as well as 1948, 1953 and 1955. • The clinicians N. HENNING (Leipzig), C. FERVERS (Solingen) who became the first to carry out adhesiolysis (1933), J.C. RUDDOCK (Los Angeles) and E. B. BENEDICT (Boston) were also involved in this development phase. (s. tab. 7.10)

► It was only the consistent work of H. KALK which gave laparoscopy its worldwide high status. (252) • Further perfecting of laparoscopy, attributable to K. BECK, W. BRÜHL, J. EISENBURG, H. HENNING, H. LENT, H. LINDNER, W. SIEDE, L. WANNAGAT and E. WILDHIRT – to name but a few of the German schools of thought – resulted in laparoscopy becoming an integral part of clinical diagnostics. With continual further development of medical technology, important additional techniques have been rendered possible.

First performance of laparoscopy		
1901	G. KELLING (<i>coelioscopy</i>)	Dresden ¹⁾
1901	D. EDLER VON OTT (<i>ventroscopy</i>)	St. Petersburg ²⁾
New description of laparoscopy		
1910	H. CH. JACOBÆUS (<i>laparoscopy</i>)	Stockholm ³⁾
1911	B.M. BERNHEIM (<i>organoscopy</i>)	Baltimore ⁴⁾
1920	B.H. ORNDOFF (<i>peritoneoscopy</i>)	Chicago ⁴⁾
1921	R. KORBSCH (1927: 1 st atlas of laparoscopy)	Oberhausen ¹⁾
1924	O. STEINER (<i>abdominoscopy</i>)	Atlanta ⁴⁾
Third phase of “laparoscopic discovery”		
1923/24	H. KALK	Frankfurt ¹⁾
1928	N. HENNING	Leipzig ¹⁾
1934	J.C. RUDDOCK	Los Angeles ⁴⁾
1939	E. B. BENEDICT	Boston ⁴⁾
Fourth laparoscopic development phase		
since 1980	laparoscopic surgical procedures	
since 1980	laparoscopic sonography	
since 1995	exploratory mini-laparoscopy	

Tab. 7.10: Historical development of laparoscopy (a selection of important steps) (1 = Germany; 2 = Russia; 3 = Sweden; 4 = USA)

After 1950 there was an enormous worldwide increase in the number of laparoscopic examinations. Statistics from H. LINDNER et al. (1976) reflect this with 141,981 laparoscopies in European countries. (249) The highest level of laparoscopic examinations (between 1970 and 1980) was estimated as being in excess of one million!

The introduction of new methods into hepatological diagnostics (virus serology, sonography, CT, MRT, to name just a few) has led to a reduction in the frequency of laparoscopic examinations since 1975. Even in hospitals with very high laparoscopy figures, frequency has been reduced to about 10%. (219) This “*laparoscopic slump*” is also obvious in our own statistics. (243)

2.2 Definition of laparoscopy

Laparoscopy is a low-risk instrumental examination technique for the abdominal cavity with a high degree of diagnostic relevance and low personnel input.

Laparoscopy, like the terms **coelioscopy**, **ventroscopy**, **organo-scopy**, **peritoneoscopy** and **abdominoscopy** (s. tab. 7.10), actually means an “endoscopy of the abdomen” and not only of the “liver” – unfortunately, such a “hepatoscopy” was all too often performed on its own. (see page 2 for further details on the term “hepatoscopy”)

2.3 Indications

Morphological findings are deemed to be an essential part of detailed diagnosis in liver diseases. Yet the results of percutaneous liver biopsy lead all too easily (e.g. with focal findings) and to a somewhat high percentage (e.g. with liver cirrhosis, chronic virus hepatitis C) to misinterpretations. *Non-directed liver biopsy does not always make it possible to detect changes which are representative of the entire liver.* Additionally, in 1–2% of cases, the material yield does not necessarily suffice for histological assessment. (s. p. 168)

Assessment of the liver surface can often be the decisive starting point for diagnosis and histological interpretation. Furthermore, laparoscopy makes it possible to inspect the entire abdominal cavity. As a result, indications for exploratory laparoscopy are significantly extended. Yet modern imaging procedures can quite often produce false-negative results as well. In individual cases, laparoscopy (possibly with directed biopsy) can be taken as a method of reference. This is also true for other specific issues, such as **congenital anomalies**. (285)

• With the introduction of imaging procedures and their perfected methods, the indication list with regard to laparoscopy has changed. Based on the information found in the literature as well as on **our own experience with 6,000 laparoscopies (1955–1987)** (243), indications for exploratory laparoscopy are given for many hepatobiliary diseases. (185, 188, 189, 194, 196, 199, 204, 206, 219, 234, 243–245, 247, 249, 250, 254, 263, 264, 272, 281, 289, 293, 298, 303, 310) (s. tab. 7.11)

2.4 Exploratory laparoscopy

The arguments put forward by G. KELLING (1923) apply just as much today as they did in the past – exploratory laparoscopy of the abdominal cavity is one of the most important aims of laparoscopy. (235) (s. tab. 7.12)

• In working towards a diagnosis, it is a fundamental principle that exploratory laparoscopy should be given priority over exploratory laparotomy. (189, 196, 204, 209, 234, 243, 244, 280, 281, 299)

1. Chronic hepatitis (227, 243, 273, 301)
 - for differential diagnosis
 - for morphological differentiation
2. Unclarified hepatomegaly and/or increasing liver consistency
3. Unclarified splenomegaly (243)
4. Unclarified rise in liver enzymes
5. Unclarified occupation of abdominal space
6. Unclarified gall bladder findings (236, 243)
7. Unclarified abdominal symptoms (240, 282)
 - adhesions (178, 223, 243)
 - suspected tuberculous peritonitis (184, 222)
 - suspected carcinomatous peritonitis (191, 243)
 - appendicitis (187, 296, 308)
8. Suspected liver cirrhosis (192, 220, 261, 266, 276)
 - differential diagnosis (212, 243)
 - assessment of further complications (232, 294)
 - demarcation of a scarred liver (243, 294)
9. Suspected focal liver lesions (190, 243, 246)
 - adenoma, echinococcosis, haemangioma (243), focal nodular hyperplasia (195, 225, 243), tuberculosis (243), sarcoidosis (243), Hodgkin's disease (243, 283, 312), liver abscess (221), etc.
10. Suspected malignant tumours
 - primary liver cell carcinoma (214, 231, 251)
 - malignancy in haemochromatosis
 - gall-bladder carcinoma (200, 241)
 - liver metastases (186, 191)
 - abdominal metastatic spread (243)
11. Suspected parasitic disease
12. Fever of unknown aetiology (218, 239, 289)
13. Ascites of unknown aetiology (198, 277)
14. Cholestasis of unknown aetiology (267, 286)
15. Clarification of systemic diseases
16. Tumour staging: “pre-look” prior to surgery, “second look” after carcinoma surgery
17. Assessment of indication for transplantation
18. Suspected lack of one liver lobe (243)
19. Emergency laparoscopy (177, 256)
 - in postbiptic bleeding
 - in postbiptic biliary leakage
 - following blunt abdominal trauma
20. Vascular processes
 - peliosis hepatis (225, 290)
 - Budd-Chiari syndrome (183)
 - Osler disease (291)

Tab. 7.11: Indications for (exploratory) laparoscopy – where it is not possible to guarantee a definitive diagnosis by means of other procedures. • *The diagnostic significance of an indication is individual and different in each case and can be categorized in steps ranging from “of little significance” through to “very important” or “absolutely necessary”*

In calling for **quality assurance** in diagnostics, it is not possible to do without the relevant accuracy and significance of laparoscopy. For this reason, the indications outlined have to be reviewed in each individual case. They can either be viewed more stringently or interpreted more widely; their diagnostic significance may be greater or less, depending on the respective case. (s. tab. 7.11)

Laparoscopy is always indicated if an abdominal clinical picture has not been clarified or a hepatobiliary disease could not be defined by non-invasive or minimally invasive procedures (such as sonography, CT, ERC, scintigraphy, MRI). (234, 243, 281) (s. tab. 7.12)

Main targets of laparoscopy

Assessment of:

1. liver and gall bladder
2. spleen
3. peritoneum, omentum, ligaments, free diaphragmatic areas

Secondary targets of laparoscopy

Assessment of:

1. free stomach wall areas, intestine, appendix
2. female minor pelvis in a head-down position (uterus, ovaries, tubes)
3. hernial orifices

To a limited extent

- pancreas
- kidneys

Tab. 7.12: Organ-related examination targets (main and secondary) in exploratory laparoscopy

► With considerably less inconvenience to the patient, exploratory laparoscopy offers a better view of the minor pelvis through to the subphrenic space than can be provided by exploratory laparotomy with the limitations imposed by incision. Adhesions can also be viewed better with the help of laparoscopy as compared to laparotomy.

► Time and personnel involved as well as the costs of nursing are all far lower with exploratory laparoscopy than with laparotomy. In the vast majority of cases, exploratory laparoscopy renders exploratory laparotomy superfluous. Above all, this is true for the detection of nonoperable carcinomas.

► When examining women, every laparoscopy should include an inspection of the minor pelvis in the head-down position.

► Each abnormal or pathological finding is to be recorded by photographic documentation. A surgeon or gynaecologist should be consulted in assessing specific findings relating to his field.

► With selected patients, *outpatient laparoscopy* has proved to be a safe and cost-saving (approx. 30% less

expensive) method with follow-up monitoring of three to four hours under hospital conditions. (297)

Mortality risk is given as being about 0.1% (–0.2%) for exploratory laparoscopy, whereas exploratory laparotomy has a lethality rate of about 2.5% – i.e. roughly 20 times higher! In advanced carcinomas, the lethality rate is as high as 50% for exploratory laparotomy versus 7.4% for laparoscopy.

The strategy generally applied in a diagnostic clarification in the case of suspected “**liver tumour**” is outlined later in a **flow algorithm**. (s. p. 204) (s. fig. 9.4)

2.5 Contraindications

Attention must be paid to clotting disorders, cardiac and coronary insufficiency, severe cardiac arrhythmia, serious hypertension, respiratory insufficiency and purulent peritonitis as possible contraindications. The same is true of Bekhterev’s disease and cerebral insufficiency (depending on the respective severity). Despite a wide range of indications, the list of contraindications (except hepatogenic clotting disorders) only covers severe extrahepatic diseases. In these cases, it is the treatment of the condition which is of paramount importance and not the diagnostic clarification of abdominal or hepatobiliary diseases. (217, 233, 244, 255, 262) (s. tab. 7.13)

Relative contraindications: Given the technical experience of the physician and the implementation of adjuvant measures, certain contraindications can be categorized as relative, and accordingly overcome; in such cases, however, a greater risk is to be expected. • *Pronounced adhesions, extreme adiposity and severe meteorism are reasons for greater restraint and due caution.* (s. tab. 7.13)

Absolute contraindications

1. Clotting disorders
2. Cardiac and coronary insufficiency, arrhythmia
3. Severe hypertension
4. Respiratory insufficiency
5. Bacterial peritonitis
6. Large hiatus hernia

Relative contraindications

7. Bekhterev’s disease
8. Cerebral insufficiency
9. Pronounced adiposity
10. Severe meteorism
11. Massive adhesions

Tab. 7.13: Absolute and relative contraindications for laparoscopy

Adhesions are not deemed to be general contraindications, yet in some cases they do involve considerable technical difficulties and a higher risk of complications

Chapter 7

– e.g. as a result of the perforation of adherent bowel loops or of the stomach. (178, 228, 274) This was also shown by three of our own cases with a bland course of disease. (243) Another factor to be feared is the puncturing of vessels in the area of the adhesions, particularly in the presence of portal hypertension with “spontaneous Talma” effect. (s. p. 163) (s. figs. 7.5; 14.11). We observed this event in 4 cases, all of which could be well managed. (243) “*Extensive adhesions will always be the worst enemy of laparoscopy*” (H. KALK, 1929). (229) • With suspected postoperative adhesions, above all in the laparoscopic working area, we have occasionally carried out a lateral X-ray examination after placement of the pneumoperitoneum. The relevance of such an examination should, however, not be overestimated. (s. fig. 7.1) This “*diagnostic method using X-ray with a gas-filled abdominal cavity*” was described for the first time by O. GOETZE in 1918. • Nevertheless, it must be clearly emphasized that abdominal adhesions are also present in a considerable percentage of patients who have not undergone surgery in the abdominal cavity. These **spontaneous adhesions** can be found in all areas of the abdomen (14.6% of cases) and are due to trauma, intestinal inflammations, pancreatitis or cholecystitis. (306) • Photographic documentation is an absolute necessity in the case of adhesions! • Frequently, symptoms related to adhesions in themselves constitute an *indication for laparoscopy*. In the course of establishing a differential diagnosis for unclarified abdominal discomfort (nausea, vomiting, etc.), it may be necessary, after ruling out all other possibilities, to consider a painful adhesion-related “**serosa syndrome**”. (243, 244) By means of an exploratory probe, the pain characteristics familiar to the patient can indeed often be triggered and then localized in the area where the adhesions exist. (s. figs. 7.2, 7.3) • In the case of **adhesiolysis** (C. FEVERS, 1933), free adhesive bridges can be severed by thermocautery, and occasionally relief from pain is achieved. • Sail-like adhesions can be carefully “fenestrated” by thermocautery in order to advance the laparoscope into areas which have hitherto been out of sight. In retrospective evaluation, we applied *thermocautery* in 120 cases (243): 87 times to fenestrate and improve visibility and 33 times as adhesiolysis for therapeutic reasons in cases of previously indeterminate abdominal pain. Almost all of these 33 patients had been through extensive diagnostic procedures, often over a number of years, with multiple courses of therapy. *One of these patients with pericholecystic adhesions (an example of which is shown in figure 7.3) had been unsuccessfully treated for almost three years (even psychotherapeutically), but after adhesiolysis, she was ultimately freed from her discomfort.*

► In cases of unclarified abdominal pain – after all other diagnostic steps have failed – exploratory laparoscopy should constitute the next step *before* commencing psychotherapy!

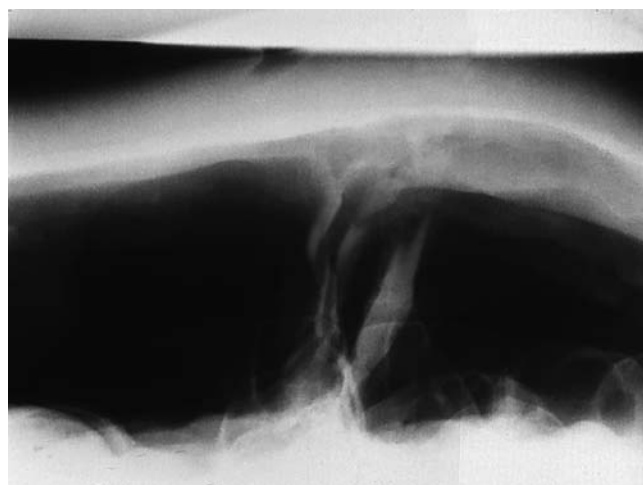


Fig. 7.1: Pneumoperitoneum with pronounced cord-like or sail-like adhesions in the abdominal cavity (X-ray from the side)

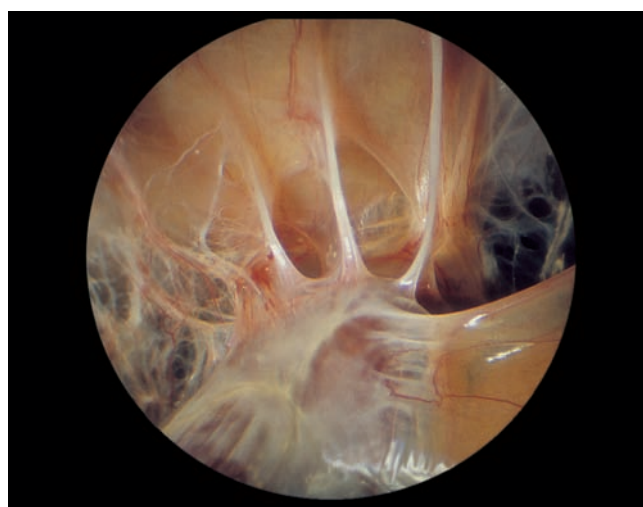


Fig. 7.2: Extensive postoperative adhesions and bridges

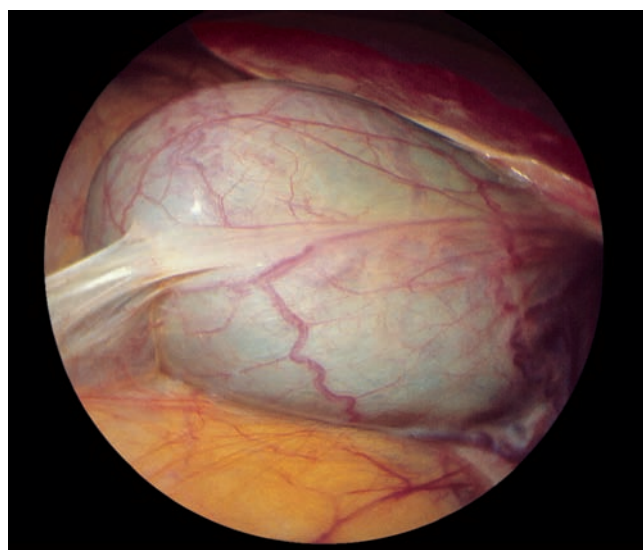


Fig. 7.3: Pericholecystic adhesions causing years of abdominal pain (“serosa syndrome”) – without previous operative intervention in the abdominal cavity

Adiposity is undoubtedly a laparoscopic problem. The abdominal walls can be enormously rich in fat, and the fatty mass is often deposited in the abdominal omentum. Sometimes excessively long instruments are required (such as anaesthesia needles, Veres needle). In two of our own cases, we were only able to carry out the examination under tremendous difficulty because the trocar was too short. The highest reported weight of a patient undergoing laparoscopy is 160 kg. (217)

Hernias likewise do not constitute a general contraindication. (217) In numerous cases, we have observed no complications. (243) • Large hiatus hernias are, however, an accepted contraindication.

Advanced age is not in itself a contraindication. The patients were above 80 years in 0.3–0.7% of cases. In our group of patients (243), 11 men and 8 women (0.32%) were older than 80, of whom 5 (0.08%) were aged between 85 and 90 years. There were no complications. Nevertheless, in cases of advanced age, indications should be viewed critically.

Children can undergo laparoscopy without particular difficulty. (207, 310) The youngest child was an infant aged 14 days (H. SELMAIR et al., 1973). We ourselves experienced no problems in examining 9 children aged between 5 and 14 years. (243) Laparoscopy is performed under general anaesthesia. With older children (as in our own cases), neuroleptic analgesia or an individual sedation is sufficient. Hepatosplenomegaly, jaundice, metabolic diseases, tumours, chronic hepatitis and portal hypertension are some of the indications.

2.6 Laparoscopic technique

Once the indications have been drawn up and critically considered, and possible contraindications weighed up, the *briefing of the patient* follows (on the day prior to laparoscopy) and the *patient's written consent* is obtained. All further measures are then taken. (s. tab. 7.14)

Sterility and asepsis are imperative for all instruments used and for the places where they are deposited (e.g. instrument trolley). We also recommend the use of sterile drapes as well as sterile surgical gowns (caps and masks are not required) after having disinfected the patient's abdomen. Once the photographic documentation has been completed (using reflex camera, Polaroid, video, etc.), gloves and drapes should be changed. Even though experience has shown the risk of infection to be extremely low for the patient, and although the sterility and asepsis aimed at are not guaranteed in certain working sequences, we still advocate, as a matter of principle, that *laparoscopy should be carried out under conditions that are largely sterile*.

Premedication

It is advisable to prepare anxious patients with sedation (e.g. doxepin 10 mg) on the evening prior to laparoscopy. For premedication

1. *Sonography*
2. *Blood coagulation tests*
 - *Quick's value, thrombocyte count, bleeding time*
3. *Possibly ECG, pulmonary function*
4. **Preparation for laparoscopy**
 - patient under fasting conditions (ca. 12 hours, avoiding gas-forming vegetables)
 - voiding of the bladder
 - stabilizing and protecting a possible hernia with an external adhesive bandage
 - with men, shaving of the abdominal area
 - premedication
 - promethazine (50 mg) + pethidine (50 mg) i. m.
 - or:
 - promethazine (50 mg) + doxepin (25 mg)
 - or:
 - midazolam (0.05–0.1 mg/kg BW)
 - (i. m., some 20–30 minutes prior to laparoscopy)
 - or:
 - midazolam (initially 1.0–2.5 mg) slowly i. v., up to 5 mg total dose
 - atropine (0.5 mg) s. c. about 15 minutes earlier
 - (After administration of triflupromazine, we occasionally observed extrapyramidal side-effects; for this reason we ceased using this substance.)
 - positioning of the patient: precisely, comfortably, with wrists and knees fixed loosely to an operating table which can be tilted on all sides
 - padded support of the ulnar nerve
 - support of the greater trochanter from the side
 - positioning of neutral electrode for coagulation, generally on the right thigh
 - sterile draping of the patient
 - disinfecting the abdomen

Tab. 7.14: Preparation for laparoscopy

purposes, the following drugs have proved to be suitable (s. tab. 7.14): pethidine (50 mg) + atropine (0.5 mg), or hydromorphone (2 mg) + atropine (0.5 mg), or midazolam (individual dosage upwards of 1 mg) + atropine (0.5 mg). • *We would recommend the administration of atropine in principle and not only if vagovasal reactions occur.* (s. pp 152, 153)

Local anaesthesia

Local anaesthesia is effected as intracutaneous skin wheal using a thin needle, whereas for bathyanaesthesia a long injection needle has to be applied. Lidocaine is recommended as an anaesthetic (0.5 or 1.0%). With the continuous injection of anaesthetic, a sharp pain is reached in the peritoneum, where a preperitoneal depot is then placed.

Veres cannula

► A description of the **Veres needle** was published by J. VERES in 1938. (300) *His name was, however, wrongly printed as Veress in this publication – the correct spelling of his name is "Veres" and the correct pronunciation is "veresch".* • After a stab incision with the tip of the scalpel (i.e. lancet), the needle is inserted against abdominal muscular pressure on the part of the patient. The resistance of both fascia and peritoneum can be felt clearly. A hollow internal cannula with a rounded end stays retracted within the Veres needle during penetration. As soon as the peritoneum has been penetrated, the blunt stylet springs out of the sharp cannula in the peritoneal cavity, and a double clicking sound of the Veres needle is audible. The free position of the needle is checked by the rapid injection of 10–20ml physiological NaCl solution. (s. fig. 7.18)

Chapter 7

Pneumoperitoneum

The point of placement used for the pneumoperitoneum is the so-called **Kalk's point** (this is the later site of insertion for the laparoscope) or the **Monro-Richter line** in the left lower abdominal region (this is the connecting line between the umbilicus and the left anterior superior iliac spine). In the third outer quarter of the line (or at the lateral tertiary point) is the "classical point" for abdominal puncture as well as for the pneumoperitoneum. • Even if a later, second anaesthesia is required for the laparoscopy, we consider it useful to maintain the functional capacity of the Veres cannula throughout the whole procedure *as a possible insufflation channel that can be used if required – without discomfort to the patient*. • As a variation on the above-mentioned points of insertion, sites can also be selected below and to the left of the umbilicus. • In 1918 O. GOETZE (Halle) introduced an **automatic needle** for producing the pneumoperitoneum. (s. fig. 7.1) (s. tab. 7.15)

Insufflation

Insufflation with nitrous oxide (N_2O , i.e. laughing gas) is now carried out by an **automatic-charting N_2O gas insufflator**. The free inflow of nitrous oxide is detectable by auscultation as an even, gentle noise above the Veres needle. After insufflation of the first 300 to 500 ml nitrous oxide, the liver dullness fades, and after a further 1 to 2 litres N_2O , a tympanic percussion sound is generally ascertained. (259, 288, 312) • From the beginning of the slow and evenly maintained process of insufflation, it is advisable to shake the vertically held Veres needle so as to remove any fragments of the omentum which may have been speared. At the same time, fragments which might be caught up between the needle and the stylet can be removed by retraction and forward thrusting of the blunt stylet. Under constant observation of the filling pressure (10 to 20 mm Hg), the required N_2O amount is introduced (3 to 5 litres, in certain cases even more) and the insufflator then switched over to automatic refill. Intraperitoneal pressure is now 10–12 mm Hg. The abdominal walls should be evenly raised. • *CO_2 is painful and therefore unsuitable for exploratory laparoscopy!*

1. Formation of emphysema

- skin emphysema
- preperitoneal emphysema
- omentum emphysema
- mediastinal emphysema
- scrotal emphysema

2. Injuries from insertion

- laceration of intestine
- laceration of blood vessels
- laceration of an ovarian cyst

3. Circulatory disorders

- collapse
- arrhythmia
- cardiac arrest

Tab. 7.15: Possible complications in producing the pneumoperitoneum or inserting a trocar

Insertion of the trocar

The site of insertion for the trocar is **Kalk's point**: 2–3 cm to the left of and above the umbilicus at the medial edge of the *rectus abdominis*. Further to the left, laterally, there is some danger due to the proximity of the superior epigastric artery, and further to the right, above the umbilicus, there is a certain risk of injuring the round ligament and the umbilical vein as well as the gall bladder. The right lower abdominal region in the area of *McBurney's point* is also to be avoided regarding the insertion of the trocar. • With ascites and adiposity, the navel moves caudad (with gynaeco-

logical cystoma, craniad), which must be considered when selecting the point of insertion. In hepatomegaly, splenomegaly and tumours, or with operation scars, the normal site of insertion should be varied accordingly. (s. tab. 7.15)

Local anaesthesia is effected in the same way (see above). After some gas has penetrated the syringe sheath, either spontaneously or after slight suction, the depth of the gas-dome and the free lateral mobility is checked with the anaesthesia needle. The **incision** is horizontal, 1.0–1.5 cm in length (subcutis and muscles must not be severed!). The **insertion of the trocar** (s. fig. 7.17) is carried out under abdominal muscular pressure on the part of the patient in the inspiration phase and by exerting considerable left-right rotating pressure. A finger of the guiding hand placed along the shaft of the trocar acts as an "**emergency brake**". After perforation of the peritoneum by the trocar (perceived by the sudden feeling of penetration into a free space and an audible outflow of gas from the tap), the trocar tip is withdrawn and the tap closed.

► *We most definitely prefer a trocar (11 mm Ø) with a conical, tapering tip (N. HENNING, 1950) as opposed to the three-edged tip.* (s. fig. 7.17) With the three-edge tipped trocar, we experienced pronounced venous bleeding of the abdominal wall, which, however, could be overcome conservatively.

The sterile **side-view laparoscope**, which has been slightly warmed, is then introduced under direct vision. (s. fig. 7.17) Subsequently, the insufflation tube is removed from the Veres cannula and fitted to the trocar. It has proved beneficial to leave the closed Veres needle (ready for use) in its position throughout the procedure of laparoscopy.

Staff requirements

Apart from the endoscopist (with intensive-care experience), a further physician should attend the laparoscopy (if possible). Two nurses trained in intensive care are required to assist. This staff constellation has proved optimal. (243)

Monitoring by apparatus

The patient is monitored by means of blood pressure measurement, ECG, and pulse oximeter. A trolley with emergency equipment must always be at hand in the endoscopy room. Further, the possibility of electrocoagulation should be given in case there is delayed bleeding. • Consideration must be given to a number of **dangers** which can be involved in producing the pneumoperitoneum or inserting a trocar. (176, 181, 197, 208, 244) (s. tab. 7.15)

2.7 Course of examination

Initial inspection focuses on the position of the Veres needle and, if necessary, an adjustment is made. • To ensure correct examination, an established **inspection schedule** has proved useful. When such a schedule is applied as a matter of routine, important findings or additional information will not be overlooked. • With *extreme changes in position*, vertigo, nausea, respiratory distress and a tendency to collapse may be observed, but these symptoms rapidly ease off once the body position has been normalized. • Altogether, the examination procedure entails four different positions. In this way, optimal results can be obtained.

Position 1	All-round view of the entire abdominal cavity in a supine position (= peritoneum, omentum, bowel loops, adhesions).
Position 2	Inspection of the right upper abdomen with the upper body raised in left rotation (= right lobe of liver, gall bladder, round ligament, falciform ligament, duodenum).
Position 3	Inspection of the left upper abdominal region with the upper body raised in right rotation (= left lobe of liver, spleen, round ligament, falciform ligament, phrenicocolic ligament, stomach, diaphragm with oesophageal foramen, pancreas).
Position 4	Inspection of the minor pelvis in a head-down position and in right and left rotation (= coecum, appendix, uterus, Fallopian tubes, ovaries, hernial orifices).

2.7.1 Assessment of the portal vessels

The development of *portal hypertension* is detectable at a very early stage by the dilatation of small venous vessels in the greater omentum, at the serosa of the stomach, at the parietal peritoneum and, in particular, at the round ligament and falciform ligament. A further increase in portal hypertension produces tortuosity of the dilated fine calibre veins. • *Collateral circulatory pathways* ultimately develop, mostly noticeable at the phrenicocolic ligament, round ligament and falciform ligament with a progredient recanalization of the umbilical vein (s. figs. 6.10; 14.12; 35.14) and paraumbilical veins (= *Cruveilhier-von Baumgarten syndrome*) (s. fig. 7.4) as well as in an area with adhesions ("*spontaneous Talma*" effect). (s. pp 160, 264) (s. figs. 7.5; 14.11)

2.7.2 Assessment of the spleen

Each laparoscopy should aim at a visual assessment of the spleen in terms of (1.) *size*, (2.) *colour*, (3.) *shape*, and (4.) identifiable *spleen diseases*. Special mention has to be made of capsular fibrosis, hyalinosis ("sugar-coated spleen"), tumours (e. g. Hodgkin's disease, retothelial sarcoma), tuberculosis, splenic cysts, splenic infarction (s. fig. 35.10) and splenic haematoma. Given appropriate positioning, the spleen is visible in 80% of cases. In the event of myeloproliferative diseases, a biopsy of the spleen (e. g. by means of the Menghini technique) may possibly provide a definitive diagnosis. (s. pp 145, 261) (s. figs. 11.1; 14.7) (see chapter 11)

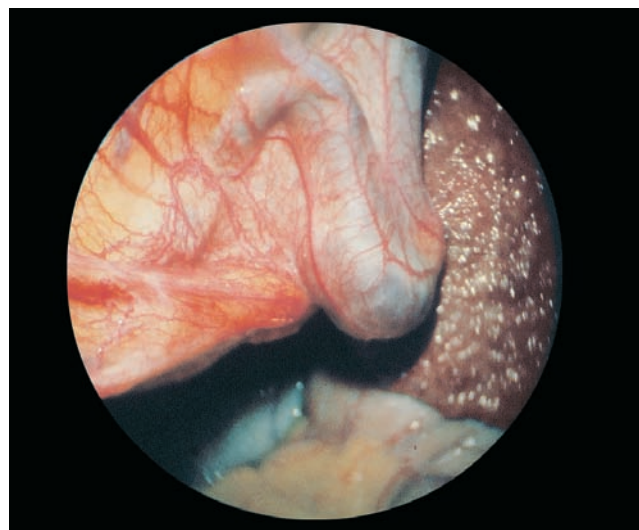


Fig. 7.4: Cruveilhier-von Baumgarten syndrome in alcohol-induced cirrhosis

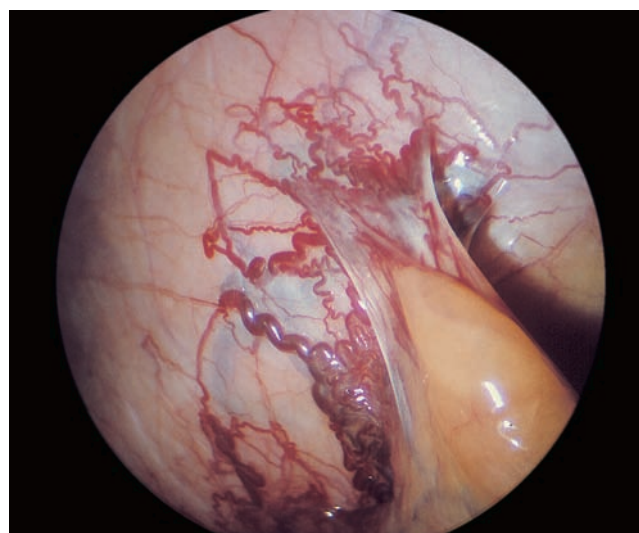


Fig. 7.5: Portal hypertension with pronounced collateral circulation in an area with adhesions ("*spontaneous Talma*" effect)

2.7.3 Tumour staging

In 1979 T. HALD et al. reported on the importance of laparoscopy in the staging of tumours of the efferent urinary tract. In 30–60% of cases, imaging procedures do not allow the inoperability of liver tumours to be recognized. Preoperative staging by means of laparoscopy showed a sensitivity of 78% and a specificity of 100%. Some 70% of the liver surface can be assessed (as can parts of the underside of the liver when the lobes are lifted). After the noninvasive staging procedure (= recording of TNM classification and other prognostic factors) has been performed, laparoscopy should be used to evaluate operability. (244) • It is also possible for metastases to develop in liver cirrhosis; this was confirmed in 11.4% of cases. (315) • Despite careful preliminary examinations, it was only laparoscopic staging which rendered the detection of peritoneal metastases

possible in 9.1% (202), 35% (305) and 40% (242) of cases, whereupon inoperability was established. • After surgery on ovarian cancer, peritoneal metastases can be expected frequently due to lymphogenic factors – in 22% of cases, this could only be detected by means of laparoscopy. (202) • In tumour staging after application of the available imaging methods in patients with oesophagus and/or gastric cardia cancer, metastases could actually be detected by means of laparoscopy in 24% (201) to 76% (307) of cases. (210, 242, 260, 265, 278) • In patients with pancreatic carcinoma, the laparoscopic detection rate for abdominal metastases varied from 24% to 42%. (179, 279, 304, 305) • In 23–38% of cases, an unnecessary laparotomy could be avoided. (179, 265, 278, 305) Laparoscopy is the best method for the detection of metastases of the omentum and/or peritoneum. (180, 191, 209, 213, 228, 243, 248, 312) (s. figs. 7.6; 37.33–37.35)

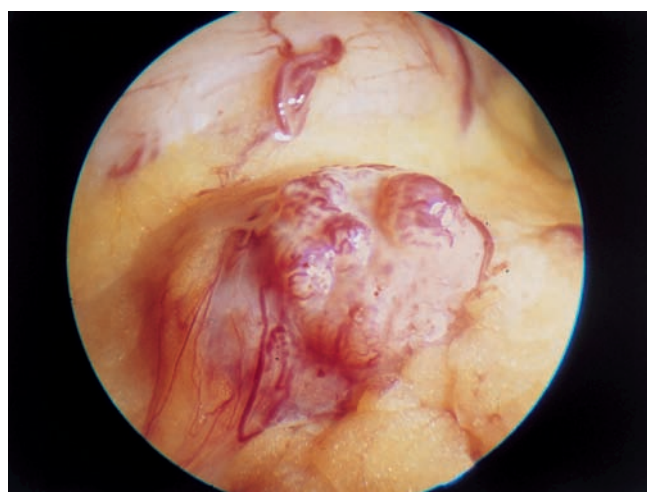


Fig. 7.6: Metastasis of a malignant melanoma in the area of the greater omentum (it is as a rule not detectable with US or CT) (s. figs. 37.35, 37.36)

2.7.4 Fever of unknown aetiology

It is not always possible to link the symptom of “fever” to a specific disease. In such cases, laparoscopy provides valuable diagnostic aid in differentiating the respective changes of the liver in order to detect rare and otherwise unidentifiable diseases. (218, 239, 289) • This was impressively demonstrated by *one of our own cases of small nodular liver tuberculosis detected by laparoscopic (and histological) diagnostics, which had been preceded by sojourns at two hospitals and unsuccessful implementation of all diagnostic possibilities.* (244) (s. figs. 24.2, 24.5) (s. p. 761!) In view of the “uncertainty” inherent in unexplained febrile conditions with liver enzyme activity, we consider percutaneous liver biopsy to be too dangerous and too unreliable in its outcome. Using laparoscopy, it was possible to explain the cause of fever (after ineffective application of every other examination method) in 37% (with the involvement of the abdominal organs in up to 94%) (218) and in 66% of cases. (289)

2.7.5 Assessment of the lymphatic vessels

The transparent-white lymphatic vessels, which normally are not (or hardly) identifiable, allow the lymph to flow to the falciform ligament in a deltoid manner. Visible lymphatic vessels are in general deemed to be congested and hence are indirectly suggestive of liver disease. Congested lymphatic vessels appear as blue-grey/silver-grey pathways, often displaying fine fibrotic intorsusceptions. In cases of jaundice, the lymphatic vessels take on a distinct yellowish/brownish colour. With pronounced dilation, segmentation of the walls is evident. (s. figs. 7.7; 16.4)

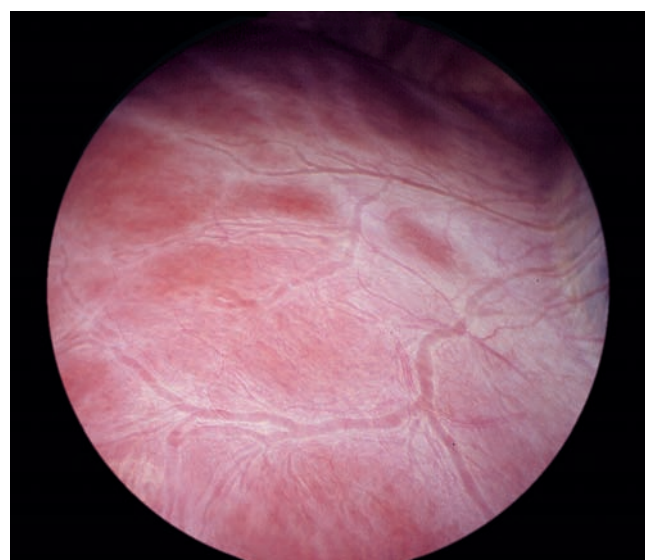


Fig. 7.7: Congested lymphatic vessels in the area of the medial part of the right lobe of liver (insertion of the left falciform ligament can be clearly identified) with partial vessel wall segmentation. Here in chronic toxic hepatitis

2.7.6 Ascites of unknown aetiology

According to our knowledge, the explanation of the aetiology of ascites goes back to O.E. NADEAU et al. (1925) and S.M. FIERST et al. (1975). After the unsuccessful application of all diagnostic procedures available today, laparoscopy ascertained the cause of ascites in 86% of cases. (198, 277) (s. figs. 16.9; 37.25)

2.8 Photographic documentation

Each pathological or interesting finding should be documented by colour photography. Laparoscopy without photographic documentation would be rather like *an X-ray examination without the X-ray picture*. However precisely a particular finding might be described, it never convinces in the same manner as a coloured photo can. Written findings and colour photography must complement one another (cf. physician's obligation to keep records!).

► It would be of great benefit to the **pathologist** if a colour Polaroid shot was enclosed with each sample of laparoscopic material obtained by liver biopsy – in addition to laboratory values, diagnostic issue in question and description of the liver surface. In evaluating the liver biopsy, the pathologist should be aware of the traditional dual assessment of an organ: *macroscopy* + *histology*.

Documentation of findings is facilitated by **reflex camera** and **Polaroid camera** for coloured photos. Various zoom ranges are used with extracorporeal flash. The film material should be highly sensitive and fine-grained. The photos should be sharply focused close-ups of the main subject. The middle ray of light should be directed vertically, and not tangentially. For photolaparoscopy, the sterile drape of the patient is covered with an extra sterile slit drape, so that the nonsterile photographic techniques can be carried out on top of it. Once the photos have been taken, the slit drape is removed and new sterile gloves are put on.

2.9 Directed biopsy

Providing there are no contraindications, each laparoscopy should incorporate a directed liver biopsy (H. KALK et al., 1943). This is mainly performed by making a *second incision* in the right upper abdominal region below the costal arch in the area of the right liver lobe, as a rule using a *Menghini needle*. (309)

(1.) In cases of **cirrhosis** and pronounced **fibrosis** or **scarred liver**, the danger of bleeding can be greater than the benefit of additional histological information. Moreover, use of the Menghini needle only produces crumbly liver fragments from the cirrhosis (rich in connective tissue), which are not reliable in their histological relevance (compare the fragments of fibrotic liver in chronic porphyria cutanea tarda as shown in figure 7.10!). Even without a biopsy of the cirrhosis, the requirement for objective documentation of all important findings is fully satisfied by coloured photographs. (s. figs. 7.15, 7.16)

(2.) Unclear structures can be punctured with a fine needle initially as an exploratory procedure (consistency? cyst? blood vessel?) before the Menghini needle is used. Reports have been written, for example, on the laparoscopic diagnosis of Budd-Chiari syndrome (183), liver abscesses (221), peliosis hepatis (225, 290), FNH (195, 225), Osler's disease (291), and unclarified cholestasis. (267, 286)

(3.) In all cases of doubt, or when findings of the right and left lobe of liver differ, both lobes should be biopsied (possibly at two different sites): the right lobe by using the customary second puncture, the left lobe by using a particularly long Menghini needle inserted through the operating laparoscope.

(4.) It should be noted that findings in the area of the right lobe of liver can usually be checked later by percu-

taneous biopsy – whereas this is not possible in the case of the left lobe.

(5.) With all difficult cases, there is a possibility of taking a second or third biopsy punch to produce a greater histological yield (e.g. in cases of granulomatous changes, haemochromatosis).

(6.) The *site of puncture* must be easy to observe. The *direction of the puncture* should be as diagonal as possible to the liver surface, mainly in the lateral (or medial cranial) part of the right lobe of liver. (s. fig. 7.8) When puncturing the left lobe, thought must be given to its significantly smaller diameter (and the danger of “piercing through”).

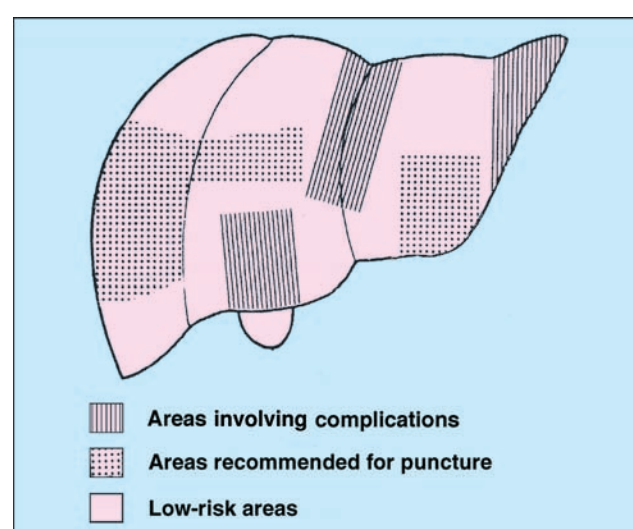


Fig. 7.8: Recommended, low-risk and contraindicated areas of puncture for liver biopsy

In cirrhosis and fibrosis, the biopsy needle used will either be the **Vim-Silverman** needle or the **Trucut** needle. Adequate tissue can thereby be obtained for assessment. Because of the increased bleeding tendency connected with these needle types, the diameter should not exceed 1.6 mm (which is generally not required anyway). The liver is punctured tangentially, mainly in the lateral area of the right lobe. Subsequent to the puncture, the stylet is removed, the outer cannula advanced, the inner needle sheath pushed forwards in a rotating movement out of the outer cannula before both are finally withdrawn together.

With circumscribed liver findings, the liver biopsy can mostly be carried out using **Robbers' forceps** (H. ROBBERS et al., 1951) (= double-spoon forceps with both lancet jaws opening). By reason of the very shallow and diagonal setting of the biopsy, there is less danger of bleeding and biliary leakage. • Occasionally, certain findings call for **combined tissue biopsy** by means of needle biopsy and forceps biopsy of the liver and/or forceps biopsy in the area of the remaining abdominal cavity.

Aftercare for each point of puncture should be continued until the bleeding has definitively stopped and delayed biliary leakage can be ruled out. Upon termination of laparoscopy, the site of puncture and the abdominal cavity as well as the point of exit of the Veres cannula must be checked for signs of bleeding. The Veres cannula should be withdrawn under observation.

Bleeding after liver biopsy generally stops spontaneously and definitively. Compression of the low-angle puncture canal (20–30°) with a (bulbous) probe can help in this respect. Further methods of arresting the bleeding include local application of thrombin solution, electrocoagulation, Heather method, BICAP technique (s. p. 357), fibrin glue injection (295), positioning of a gelatine cylinder (211), argon-plasma coagulation, and arterial embolization. (83, 112)

Biliary leakage (s. fig. 7.9) can be managed canal with a palpation probe or drawing off the bile by suction. Electrocoagulation is also deemed reliable, as is the introduction of a drain through an appropriately placed trocar. It was also our own experience (243) that operative intervention was not necessary. (118)

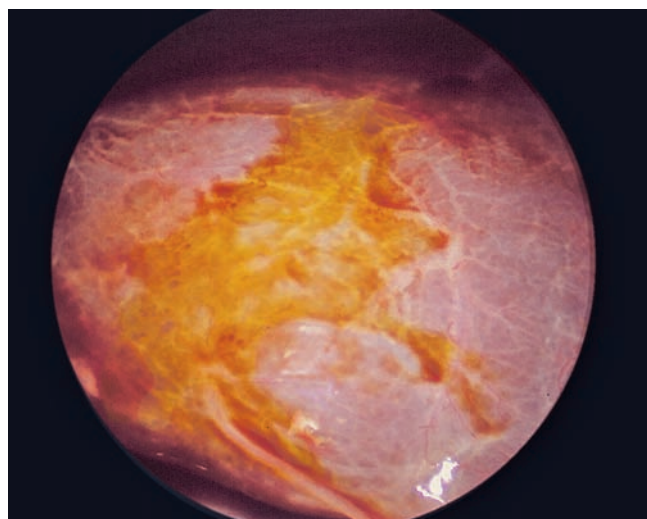


Fig. 7.9: Biliary leakage from biopsy canal after puncture

2.10 UV fluorescence

Porphyria cutanea tarda and chronic hepatic porphyria are characterized by porphyrin fluorescence in the liver cell. For every 1,000 biopsies, there are three to five red fluorescent liver specimens. Unfortunately, such UV examinations of the biopsy material are not carried out regularly. In an indeterminate diagnosis, red fluorescence can confirm chronic hepatic porphyria that has hitherto remained unidentified. (s. fig. 7.10)

After being extracted, each **biopsy specimen** should be examined in a dish with physiological NaCl solution under **UV light (366 nm)** for a period of some 15 minutes so as not to overlook the typical red fluorescence

of **chronic hepatic porphyria**: *types A and B* only show isolated red fluorescent spots in the liver sample, *type C* (as a clinically latent form) already displays a net-like red fluorescence and *type D* (as a manifest form) a homogeneous distribution of red fluorescence. (s. fig. 7.10) • The pathologist will notice the uncharacteristic liver changes, but is not able to attribute their genesis to porphyria. (15) For this reason, chronic liver disease sometimes remain unexplained and hence “cryptogenic”.

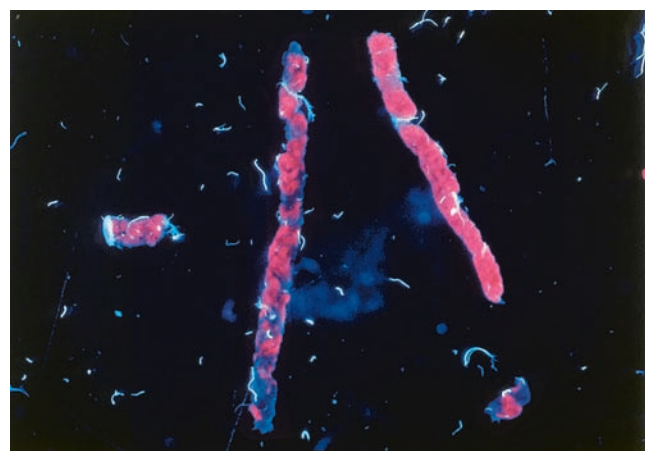


Fig. 7.10: Red fluorescent liver specimen in porphyria cutanea tarda (type D)

2.11 Extrahepatic findings

The diagnostic yield of unexpected, even surprising, extrahepatic findings is quite high at 5–10%. Among our 5,992 laparoscopies, we noted 452 such findings (= 7.5%): e.g. adhesions (s. figs. 7.1–7.3), peritoneal tuberculosis (184, 222) (s. fig. 7.11), and carcinosis (191) (s. figs. 7.6; 37.33–37.35), diverse malignomas (s. fig. 7.12), Fitz-Hugh-Curtis syndrome (s. fig. 24.2), endometriosis, myomas, ovarian cysts, Stein-Leventhal syndrome (s. fig. 7.13), Hodgkin's disease (s. fig. 38.8), chronic appendicitis, echinococcus, and so on. (243) • In cases of unexplained pain in the abdomen, laparoscopy is indicated as a last resort for clarification of the complaints. (244, 282) This is necessary above all in differential diagnosis between gynaecological disease and appendicitis. (187, 240, 308) In suspected appendicitis, appendectomy frequently proved to be the wrong decision: in 23% of cases involving young women, a gynaecological cause of complaint was found; however, in older patients (> 50 years), appendicitis was actually detected in 92–96% of cases. (187) • The clinical picture of an acute abdomen could be clarified in > 85% of cases by means of exploratory laparoscopy. (177, 256, 282) • *The opportunity of clarifying unexplained symptoms by exploratory laparoscopy should be made use of whenever possible.* At this early point, it is of no importance whether the ultimate explanation or definition of findings proves to be clinically relevant in the individual case, or is without significance. (219, 241)

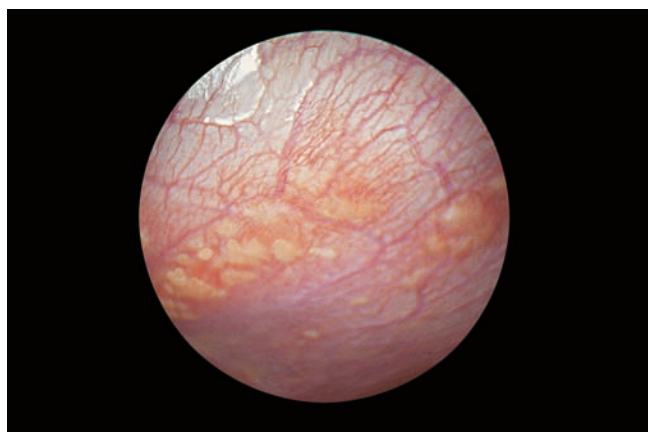


Fig. 7.11: Peritoneal tuberculosis: fever of unknown aetiology in a severe course of disease

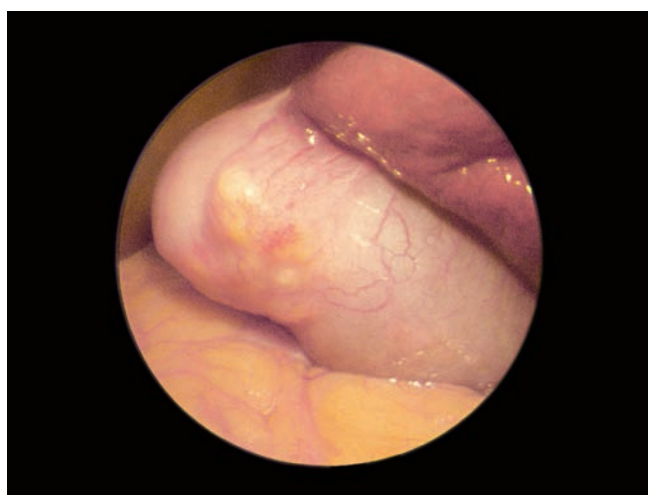


Fig. 7.12: Gall-bladder carcinoma: clinical and radiological suspicion of “cholecystopathy”

2.12 Complications

The type and frequency of complications involved in laparoscopy are determined by the same **influencing factors** as were outlined for the complication rate of percutaneous liver biopsy. (s. tab. 7.5) These factors should be considered critically and without bias.

The most frequent complication by far is **bleeding**. If this cannot be stopped conservatively, it may require surgery – or it can even prove lethal. Injuries may occur during the insertion of the *Veres cannula* and the *trocars* when vessels and varices in the abdominal wall and omentum as well as abdominal vessels have been pierced. Isolated cases of bleeding have been reported after injury to the spleen – which is perhaps understandable in splenomegaly, but nevertheless avoidable. *Liver puncture* (as well as *forceps biopsy* in the case of pathological abdominal findings) can be a further cause of bleeding, above all in cirrhosis or liver tumours.

Other *severe complications* worth mentioning include: perforation of hollow organs (gall bladder, colon, stomach,

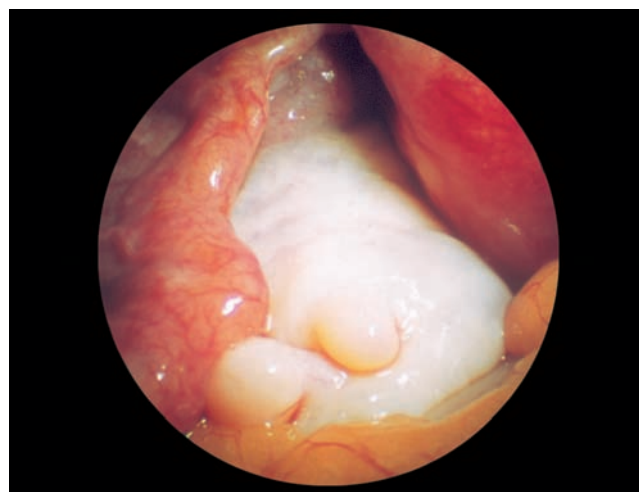


Fig. 7.13: Stein-Leventhal syndrome: white, thickened capsule of the right ovary. Clinical suspicion of pronounced liver damage due to hormone therapy

small intestine, ovarian cysts), emphysema formation due to gas insufflation, circulatory and cardiac arrhythmia, respiratory arrest, rupture of the spleen (203) and injury to the spleen (253), as well as the complications occasionally occurring with liver biopsy (haemobilia (275), haematoma, a. v. fistula (284), biliary leakage, sepsis (205), etc.). (176, 185, 206, 217, 233, 255, 262, 271) The (disturbing) occurrence of bradycardia is not usually evident when atropine is administered as routine premedication. (s. p. 161) • Among our own 5,992 laparoscopies, we recorded 58 complications (0.97%), yet no instance of death. In five cases of bleeding, operative treatment was required (0.08%). (243)

► During laparoscopy, we routinely maintain an intravenous *drip*. This has proved beneficial for additional sedation as well as in those cases where complications occur; it can therefore be recommended as a general principle.

2.13 Frequency of complications

Compiled statistics and publications involving a larger number of patients provide an overview of the frequency of complications and cases of death. (s. tab. 7.16) In 17 laparoscopy series covering 46,364 patients, a complication rate of 0.149% and a lethality of 0.054% were established. (262) • Occasionally, the complication rate was somewhat higher in centres with more frequent examinations: it is indeed possible that the greater the experience on the part of the physician, the more likely it is that risks are taken in evaluating contraindications. • *With a decrease in the number of laparoscopies performed, however, it must be expected that laparoscopic experience will also decline, so that the incidence of complications will (unfortunately) rise – a fact which might be blamed all too easily on laparoscopy itself. Neither of these extreme situation-related developments can be ac-*

Author	Total number	Complications		Cases of death	
		n	%	n	%
Brühl, W. (1966)*	63,845	1,595	2.49	19	0.029
Look, D. (1975)*	21,387	336	1.57	3	0.014
Paolaggi, J.A. et al. (1976)*	34,597	176	0.51	33	0.09
Silvis, St. E. et al. (1976)	4,404	31	0.70	1	0.02
Wittmann, J. et al. (1979)	2,322	7	0.30	1	0.04
Takemoto, T. et al. (1980)*	31,652	300	0.95	24	0.076
Manenti, A. et al. (1980)*	3,000	49	1.66	4	0.133
Henning, H. et al. (1985)*	46,364	69	0.15	25	0.054
Kuntz, E. (1987)	5,992	58	0.97	—	—
Marti-Vicente, A. et al. (1992)	8,915	54	0.60	10	0.11
Vargas, C. et al. (1995)	1,715	39	2.15	1	0.06
	224,193	2,665	1.19	121	0.054

Tab. 7.16: Frequency of laparoscopic complications and cases of death (* = compiled statistics)

cepted. • Some of the complications observed in the past (193, 230, 271, 293) should not really be expected today, given modern technical possibilities. Some statistics not only included severe complications, but also harmless ones, a fact which explains the differences in percentages. • The frequency of *more severe complications* is **0.15–0.80%**, the *total rate* of significant complications can be put at **<1.0%**. Based on compiled statistics, the lethality rate is up to **0.07%**. • Some **0.08–0.2%** of complications required *operative intervention*. • Registration of all complications (even slight or harmless events) resulted in a complication rate of 3.0% (255) and 4.87% (217). • In 6,000 laparoscopies of our own, the complication rate was 0.97%, with a mortality rate of 0%. (243) • Out of 20,000 laparoscopies, the largest number ever registered in one hospital, E. WILDHIRT reported just 2 cases of death (0.01%). • The largest number of laparoscopies to be performed in a single hospital is believed to be over 50,000 (R. LLANIO et al., Habana/Cuba) (*personal communication*).

2.14 Diagnostic validity

The accuracy of histological diagnosis depends on (1.) the *biopsy specimen* being large enough (> 1.5 cm, 5–10 portal fields) as well as being definitively assessable (1, 63, 94, 143, 165) and (2.) whether the specimen can be deemed to be *representative for the liver* – bearing in mind that the usual weight of a biopsy punch amounts to 20–30 mg (i.e. 1/75,000 to 1/50,000) of the total liver. • It depends equally on the *hepatological experience* of the investigating pathologist and on the findings available to him (possibly including a Polaroid photograph of the liver!). • It was shown in a study that when the histological result was double-checked by a pathologist with extensive experience in hepatology, there was complete agreement only in 34.4%, considerable discrepancy in 28.0% and slight discrepancy in 37.6% of cases. (6)

Diffuse liver diseases: Histological findings of the biopsy specimen are generally considered to be representative

for the given liver disease. The accuracy of percutaneous bioptic diagnosis is 80 to 100%. • The colour of the biopsy specimen, which varies from pale yellow (fatty liver) to greenish-black (metastasis of melanoma), may give a hint of the respective underlying disease. (s. fig. 7.14) (27, 104, 106, 108, 212, 227, 247, 273, 301, 303)



Fig. 7.14: Liver biopsy specimens: I. in fatty liver (pale yellow), II. in a metastasis of a malignant melanoma (greenish-black) (s. fig. 7.10)

Focal liver diseases: Biopsy material cannot be guaranteed as being representative in every case. A higher degree of diagnostic accuracy can be achieved by a two- to threefold liver biopsy in the course of a laparoscopic-biopic examination of both lobes of liver. The same is true for peliosis hepatis (225, 270), granulomas and chronic hepatitis C, for example. (117)

► **Cirrhosis:** In cases of cirrhosis, consideration must be given to the fact that the condition relates to the entire liver – yet not necessarily to each lobular area. For this reason, micronodular cirrhosis is generally better targeted (95%) than macronodular cirrhosis (60%). (84) Under certain circumstances, the biopsy of a large regenerative node can lead to the (understandably) wrong diagnosis of a “practically normal liver parenchyma”. *Consequently, the false-negative rate with percutaneous biopsy of cirrhosis lies between 9.3% and 51%* (84, 192,

220, 227, 237, 243, 261, 270, 276, 301, 302, 314) and can even be as high as 80% if the yield is smaller than 5 mm. (63) This high error rate is caused by the Menghini needle slipping off the cirrhotic connective tissue and penetrating the neighbouring soft regenerations. The Menghini technique usually only produces *crumbly fragments* of a cirrhotic liver, since fibrous tissue septa remain in the liver, rather like the panicles of a stripped leaf. Such fragments generally suggest the presence of cirrhosis, even if the pathologist is unable to make a definitive diagnosis. (s. figs. 7.15, 7.16) • *A percutaneous bioptic diagnosis of cirrhosis is not acceptable because of the wide margin of error and the greater risks involved with the biopsy. Laparoscopy with its additional techniques – now deemed to be the gold standard – ought to be performed instead.* • The diagnosis of liver cirrhosis, and its differentiation from fibrosis and scarred liver, can as a rule be reliably established by looking closely at the surface of the liver (“glance diagnosis”). Findings should also be documented by colour photography. (s. figs. 14.3; 16.4, 16.5; 21.9; 24.2, 24.5; 31.22; 32.5; 33.4; 35.2, 35.4, 35.8, 35.17, and others)

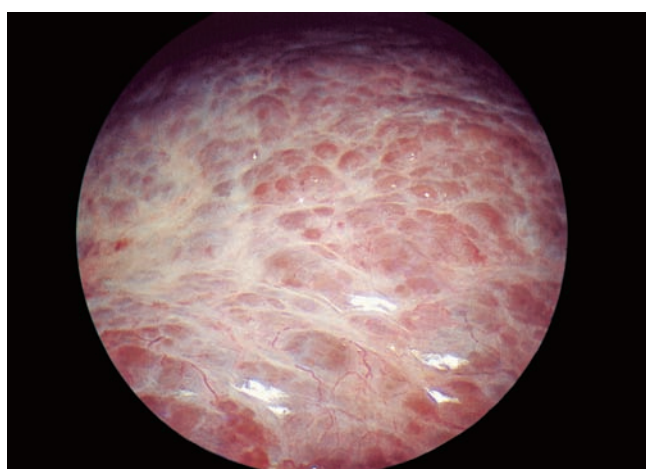


Fig. 7.15: Active, micronodular, in part moderately nodular (alcohol-related) cirrhosis with pronounced pathways of postnecrotic connective tissue

Due to their cutting action (which differs from the Menghini technique), **Vim-Silverman** and **Trucut needles** produce a sufficiently large and almost intact cirrhosis tissue sample. As a consequence, the false-positive results can be brought down to below 10%. Nevertheless, the risk of subsequent bleeding is clearly higher. For this reason, the diameter of the needle should definitely not exceed 1.6 mm.

► The combined examination with **laparoscopy** and **directed biopsy** (thick- or fine-needle biopsy or use of Robbers' forceps) yields the greatest diagnostic accuracy at 97–100%. This has been impressively confirmed in *children* as well. • Foci not visible by laparoscopy can be detected by ultrasound- or CT-guided biopsy and fine-

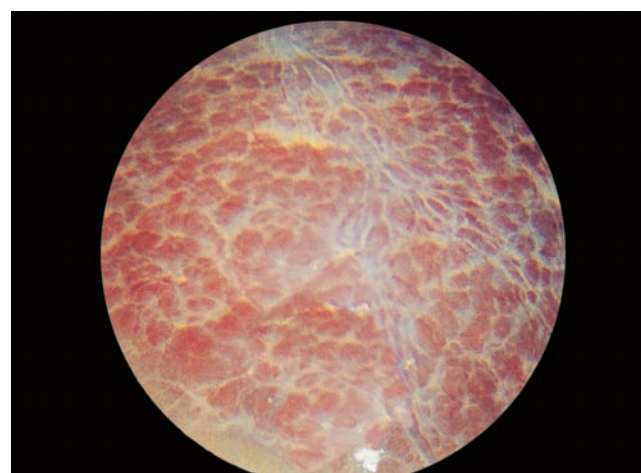


Fig. 7.16: Inactive, micronodular (drug-related) cirrhosis with fine pathways of connective tissue; clinically and histologically definable as “liver fibrosis” (sonographically no signs of portal hypertension)

needle puncture. Occasionally, an existing liver disease cannot be differentiated morphologically, simply because biopsy is contraindicated.

► Laparoscopy is particularly significant in differentiating between **benign** or **malignant foci**, such as adenoma with malignant degeneration (s. fig. 29.14), haemangioma (s. figs. 36.8, 36.9), focal nodular hyperplasia (s. fig. 29.12), Hodgkin's disease (313) (s. fig. 38.8), carcinoma in cirrhosis (232) (s. fig. 37.9), metastases in the area of the liver, ligaments or serosa (s. figs. 37.24, 37.33, 37.34, 37.35), etc. Exploratory laparotomy, which was mostly used in the past, is now obsolete. • In such cases, there is no need to perform “one-second needle biopsy” – just “**one-second glance diagnosis**” might well be fully sufficient for an exact assessment. (see chapters 36 and 37)

► The **cost factor** must likewise be considered; in Germany, for example, laparoscopy is very reasonable at about 75 US dollars as compared to scintigraphy (approx. 130 US dollars), CT (approx. 240 US dollars) and MRT (approx. 400 US dollars).

► From the point of view of hepatological **detailed diagnosis**, it is necessary to carry out liver biopsy, laparoscopy or fine-needle biopsy, depending on the diagnostic issue in question. They are part of the diagnostic routine of a clinical hepatologist. A high degree of experience resulting from the routine performance of laparoscopy also guarantees a maximum of diagnostic findings in combination with a minimum of complications. • In this connection, a **laparoscopic training programme** has proved most useful. (272, 299) Such programmes might help in future to revive laparoscopy as a routine method of investigation – even under outpatient conditions.

3 New technical progress

► With the help of fibre optics it has been possible to develop much smaller instruments with a diameter of 2 mm (max. 2.75 mm) – so-called **mini-laparoscopy**. (s. fig. 7.18) Clinically speaking, this revolutionary technique has stood the test in an excellent manner. (224) This also applies to the field of hepatology, especially concerning high-risk patients. (215, 216, 258, 287) The lighting conditions are still not completely satisfactory and illumination is often insufficient. Up to now, only prograde optics have been available (cf. **conventional laparoscopy** with side-vision and angle optics). (s. fig. 7.17) Nevertheless, we now have a minimally invasive, elegant and safe technique for exploratory laparoscopy and targeted biopsy at our disposal. This new technique will signify the renaissance of laparoscopy, probably also under outpatient conditions.

► The introduction of **laparoscopic sonography** has opened up new diagnostic possibilities. (s. p. 135) (s. tab. 7.10) This applies above all to the detection of intrahepatic metastases, lymphnodular metastases and changes in the vascular system. In 46% of patients, new insight was gained, which led to a modification of therapy in 40% of cases. (210) In 10% of patients, intrahepatic metastases, some with a diameter of <1 cm, were discovered with the help of this technique, even in segments 3 and 4 (H. FOROUTANI et al., 2000).

► It is to be expected that by means of **light-induced fluorescence diagnostics**, further improvements in the differentiation of morphological findings will be achieved in the future.

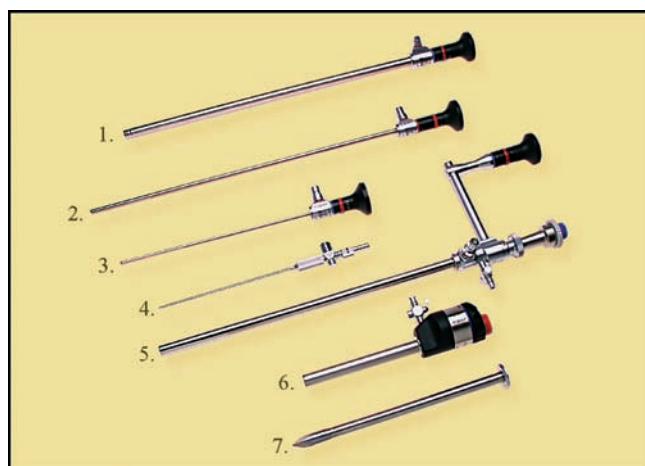


Fig. 7.17: Conventional laparoscopy equipment: (1.) laparoscope, Ø 10 mm, distortion-free, angle of view 0°, working length 300 mm; (2.) laparoscope, Ø 5.3 mm, distortion-free, angle of view 25°, working length 300 mm; (3.) laparoscope Ø 3.5 mm, working length 180 mm; (4.) Veres cannula including Luer connector, working length 120 mm; (5.) operating laparoscope, Ø 10 mm, distortion-free, with right-angled eyepiece, 5 mm working channel, with detachable automatic instrument valves, angle of view 0°, working length 265 mm; (6.) trocar sleeve, with insufflation tap and magnetic-ball valve, metal sleeve standard, straight distal tip, working length 100 mm; (7.) trocar, pyramidal tip (autoclavable)

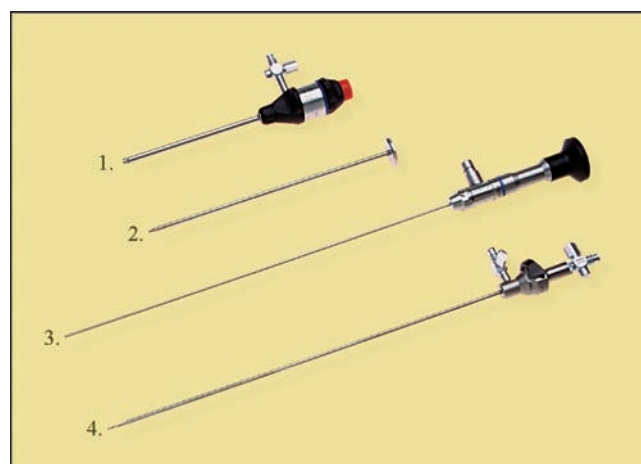


Fig. 7.18: Mini-laparoscopy equipment: (1.) trocar sleeve, Ø 5.5 mm, with insufflation tap and magnetic-ball valve; (2.) trocar, conical tip; (3.) minifibre laparoscope, Ø 2 mm, angle of view 0°, working length 270 mm; (4.) Veres cannula, Ø 2.3 mm, with outer sheath, working length 270 mm (autoclavable)

4 Synopsis and recommendation

During laparoscopy, there is something like personal contact with the pathological finding. For me, in the course of more than 6,000 laparoscopies, this feeling was always an enrichment regarding the relationship between doctor and patient.

No other procedure provides a finding which is so true to colour and so impressive in detail as that performed by the eye of the laparoscopist.

Only laparoscopy makes it possible to carry out targeted (or occasionally multiple) biopsy in both liver lobes. Particularly in chronic hepatitis, such a procedure improves diagnostic safety considerably, because this disease is often not equally pronounced in all parts of the liver. Furthermore, the small area which can be accessed by percutaneous biopsy is not necessarily representative of the liver as a whole!

As a rule, numerous findings pertaining to liver surface, peritoneum, omentum and ligaments are easily recognized with the laparoscopic eye; in most cases, they can be attributed to a corresponding diagnosis and histologically verified with the help of targeted biopsy. This is simply not possible with other procedures.

Using Robbers forceps, the laparoscopist is able to extract optimal tissue for the pathologist from small focal lesions of the liver surface, which is not possible with percutaneous biopsy or imaging-guided biopsy. The search for metastases by means of all available methods can be improved by laparoscopy to a considerable extent. This may be of decisive importance for later therapy.

The risks involved in laparoscopy when carried out by an experienced team are minimal; statistically speaking, they are “less than making the journey to the hospital by car” (this also applies to imaging techniques).

The costs of laparoscopy are in every respect (acquisition, maintenance, personnel, clinical application) far lower than with CT, MRT, etc.

► Every department of hepatology really ought to have an experienced laparoscopy team! The indication for laparoscopy is given in those cases where no certain diagnosis has been reached by means of imaging procedures – provided, of course, that there is a good chance of success. All findings should be archived with the help of photodocumentation and verified histologically by means of biopsy. The ultimate aim is to achieve a combined assessment based on macroscopic and microscopic morphology.

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Leberbiopsie

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2008, XX, 937 p. With CD-ROM., Hardcover

ISBN: 978-3-540-76838-8