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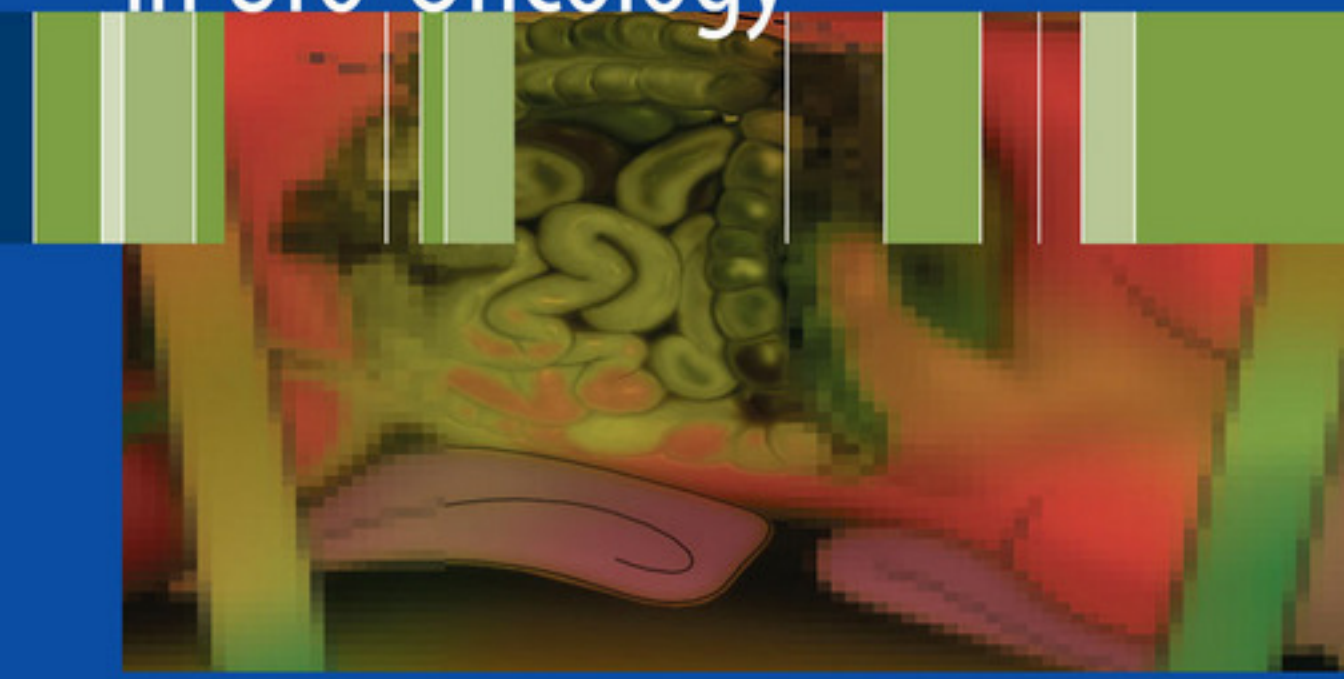
Laparoscopic Techniques in Uro-Oncology



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Laparoscopic Techniques in Uro-Oncology

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by

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Foreword

Laparoscopic surgery, both free-hand and robotic-assisted, has proved to be a transformational technology with a major impact on urologic oncology. While academic urologists today vigorously debate whether a procedure done laparoscopically yields better outcomes than the comparable open procedure, urologic surgeons are voting with their feet: they are performing more and more laparoscopic surgeries every year. The overwhelming interest in laparoscopic surgery is apparent at every urological meeting, but it is perhaps most evident in urologic training programs. Young urologists clearly understand that they must learn minimally invasive techniques if they are to be competitive in practice, particularly in the field of oncology.

Regardless of the outcome of this debate, the development of laparoscopic surgery has wrought a major resurgence of interest in the importance of surgical technique. A decade ago, surgeons themselves seemed bored by presentations or publications that described a surgical technique. There was a general sense that it had all been worked out long ago. That attitude seems oddly out of place today, when our literature and our meetings are filled with intense debates about the differences between surgical approaches and the importance of technique. We now know, for example, that with regard to all important outcomes of major cancer, the skill and experience of the surgeon have a profound impact on the results of surgery. We know that there is a learning curve, sometimes remarkably prolonged, for crucial outcomes such as cancer control after prostatectomy.

Recent studies suggest that both short- and intermediate-term outcomes appear to be comparable between open and some minimally invasive approaches, such as robotic-assisted laparoscopic prostatectomy. Much of this improvement has come from refinements in the open surgical approach to meet the challenge of the laparoscopic approach. When laparoscopic prostatectomy was first performed in 1992, the median hospital stay for patients in the United States after the open procedure was nine days and the median blood loss well over a liter. The typical incision was from the pubis to the umbilicus. Today, in hospitals where robotic surgery has become common, the median length of stay for both robotic and open prostatectomy is the same, less than two days. The need for narcotics, the estimated blood loss, and even the time to convalescence and complete return to normal activities are similar. An analogous story can be told of open surgery for kidney cancer, with the development of increasingly smaller incisions and more conservative surgery. Thus, laparoscopic surgery has had a profound effect on open surgery, constantly pushing open surgeons to develop kinder and gentler techniques while continuing to strive for the best possible long-term outcomes.

Laparoscopic approaches, whether free-hand or robotic-assisted, are radically different from comparable open procedures and call for an entirely different set of skills. One great advantage of this different skill set is that some surgeons who struggled to get good results with the open procedure found that they were highly adept at the laparoscopic or robotic-assisted procedures. Of course, others found the new techniques challenging and did not adopt them. While laparoscopic surgery may not be the right tool for every surgeon, our patients benefit from having access to a variety of approaches that can achieve good results.

One worries about the intoxicating effects of dazzling new technology. While the da Vinci robot is a remarkably complex and sophisticated machine, it has proven disappointing by not giving us better overall long-term results than can be achieved with good open surgery. This does not mean that the surgical robot is a distraction or an unnecessary expense, but that the capability of the current robot may not offer sufficient advantages over open surgical techniques to overcome the limitations of inflexibility, loss of haptic feedback, and loss of direct visualization of the field.

There is every reason to be optimistic about the future of laparoscopic surgery, whether free-hand or robotic. This approach can readily incorporate modern technological breakthroughs that would prove difficult during open surgery. One excellent example is the possibility of the "glowing margin," in which a monoclonal antibody to prostate cancer, labeled with a fluorophore, could be given to the patient a day before the operation. Then, during laparoscopic prostatectomy, a laser built in to the camera system could flash for a few milliseconds and create a readily visible glow in the area of cancer. This kind of technology is readily adaptable to the bloodless field and camera system inherent in laparoscopic surgery.

Laparoscopic Techniques in Uro-Oncology is an enormously valuable educational tool for young surgeons learning these techniques for the first time, as well as for established surgeons constantly seeking to improve. Written by four giants in the field, representing both the European and American developments in laparoscopic surgery, this beautifully illustrated book provides not only fundamental insight into the laparoscopic anatomy of the genitourinary system but also details numerous tricks of the trade that can lead to improved techniques and better results. The authors are to be congratulated on a monumental task. They challenged themselves to produce a text that would teach surgical technique, and they have succeeded remarkably well. It is hard to imagine how any serious surgeon performing laparoscopic surgery for a genitourinary cancer would be comfortable without having this text readily at hand. I can imagine seeing it in the operating room, in conference rooms, and in the offices of every urologic cancer surgeon. It is a wonderful, lucid, and highly effective compilation of surgical insights from the most brilliant leaders in the field.

One already hopes that future editions will be produced on a regular basis, incorporating the authors' insights in this rapidly evolving field.

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Preface

Since its introduction more than 15 years ago, urologic laparoscopy has matured significantly, emerging as a sound, viable alternative for many patients with renal, testicular, bladder, prostate and other urologic cancers. In recent times we have witnessed the emergence of the discipline of minimally invasive uro-oncology and advanced minimally invasive surgical techniques are now a strong viable partner to radical open surgery.

This is a "technique" book intended for urologists with prior experience in basic laparoscopy and uro-oncology. The focus is on practical, step-by-step details and subtleties. We have intentionally omitted any discussion of diagnoses, indications, instrumentation, or basics of laparoscopic access; there are already excellent textbooks dealing with these issues. The techniques we have described here are based on the aggregate of our personal experiences performing over 8,000 laparoscopic surgeries. We have tried to distill "what works" based on our knowledge of the errors made and the successes that have withstood the test of time. Not all techniques are described, and many variants are omitted. This does not mean those techniques have no value, but rather that we prefer the ones presented herein.

We hope this book will assist laparoscopic urologic oncologists in offering their patients a technically superior operation, performed in the safest manner. If this is the case, our work of the past 15 years would be validated. For the four of us, it has been a true privilege to participate in the development of this field and it is equally gratifying for us to share our collective experience with our colleagues.

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Günter Janetschek
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A book is not made by one, two, or even four writers. It is a formidable project that involves many other people who contribute their knowledge, skills, and practical experience. In a technical textbook such as this, surgeons have the most visible place. But beyond the four named authors, this book has been brought to fruition by many more. They should be thanked here for their insights, critiques, comments, and support during the development of this textbook. It would be impossible to thank all of them in this space and we apologize to them in advance for these omissions.

We would like also to thank urology editorial team at Memorial Sloan-Kettering Cancer Center: Susan Aiello, Barbara Kristaponis, Michael McGregor, Peggy McPartland, Janet Novak, and Joyce Tsoi for their help in the effort to make this information clear and understandable. We would like, in addition, to acknowledge Melissa Morton at Springer for her enthusiastic support and for her patience. Springer has trusted us and allowed us to bring to the urological community this sum of our experience.

If this textbook meets the expectation of our peers and is useful to future laparoscopic surgeons, it is because all of these endeavors were indispensable.

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Laparoscopic Anatomy of the Upper Urinary Tract: Intra-Abdominal and Retroperitoneal Approaches

Laparoscopy, with its advantages and limitations, requires a different topographic comprehension of surgical anatomy, adapted to a certain angle of vision and magnification. The anatomical perspective of the surgical field during laparoscopy is somewhat different from that usually seen during open surgery, and considering the anatomy from a different perspective is a prerequisite for performing safe and efficient surgery. Therefore, mastering laparoscopic topographic anatomy becomes indispensable for identifying structures and recognizing their spatial relationships. This chapter presents the topographic anatomy of the retroperitoneum as it appears to the laparoscopist. Positional relationships follow standard anatomical terminology, so that superior, inferior, anterior, and posterior refer to positions toward the head, feet, surface, and back, respectively. The right and left upper urinary tracts are presented separately.

For transperitoneal laparoscopy of the upper abdomen, the patient is placed on the operating table in a 45° lateral decubitus position, and the table is slightly flexed. For retroperitoneal laparoscopy, the patient is placed in a 90° standard flank position.

Right Upper Urinary Tract

Intra-Abdominal Approach

During transperitoneal laparoscopy, the anatomy can be seen clearly as soon as the laparoscope is introduced into the abdominal cavity. The liver lies on the organs of the upper retroperitoneum (Figure 1.1) and so must always be retracted to gain access to the adrenal gland and the upper pole of the kidney. The gallbladder comes into view when the liver is lifted up. The hepatoduodenal ligament travels between the dorsal aspect of the

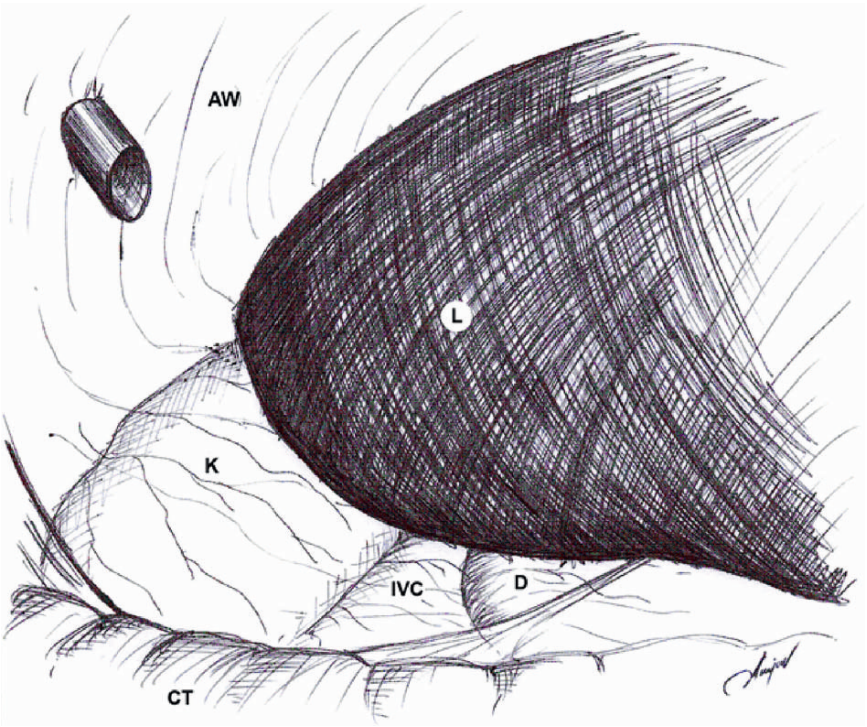

FIGURE 1.1. View of upper right abdomen (laparoscope in umbilicus, 30° lens). AW = lateral abdominal wall, CT = transverse colon, D = duodenum, IVC = inferior vena cava, K = kidney, L = liver

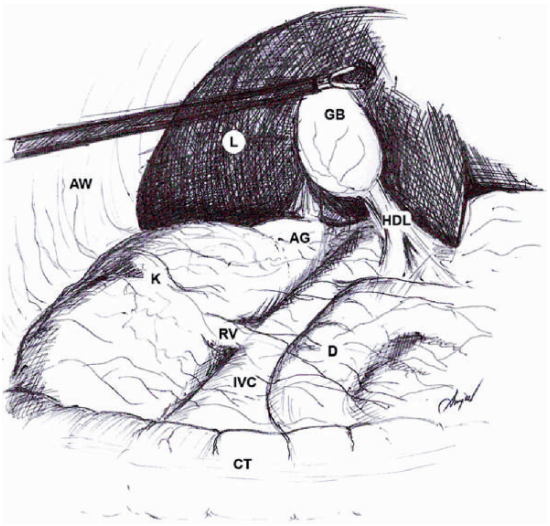

FIGURE 1.2. View of upper right abdomen after retraction of liver.AG = adrenal gland, AW = lateral abdominal wall, CT = transverse colon, D = duodenum, GB = gallbladder, HDL = hepatoduodenal ligament, IVC = inferior vena cava, K = kidney, L = liver, RV = renal vein

liver and the duodenum. The entrance into the bursa omentalis is between the hepatoduodenic ligament and the inferior vena cava (Figure 1.2). The cecum, ascending colon, right colonic flexure, and transverse colon are always visible, even in obese patients.

The lower pole of the right kidney and the proximal ureter are covered by the colonic flexure and the transverse colon. Most of the right kidney, however, can be considered as “intra-abdominal” and is covered only by Gerota’s fascia and the peritoneum (Figures 1.1 and 1.2). The same is true of the right adrenal gland, which lies directly underneath and posterior to the peritoneum (Figure 1.2). At the level of the renal veins, the ventral surface of the inferior vena cava is covered by the transverse colon and duodenum. Its caudal portion disappears underneath the transverse colon (Figures 1.2 and 1,3). Cranial to the duodenum, the vena cava is covered only by the peritoneum, and it can be recognized before any dissection in thin patients (Figure 1.2). See Figure 1.3 for anatomy of

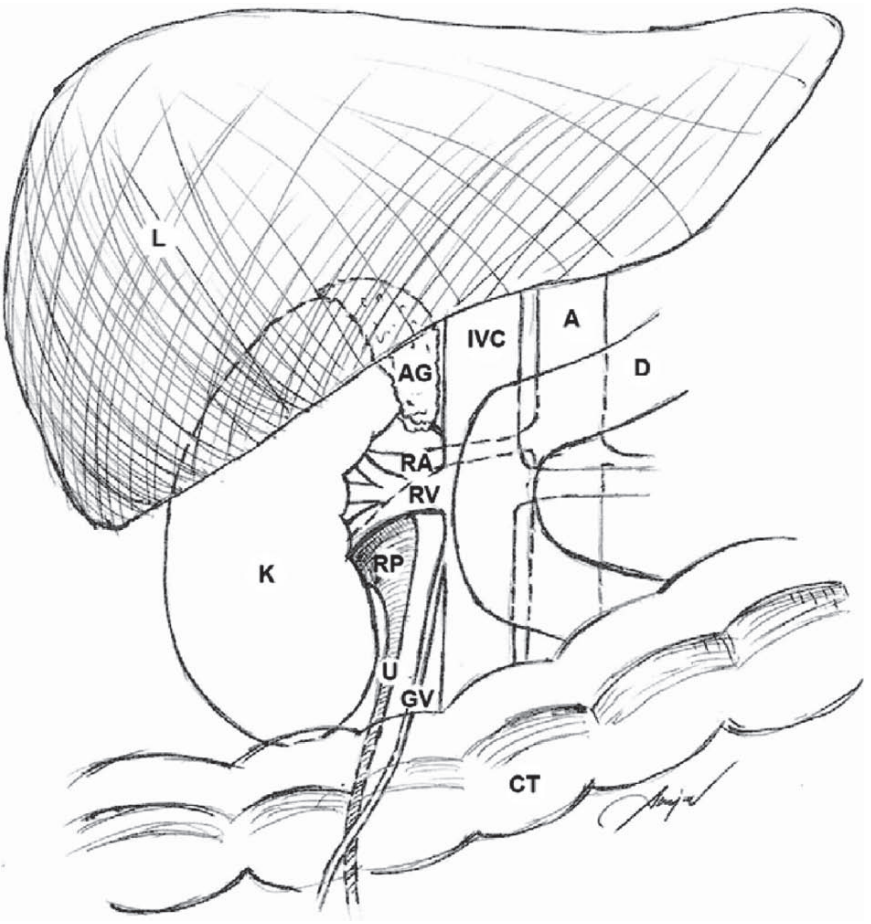

FIGURE 1.3. Anatomy of upper right abdomen. Figure key: A = aorta, AG = adrenal gland, CT = transverse colon, D = duodenum, GV = gonadal vessel, IVC = inferior vena cava, K = kidney, L = liver, RA = renal artery, RP = renal pelvis, RV = renal vein, U = ureter

the kidney, its vessels, and the ureter in relation to the surrounding structures.

Exposure of the Retroperitoneum

Complete exposure of the retroperitoneum requires dissection of the ascending colon and the right colonic flexure in the plane of Toldt's fascia. During displacement of the transverse colon, care must be taken with the lower part of the duodenum, which crosses just dorsal to the colon. The duodenum and the head of the pancreas are then displaced medially, and the retroperitoneum becomes freely accessible (Figure 1.4). The extent of dissection of the bowel, however, depends largely on the procedure that is to be done. Adrenalectomy, for example, requires only retraction of the liver, with no dissection of the colon and no or only minimal dissection of the duodenum. For radical nephrectomy, minimal displacement of the transverse colon and right colonic flexure is required, but some dissection of the duodenum is necessary to expose the right renal pedicle. In contrast, retroperitoneal lymph node dissection for testicular cancer requires wide exposure of the entire retroperitoneum, because the interaortocaval space has to be approached as well. This can be achieved only after complete medial displacement of the entire right colon, the duodenum, and the head of the pancreas.

Kidney, Ureter, and Renal Vessels

After exposure of the retroperitoneum in the plane of Toldt's fascia, the right renal vein is readily accessible (Figure 1.4). The key landmark for

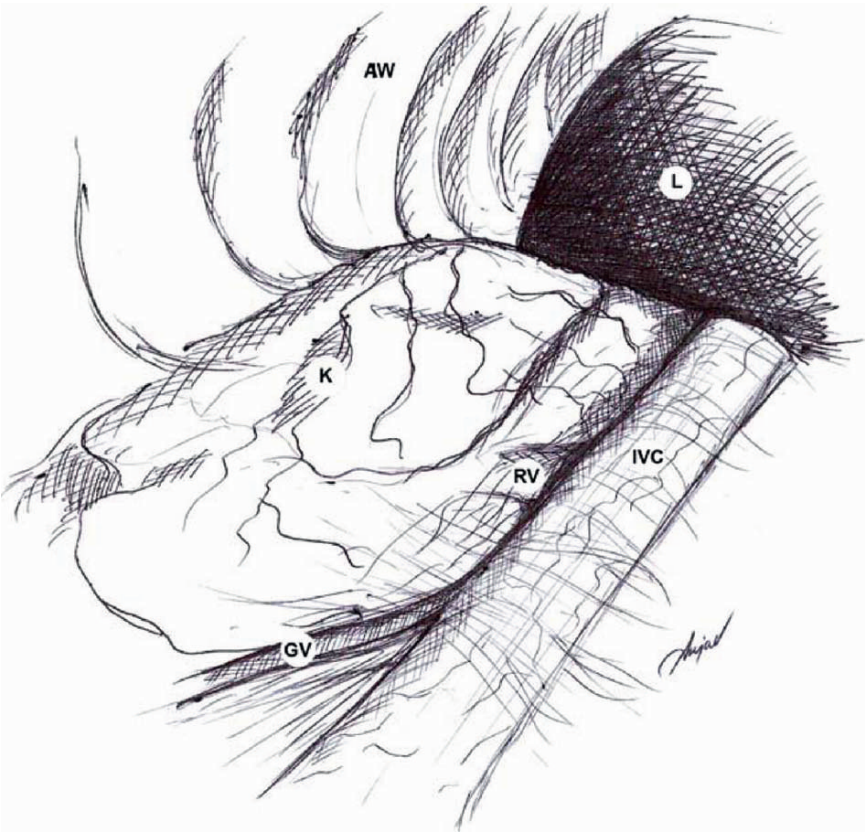

FIGURE 1.4. View of upper right abdomen after medial displacement of colon and duodenum and retraction of liver. AW = lateral abdominal wall, GV = gonadal vessel, IVC = inferior vena cava, K = kidney, L = liver, RV = renal vein

the approach to the right ureter is the gonadal vein. It opens into the inferior vena cava a few centimeters below the right renal vein. The retroperitoneum is opened on the lateral edge of the gonadal vein. Dissection is performed down to the psoas muscle. Further caudal dissection reveals the ureter, which crosses the gonadal vein on its dorsal side (Figure 1.3). In the area of the crossing, several venous anastomoses between the gonadal and ureteral veins require careful dissection and meticulous hemostasis. Cranial to the crossing, the ureter is lateral to the gonadal vein; while caudal to the crossing, the ureter runs medial to the gonadal vein. It is important to remember the ventrodorsal orientation of structures at the crossing: gonadal vein <n> ureter <n> psoas muscle. To approach the renal artery (e.g., for a nephrectomy), the lower pole of the kidney must be freed and lifted up (Figure 1.3).

Caveats: Although the gonadal vein typically inserts into the inferior vena cava, it can insert into the right renal vein as well. If this potential anomalous relationship is not recognized, the renal vein can initially be confused with the inferior vena cava and be a source of serious iatrogenic injury. Such anomalous vasculature (among other things) can be identified by a preoperative 3-D CT scan. Accessory renal blood vessels may or may not lie in a slightly more anterior plane than the main renal vessels and are end arteries without collateral supply. As a rule, the right inferior polar artery is always precaval. Such accessory renal arteries and the often accompanying accessory renal vein are present in approximately 20% of patients.

Adrenal Gland

A specific understanding of adrenal surgical anatomy is key for the safe performance of laparoscopic

adrenalectomy. Located within the retroperitoneum and inside Gerota's fascia, the adrenal glands are separated from the upper pole of the kidney by a fibrous layer. Both adrenal glands are distinct in shape and size, anatomic location and relationships with adjacent structures, and vascular supply.

The triangular-shaped right adrenal gland lies cranial and slightly medial to the superior pole of the kidney. The right adrenal gland is the most superior organ structure in the right half of the retroperitoneum. As such, accessing the right adrenal gland during transperitoneal laparoscopy requires that the liver is substantially retracted superiorly. The medial portion of the adrenal gland abuts the inferior vena cava and, at times, a significant portion of its parenchyma can be located retrocaval (posterior to the inferior vena cava).

Superiorly, the adrenal gland abuts the under surface of the liver. Laterally, the adrenal gland is bounded by the most inferior portions of the diaphragm and the lateral abdominal wall. Posteriorly, the adrenal gland lies atop the psoas muscle and receives collateral blood supply from small arterial perforating vessels originating from the inferior phrenic artery (superior pedicle), the aorta (middle pedicle), and the right renal artery (inferior pedicle). Specific and identifiable arteries to the adrenal gland usually cannot be discretely identified. However, a single, short adrenal vein drains directly into the inferior vena cava. This adrenal vein is a short, wide vessel, originating from the superior-medial aspect of the adrenal gland, that enters directly into the lateral aspect of the inferior vena cava in a high infrahepatic location. This means that the adrenal vein cannot be seen without significant cranial mobilization of the liver. Identifying the adrenal vein is strongly recommended before making any attempt to mobilize the adrenal gland. If the vein tears, it will avulse at its junction into the inferior vena cava, which can lead to significant bleeding that is difficult to control.

Retroperitoneal Approach

Kidney

After the surgeon has obtained proper retroperitoneal access, the psoas muscle becomes the horizontal floor of the surgeon's view and his or her main landmark throughout the surgery. This horizontal orientation must be maintained at all times (Figure 1.5). To see the bulk of the kidney and to be able to apply

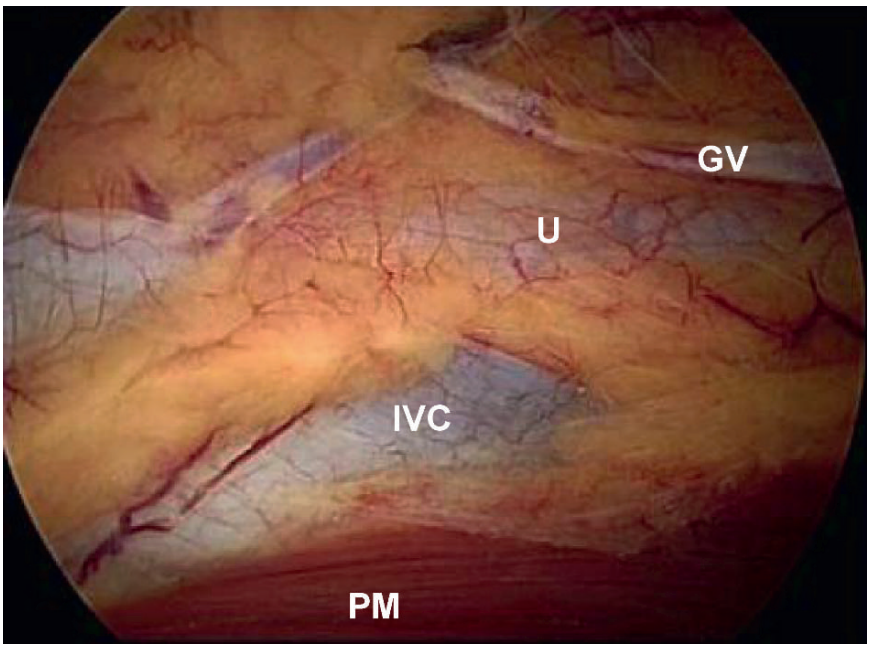

FIGURE 1.5. Right retroperitoneal approach: psoas muscle (PM), inferior vena cava (IVC), ureter (U), gonadal vessel (GV)