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Atlas of Upper Gastrointestinal and Hepato-Pancreato-Biliary Surgery

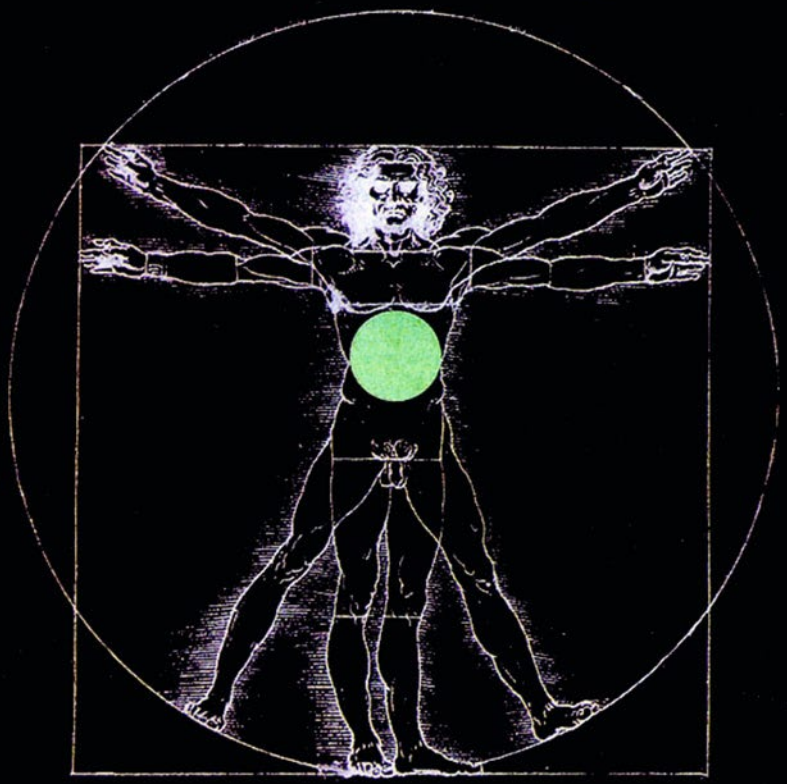
Second Edition

Springer

Atlas of Upper Gastrointestinal and Hepato-Pancreato-Biliary Surgery

The medicine
and
the arts
as a symbiosis
give us humans
a healthy community

Gottfried Honegger



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Preface

The success of the first version of the *Atlas of Upper Gastrointestinal and Hepato-Pancreato-Biliary Surgery*, published in 2007, encouraged us to prepare an updated version keeping the spirit of the original Atlas, and adding modifications, novelties, and new innovations in the technical aspects of these operative procedures. For the new edition, we added a leader in the field of Liver and Biliary Surgery from Asia, Dr. Masaru Miyazaki. Modifications of the text were needed in about 60% of the chapters, and modifications and additions in the artwork in about 30% of the chapters. To follow emerging developments in surgery, we added new approaches in laparoscopic and robotic surgery in many chapters. Also to enhance clarity, the liver section is now divided into transplant and non-transplant procedures. New procedures are described, such as the new two-staged liver resection ALPPS or the use the new electroporation technology for targeted tumor ablation. Two new chapters were added to Section 1 on general principles including: general surgical devices for cutting and sealing and an introduction to robotic surgery, because this section showed highest rank in online downloads for the first edition of the Atlas.

Knowledge of anatomy and precise surgical technique remain the foundation of high-quality surgery. A knowledgeable surgeon, equipped with excellent theoretic and clinical skills, will only be accomplished when he or she masters the operative techniques of the practice of surgery. The legacy of an academic surgeon or a surgical educator relies in great part on the transmission of his or her surgical abilities to hands-on clinical practice. During the last few years, we as surgical educators felt more and more that teaching surgical skills and techniques are compromised due to the plethora of new information dealing with other aspects of surgery. The number of new procedures and techniques developed since the early 1990s, as for example, laparoscopic liver resection or Roux-en-Y gastric bypass, although offering obvious advantages for the patients, constitute a real technical challenge for us surgeons. Therefore, possibly more than ever before, surgeons need to update their knowledge about the various surgical procedures and techniques available.

In bringing forth the first and second editions of the atlas, our goal was to create a comprehensive and educational tool focusing on the upper abdomen and emphasizing all details of operative techniques including "tricks" from experienced surgeons. In view of the availability of many textbooks describing non-technical aspects of surgery, we purposely avoided writing a text addressing the disease processes, but instead concentrated on the operative techniques, which are evolving rapidly. The technical aspects described are the real message of the atlas. We standardized the text associated with each procedure, covering a list of the most common indications and contraindications, a step-by-step description of the procedure, a list of the most common complications, and finally the insightful tricks of the experienced surgeon. We also included an introductory section covering basic principles of operative surgery including operative accesses, positioning of the patient, and the use of retractors, drains, staplers, and the newer devices to facilitate dissection, transection, and hemostasis both for laparoscopy and open surgery.

While a surgeon 50 years ago could treat diseases from head to toe, this concept has evolved, and today some degree of specialization is the rule worldwide. Most countries or accrediting authorities have designed various boards for sub-specializations; indeed, after a broad training in general surgery, many young surgeons will move on further into a specific field. Upper gastrointestinal and hepato-pancreato-biliary surgery have emerged as specialized fields of general surgery, including common procedures belonging to the scope of general surgery as well as complex procedures, that probably should be performed only by specialized surgeons. We opted for a comprehensive approach of upper gastrointestinal and hepato-pancreato-biliary surgery, covering most open and laparoscopic procedures ranging from straightforward procedures such as laparoscopic cholecystectomy to the more complex procedures, such as spleno-renal shunt and liver or pancreas transplantation.

This second edition of the *Atlas of Upper Gastrointestinal and Hepato-Pancreato-Biliary Surgery* presents consistent illustrations created by a single artist. This approach is key to following a procedure, step-by-step, in a consistent and attractive manner. In selecting contributors from literally all around the world, we sought surgeons who had extensive and recognized experience with the procedure. The contributors are established educators and have successfully mentored many young surgeons.

The *Atlas of Upper Gastrointestinal and Hepato-Pancreato-Biliary Surgery* is subdivided into seven sections, each coordinated by a section editor in a close collaboration with the artist. A balance was achieved in each procedure to highlight the educational message in combination with the art of medical drawing.

Based on the personal experience of the expert authors, a few tricks are presented at the end of each procedure. Some procedures, such as those related to portal hypertension, are becoming less popular. This atlas may contribute significantly to preserving the accumulating knowledge of these demanding surgical procedures as these procedures become less frequent.

The second edition of the *Atlas of Upper Gastrointestinal and Hepato-Pancreato-Biliary Surgery* is intended for students and residents in surgery and for fellows specializing in upper gastrointestinal and hepato-pancreato-biliary surgery preparing themselves for the operation. At the same time, this atlas will be useful for specialists and general surgeons who may compare their techniques with the one described herein or find some additional help or tricks when performing rare procedures.

In summary, we believe that the second edition of the *Atlas of Upper Gastrointestinal and Hepato-Pancreato-Biliary Surgery* is truly a new atlas, new in concept, and new in scope.

We hope that specialists as well as surgeons at various levels of training will benefit from this huge effort, combining the work of many experts, a gifted artist, and the publisher.

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Acknowledgments

The creation of an atlas covering the entire scope of upper gastrointestinal and hepato-pancreato-biliary surgery is dependent on a team effort, which is possible only with the support and enthusiasm of many individuals. First of all, an atlas is a series of drawings, which should transmit the appropriate knowledge in an artistic way.

We are deeply indebted to Mr. Jörg Kühn, who undertook so successfully the daunting task of creating an entirely new and exhaustive visual depiction of many upper gastrointestinal and hepato-pancreato-biliary procedures. His imagination, ingenuity, understanding of surgical anatomy, and artistic skill have produced what we believe is the definitive rendering of today's upper gastrointestinal and hepato-pancreato-biliary operations. The original work from Mr. Jörg Kühn and the new drawings were arranged and harmonized by the huge effort from Mr. Lee Klein, senior editor at Springer in Philadelphia, USA.

A very special acknowledgment should go to the Associate Editor Dr. Christoph Tschuor, who took over the challenging task of coordinating this book from Panco Georgiev, who coordinated the first edition of the Atlas. Dr. Christoph Tschuor is a bright senior resident, who, following an academic track in surgery at the University Hospital in Zürich, devoted an incredible amount of time and effort to organizing and supervising the second edition of the atlas on behalf of the Editors. We are also indebted to Madeleine Meyer and Susanne Gaal, Staff Assistants in the Zurich office, who also put tireless efforts into assisting the Editors in many of their tasks. Furthermore, we are grateful for the support from the Liver and Gastrointestinal Disease Foundation (LGID).

Finally, we would like to thank the entire staff at Springer, particularly Gabriele Schröder, who was very supportive from the first idea of this atlas, and maintained their enthusiasm until the end.

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General Principles

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Introduction: General Principles

Pierre-Alain Clavien, Michael G. Sarr

A competent surgeon must be aware of all the general aspects of a surgical procedure to be able to perform specific interventions successfully and expeditiously. The old adage that "exposure, exposure, and exposure" are the three most important factors for the good outcome of a surgical procedure remains true for both open and laparoscopic approaches.

Each procedure must start with careful positioning of the patient prior to wide disinfection of the operative field, draping, and incision. Compared to the first edition of the Atlas, we added two new chapters: one on new devices for cutting and sealing tissues, and a second one to introduce robotic surgery. Significant changes were performed in about one third of the other chapters. The second chapter covers the various options for positioning of the patient on the operating table and describes the incisions that are available to enter the abdominal cavity. The third chapter focuses on different principles of exposure through the use of various types of retractors, providing examples of the most commonly used retractors. The fourth chapter addresses the use of mechanical staplers. Currently, staplers are increasingly being used for many open and laparoscopic procedures, and the industry has partnered actively with the surgical field in developing new devices enabling sophisticated maneuvers, often to reach otherwise small and relatively inaccessible areas. Proper knowledge of the general principles of the use, limitations, and function of mechanical staplers is mandatory for modern surgery, because their misuse or naiveté about their limitations may result in devastating complications such as anastomotic leakage or bleeding. While Billroth claimed more than a century ago that "drainage saves many lives", the use of the "time-honored" surgical drain has changed dramatically, because accumulating studies have shown convincingly that drains are often useless or even harmful in many procedures. Open drains are rarely needed today. This chapter presents the principles of the various types of drains including a table of "evidence-based" utility of drains for upper abdominal surgery. A new chapter introduces devices for cutting and sealing tissues which are nowadays used in most centers and allow accurate dissection and hemostasis of tissue. The last chapter introduces robotic surgery for procedures such as robotic cholecystectomy, distal pancreatectomy, gastrectomy, and hepatectomy outlined in following sections.

These chapters covering the general aspects of surgery were prepared in a simple, yet comprehensive manner. We believe that the didactic and basic information provided in these introductory chapters of the Atlas will be of value for both trainees and specialized surgeons.

P.-A. Clavien, M.G. Sarr, Y. Fong, M. Miyazaki (Eds.), *Atlas of Upper Gastrointestinal and Hepato-Pancreato-Biliary Surgery,*
DOI 10.1007/978-3-662-46546-2_1,

Positioning and Accesses

Yvonne Knoblauch, Dieter Hahnloser

Positioning

Correct and stable positioning of the patient is the first step for a successful operation. Safe positioning of the arm and leg are crucial in preventing pressure lesions, such as ulnar or peroneal neuropathy and neurologic "stretch" injuries to the upper extremities.

Supine Position

The supine position is used for most abdominal procedures. The arms can be left out (Fig. 2.1a) or kept close to the body (Fig. 2.1b), depending on the type of operation to be performed.

- Anchor the patient's legs and/or ankles with a strap in case tilt is required
- Protect arms with a pillowcase, gauze sponge, or silicone pad
- Avoid traction on the brachial plexus (abduction of the shoulder should be < 90°)

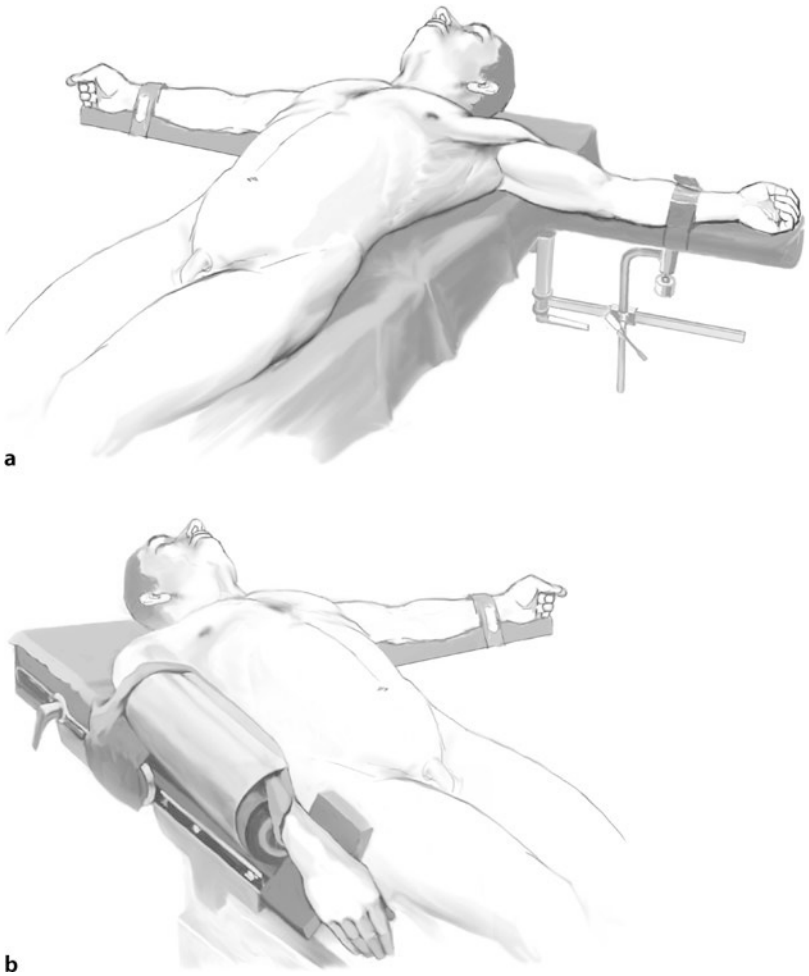


Fig. 2.1

P.-A. Clavien, M. G. Sarr, Y. Fong, M. Miyazaki (Eds.), *Atlas of Upper Gastrointestinal and Hepato-Pancreato-Biliary Surgery,*
DOI 10.1007/978-3-662-46546-2_2,

French Position

The French position (Fig. 2.2) is one possible patient position for a laparoscopic cholecystectomy (the "American" supine position with both arms tucked alongside the body being the other). This position can also be used for upper abdominal operations such as laparoscopic fundoplication or gastric surgery.

- The patient's legs are placed in stirrups or supported under the knee
- Legs need to be placed horizontally or slightly bent to allow free movements with laparoscopic tools
- Avoid any pressure on the peroneal (lateral popliteal) nerve

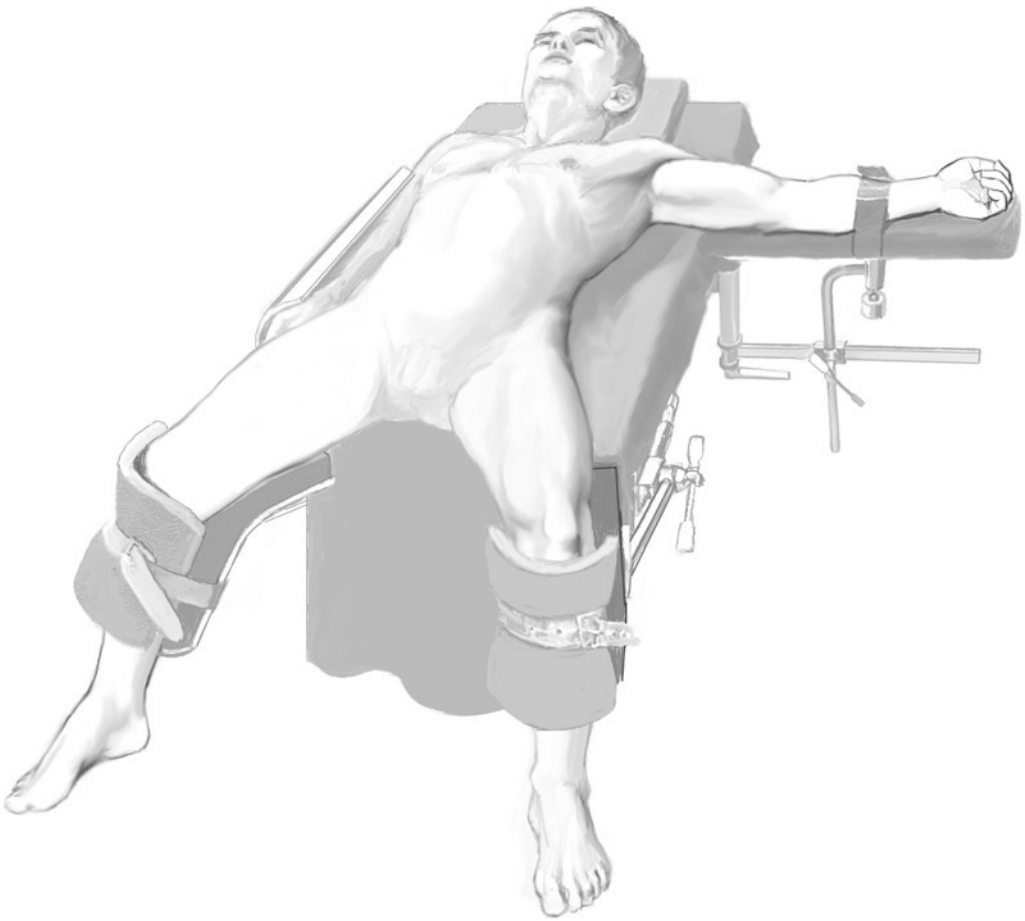


Fig. 2.2

Beach Chair Position

The beach chair position (Fig. 2.3) is used for most laparoscopic obesity surgery procedures
- Requires a special weight-bearing table
- The patient is almost "sitting" on the table
- Avoid any pressure on arms, the brachial plexus, and the peroneal (lateral popliteal) nerve

Fig. 2.3

Positioning for Esophageal Surgery

For esophageal resection and reconstruction, several approaches can be used. Depending on the location of the disease and the surgical approach, the positioning is adapted accordingly.

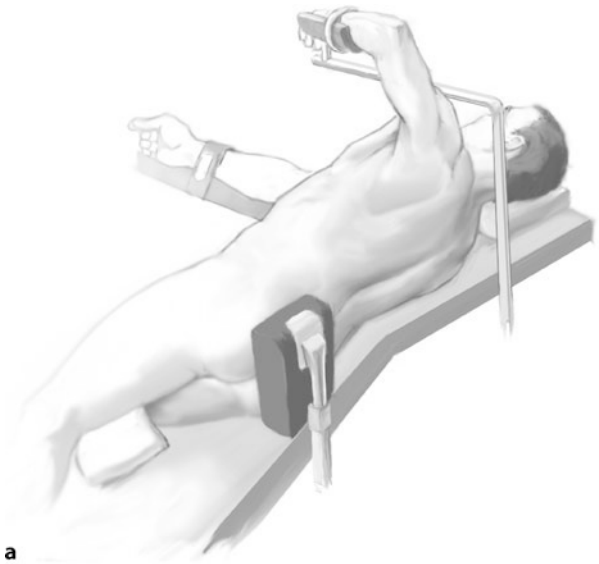
The positions used are:

a) *Supine* position with overextended thoracic spine, the head rotated to the right and extended. The right arm is left out and the left arm is tucked alongside the body (Fig. 2.4). This position is commonly used for transhiatal esophagectomies enabling
- Good exposure of the upper abdomen
- Good exposure for the cervical anastomosis

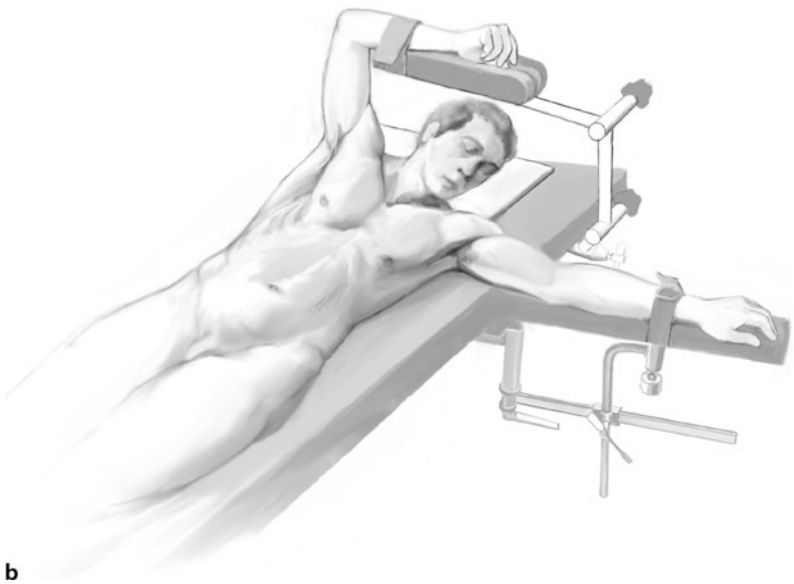
b) *Right or left lateral decubitus* (Fig. 2.5a)
- Good for the intrathoracic anastomosis distal to azygous vein; left decubitus is good for higher intrathoracic anastomoses
- Procedures on the upper thoracic esophagus are approached via a right posterolateral thoracotomy, and similar procedures on the lower esophagus are best approached through the same incision on the left side
- The table is bent slightly at the thoracic level, allowing further opening of the thoracic cavity after thoracotomy

c) *45° lateral decubitus or screw position* (Fig. 2.5b)
- An advantage is that the abdominal, thoracic, and/or cervical phase of the procedure can be performed without changing the position
- For optimal access, the operating table can be tilted side-to-side
- The main disadvantage is a more limited exposure

Fig. 2.4



a



b

Fig. 2.5

Incisions

Abdomen

Choice of approach for entering the abdominal cavity depends upon:

- The accuracy of the preoperative diagnosis
- The location and extent of the disease
- Previous scars
- The requirement of a possible extension of the incision
- Anatomic structures, such as skin, fascia, muscles, nerves, and blood vessels. The abdominal wall should stay functional. Whenever possible, incisions are placed along the lines of Langer, and muscles and fascia are divided along their fibers; all attempts to avoid transection of muscles of the abdominal wall should be entertained

Mark the incision prior to cutting to prevent malpositioning.

Midline Incision

The midline incision is the most expedient choice for opening the abdomen and provides unrestricted access, regardless of the patient's size or shape (including exposure of the pelvis). The advantages of a midline incision are:

- Can be extended into a median sternotomy
- Minimal blood loss
- No muscle fibers are divided
- No nerves are injured
- Is suitable for repeated celiotomies
- Offers best exposure to all areas of the peritoneal cavity in an emergency situation with unclear diagnosis

The Steps

- Place skin incision exactly in the midline, above and below the umbilicus from the tip of the xiphoid to the pubis (extension as needed) (Fig. 2.6a); avoid transecting midline fascia all the way up to the xiphoid
- Deflect the incision around the umbilicus to the left or the right. The evasion of the umbilicus on the left side is preferred, because of possible rudimentary umbilical vessels. In general, use the opposite side of the umbilicus if an ostomy is planned
- The scalpel or the cautery can be used all the way
- By pulling the wound edges laterally, the fat spreads and the plane separates down to the midline fascia (Fig. 2.6b and 2.6c)
- Apply digital pressure to minimize bleeding
- Incise the fascia with the scalpel or cautery just above or below the umbilicus, as the linea alba is widest around the umbilicus
- Gently lift up the peritoneum with pickups before opening to avoid small bowel lesions (Fig. 2.6d)
- Care to incise the linea alba without any lateral exposure of the rectus muscles markedly facilitates the closure

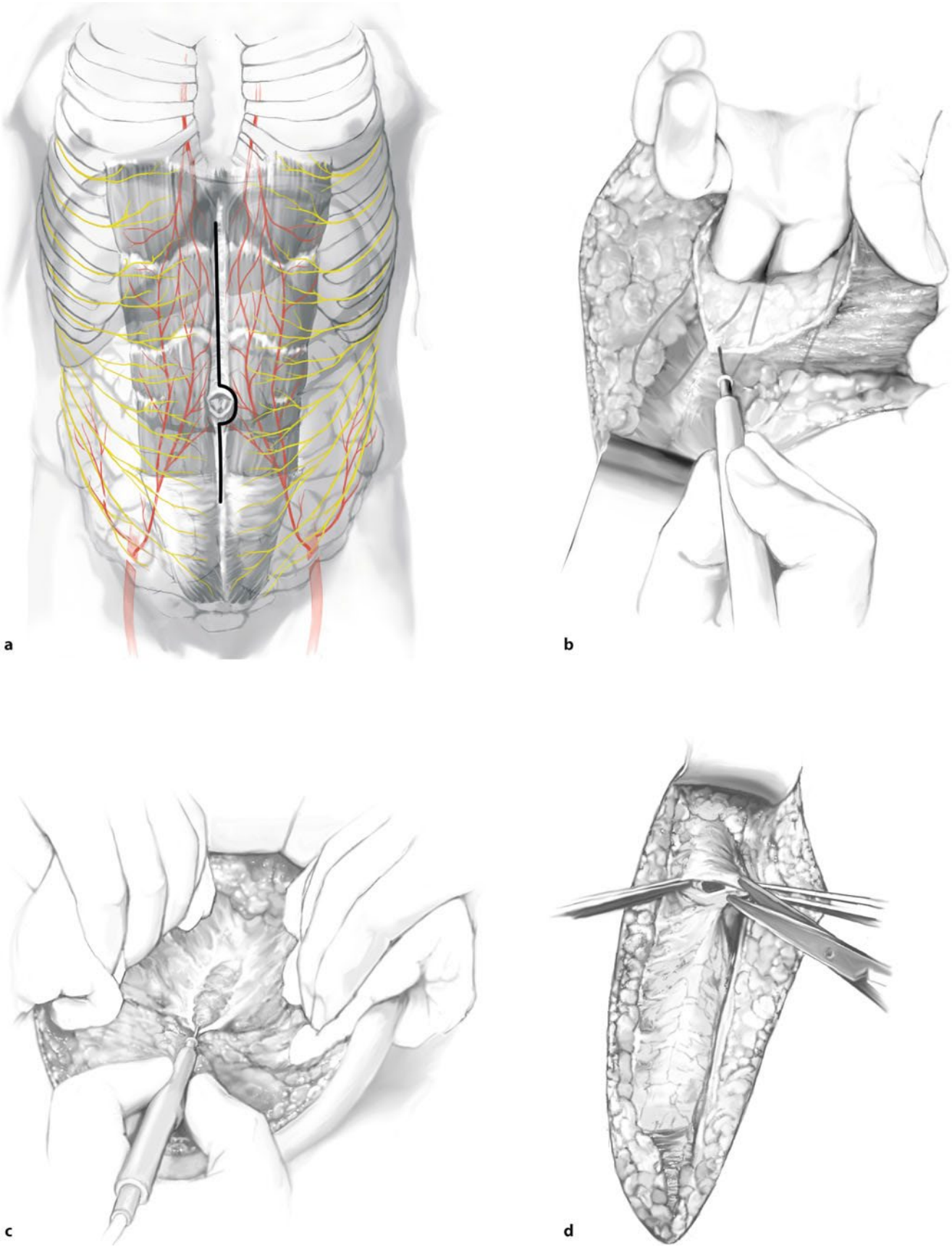


Fig. 2.6

Subcostal Incision (Fig. 2.7a)

The subcostal incision is usually made for cholecystectomy or common bile duct exploration (right subcostal incision) and for elective splenectomy (left subcostal incision) (Fig. 2.7a). The major advantages of the subcostal incision over the upper midline incision are greater lateral exposure and possibly less pain. The disadvantage is that the operation takes longer, because there are more layers to close. The subcostal incision generally heals well with less risk of hernia formation.

The Steps

- Place skin incision two finger breadths caudal to the costal margin. This facilitates closure so that the incision line is not on or over the costal margin
- Incise the anterior and posterior sheet of the rectus muscle. The muscle is cut slowly with the cautery (Fig. 2.7b); care should be taken to ligate or cauterize the inferior epigastric vessels
- Laterally, the fascia of the transverse muscle may need to be cut
- Try not to incise the fascia in the midline, but if necessary, extend the incision medially

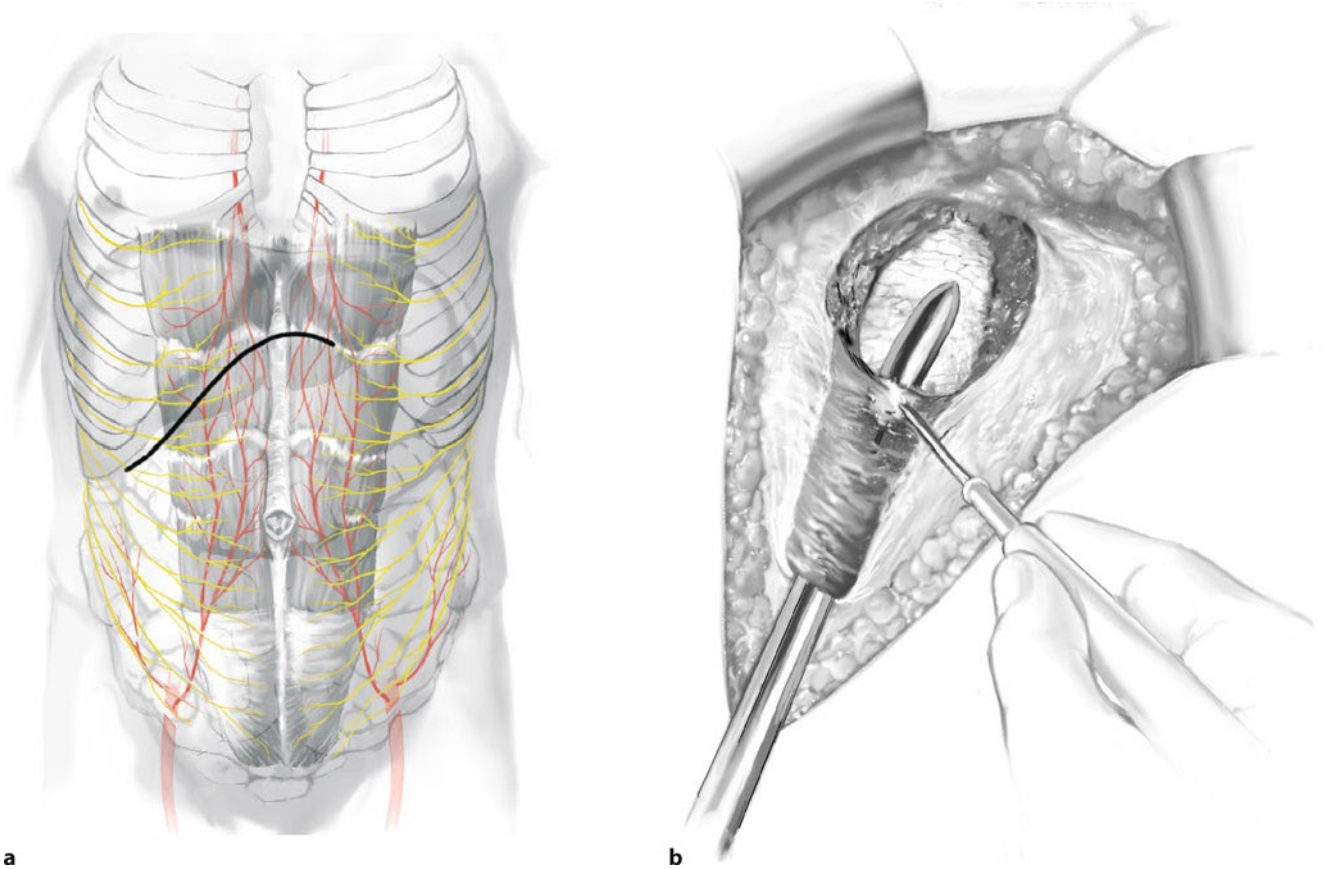


Fig. 2.7

Bilateral Subcostal Incision

The bilateral subcostal incision is used to access the liver for transplant and major liver resections. Also, most pancreas resections are performed with this incision. The exposure is often helped with a vertical extension to the xiphoid (the so-called "Mercedes star" incision).

The Steps

- Incision of skin and fascia as described above
- For pancreas resections, the incision is generally placed three to four finger breadths below the costal margin
- Mobilization of the liver begins with the division of the falciform ligament as well as the liver's reflection of peritoneum with the anterior wall
- Division of the round ligament (a fibrous cord resulting from the obliteration of the umbilical vein), which should be ligated to avoid bleeding, particularly in the presence of portal hypertension
- It is preferable to mobilize the liver prior to the use of stationary retractors to reduce the necessity of frequent repositioning

J-shaped Incision

The J-shaped incision (Makuuchi incision) is used most frequently for surgery on the right liver. This incision provides a particularly good access to the area between the inferior vena cava and the right hepatic vein. The J-shaped incision can be extended laterally to a thoracotomy for better exposure.

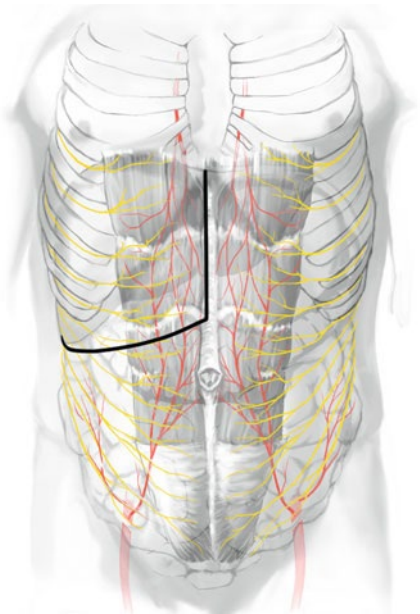


Fig. 2.8

Esophageal Surgery

Like the various positions used in esophageal surgery, there are different incisions used depending on the location of the disease, the level of the anastomosis, and the surgeon's preference. Most of the time, a combination of two or more of the following incisions are used:

a) *Upper midline laparotomy*

- As described in the previous section on the abdomen
- Can be combined with a transverse laparotomy for better exposure

b) *Thoracotomy*

- Anterolateral: skin incision usually in the fourth or fifth intercostal space
- Posterolateral: skin incision in the seventh intercostal space at the angle of the scapula (Fig. 2.9a). A paravertebral or anterior extension is possible

- The intercostal muscle is freed from the upper border of the rib (avoids damaging the intercostal nerve and blood vessels, which lie just posterior to the inferior border of the rib) (Fig. 2.9b)
- The parietal pleura is opened with scissors, and the ribs are separated with a retractor

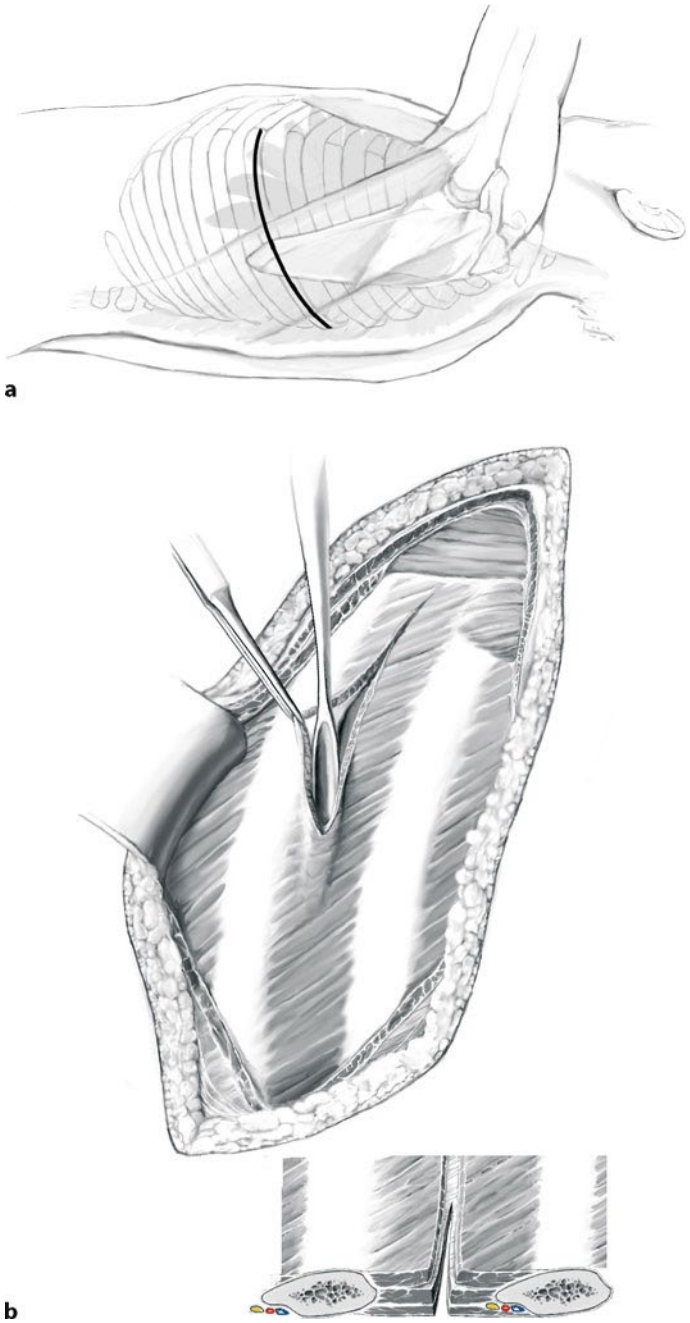


Fig. 2.9

c) *Cervical incision*

- Incision along the anterior border of the sternocleidomastoid muscle (Fig. 2.10a)
- Division of the platysma in the direction of the incision
- The omohyoid muscle (Fig. 2.10b) and, if necessary, the inferior thyroid artery and/or middle thyroid vein are divided to provide clear exposure
- The sternocleidomastoid muscle and carotid sheath and its contents are retracted laterally (Fig. 2.10c), and the trachea, larynx, and thyroid lobe are retracted medially (Fig. 2.10a)