Laparoscopic anatomy of the female pelvis, from the peritoneum to the retroperitoneum

Main points

- know how to make the most of the anatomical advantages provided by laparoscopy, i.e. control of the environment, good ergonomics and the specific aspects of endoscopic dissection;

- familiarity not only with the peritoneal operating field, but also the laparoscopic approach to the various retroperitoneal spaces in the pelvis and the anatomical structures they contain;

- understand the functional organisation of the pelvic retroperitoneum using laparoscopic vision.
Laparoscopy and anatomy provide a wonderful combination for approaching the female pelvis. Thanks to the laparoscopic approach, observation of the anatomy is magnified which is of particular benefit in the pelvic retroperitoneum. This advantage of laparoscopy is in part the consequence of progress in technology, now capable of providing high quality images, but results above all from the specific techniques developed for laparoscopic dissection. While the endoscope takes the surgeon’s vision and instruments right inside the pelvis in contact with the furthest structures, the real guarantee of good anatomical visibility lies in meticulous haemostasis throughout the dissection process. Haemostasis of small vessels, often neglected in a traditional approach, is made easier by the magnified view afforded by the endoscope and use of a bipolar power source.

At the same time the goal of this «microsurgical» approach is improved peroperative preservation of functional structures in the pelvis, notably the vasculo-nervous elements, with important clinical consequences. This chapter deals with various surgical views of the pelvis, placing the accent on the retroperitoneum where this approach appears to have the most significant advantages. With the aim of using standard anatomo-surgical terms, as far as possible we have used the Nomina Anatomica international anatomical terminology adapted to French by the French College of professors of anatomy.

For those interested in further information, we can thoroughly recommend the reference anatomical work [1] or recent international publications on the subject [5].

PERITONEAL OPERATING FIELD AND PELVIC CAVITY

Anterior abdominal wall

When inserting the lateral operating trocars, great care must be taken to identify the inferior epigastric vessels. The classic safety triangle insertion with trocars placed supra-pubically and inside these vessels is no longer used today for ergonomic reasons.

Identifying the inferior epigastric vessels

If it is difficult to view them transperitoneally, for example in obese patients, then the lateral edge of the rectus abdominis muscle is used as a landmark when inserting the lateral trocars. Inserting the trocar outside this limit avoids any damage to these vessels, since they run along the posterior surface of this muscle above the pelvis.

For a pelvic approach, the lateral trocars are nowadays placed adjacent to the anterosuperior iliac spine laterally to these vessels. They originate from the external iliac vessels in the femoral arch area beneath the round ligament. They then run up the anterior abdominal wall laterally to the umbilical artery and go behind the rectus abdominis muscles level with the anterosuperior iliac spine. As shown in figure 2.1, they are most often visible during laparoscopy either directly through the peritoneum, or thanks to the peritoneal relief (lateral umbilical fold) that they form outside the relief of the umbilical artery (median umbilical fold).

Pelvic peritoneum

Figure 2.2 shows a general view of the pelvis after installation in the Trendelenburg position, with the loops of bowel fallen back above the promontory and uterine anteversion. External uterine cannulation is a crucial element for mobilisation of the uterus. In addition to exposure the various sides of the uterus, it will also provide easier access to the vesico-uterine and recto-uterine (Douglas) pouches, with their subjacent septums, and access to the lateral retroperitoneal spaces level with the broad ligaments.

2.1
Inferior epigastric vessels. Left side
2.2
General view of the pelvis.

2.3
Right lateral view of the pelvis.
(1. round ligament; 2: suspensory ligament of the ovary; 3: external iliac vessels; 4: ureter).

2.4 Right ovarian fossa and ureter.

The lateral endoscopic view of the pelvic cavity (figure 2.3) allows the uterine adnexa, tube and ovary to be seen in greater detail, along with the broad ligament whose anterior peritoneal leaf is lifted in the middle by the round ligament running between the uterine horn and deep inguinal ring. We can also see where the suspensory ligament of the ovary (lumbo-ovarian ligament) emerges, crossing over the line of the external iliac vessels. Inwards from this pedicle, the endoscopic forceps is indicating the parietal and retroligamentary portion of the right ureter in the ovarian fossa.

In thin patients, it is sometimes possible to see through the peritoneum of this fossa the first collateral branches of the anterior trunk of the internal iliac artery (hypogastric artery), to which the ureter lies laterally; this anterior trunk consists of: the umbilical, uterine and vaginal arteries (figure 2.4). Note that on the left side it is often more difficult to view the ureter at this level, along with the point where the suspensory ligament of the ovary emerges, due to the presence of the sigmoid colon and rectum. For these structures to be approached it is thus often necessary to detach the recto-sigmoid junction level with the external iliac vessels. A more detailed description of the pelvic ureter will be given in a specific paragraph (see page 30).

Promontory

Lying at the upper limit of the pelvis, the promontory is most often approached to the right of the sigmoid. Consequently laparoscopic exposure of the promontory
along with the sacral concavity can be made easier in certain procedures (see chapter 11, page 179) by transparietal fixation of the perisigmoid and perirectal fatty tissue in the left hypochondrium.

Figure 2.5 illustrates the sub-peritoneal anatomical structures to be seen in this area. On the midline, the median sacral vessels are located level with the common prevertebral ligament. They are generally preserved during laparoscopic promonto-fixation, where in our practice the prosthesis is fixed to the right side of the ligament. Laterally to the right: we can see the homolateral primitive iliac artery, then the iliac bifurcation and the ureter crossing the origin of the external iliac artery. Since the iliac venous junction is located lower and slightly lateral relative to the bifurcation of the aorta, it is the left primitive iliac vein that represents the upper limit of this region.

Promontory.

**Left common iliac vein and promontory**

Its closeness and certain anatomical variations mean it is essential to identify this vascular structure accurately when approaching and dissecting the promontory.

It is a potentially dangerous vein during dissection of the promontory because it is so close, and because it is not always easy to locate. This is due in part to the pressure of the pneumoperitoneum which tends to flatten its peritoneal relief, more particularly in obese patients, in which case its blue colour will help to show it up. In addition certain anatomical variations such as a venous junction lower down and/or sacralisation of the promontory link it even closer to the promontory and increase the care needed when dissecting it.

**Anatomical variations**

When working in the female pelvis, the possibility of such variations must be borne in mind, notably with respect to the vascularisation where they occur relatively frequently.

**PELVIC RETROPERITONEUM**

The connective tissue space between the pelvic peritoneum and abdominal walls is of prime importance from the functional point of view, due to the anatomical structures it contains. It is crossed by the ureter, the vessels, lymphatic system and autonomic nervous system to and from the pelvic viscera. It is a real challenge for surgical treatment for cancer and deep endometriosis, not forgetting prolapse.

Its functional organisation is provided by dense connective structures, the visceral «ligaments» and visceral and parietal fascias, leaving areas of looser connective tissue in contact with the viscera and abdominal walls which can be cleaved surgically, i.e. spaces and septums. The method for dealing with these spaces, which are virtual in terms of their physiological condition, forms the very basis of surgical dissection.

Concerning the septums and spaces, the following are found in succession (figure 2.6):

- on the midline, the vesico-uterine, vesico-vaginal, recto-vaginal septums and the retropubic (Cave of Retzius), rectorectal and presacral spaces;

- laterally, two matching and symmetrical spaces: the paravesical and pararectal fossae.

These various spaces communicate with each other at their ends.

Outside the rectorectal and presacral space, they are described here from the endoscopic point of view.

Concerning the visceral «ligaments», the following are also described:

- sagittally the vesico-uterine ligaments (formerly termed the internal pillars of the bladder) and uterosacral ligaments;

- laterally, the parametrium, paracervix, lateral ligament of the bladder (formerly the external pillars of the bladder), and the lateral ligament of the rectum.

The lateral ligaments carry the terminal branches of the anterior trunk of the internal iliac artery. Concerning the sagittal ligaments, these contain autonomic nervous
system nerves along part of their course. They are of great importance surgically.

As already mentioned, these are not ligaments in the strictly anatomical sense, but areas where the connective tissues are more dense, exchanging fibres with each other and prolonged by the fascias at their ends. The result is that these structures are intricately mingled which means they can give rise to confusion, not only for the surgeon but also for any description of the surgical techniques. This situation applies for the lateral «ligaments» (figures 2.7 and 2.8). In contact with the lateral abdominal wall (figure 2. 9), the parametrium, paracervix and lateral ligament of the bladder form a perfectly continuous insertion and it is not possible to tell them apart. The same applies at the bladder (figure 2.10) for the vesico-uterine ligament, parametrium (anterior expansion) and lateral ligament of the bladder. The impression the surgeon has is that there is a single structure running transversally through the lateral pelvis, giving rise to various names such as the cardinal ligament (parametrium-paracervix), which continue to be used and add to the confusion because of their imprecision. This is why it now seems to be most appropriate to use the international anatomical terminology for this subject, with the aim of harmonising the vocabulary of surgical anatomy [1]. The ureter remains the essential landmark when distinguishing between these structures. For the sake of clarity, it should be remembered that the parametrium carries the uterine artery and is located above the ureter, while the paracervix carries the vaginal artery or arteries and is located below the ureter, as is the lateral ligament of the bladder which carries the superior vesical artery.

In this context, the discernment provided by laparoscopy can cope perfectly with the anatomical detail and complexity of these structures.
thus invaluable for the surgeon, revealing the plane that needs to be followed to enlarge the space and helping the dissection to progress. This advantage also gives laparoscopic surgical dissection an «intuitive» element. When opening certain spaces, it is possible in fact to do without the usual anatomical landmarks and follow the gas once the superficial layer of connective tissue has been breached.

Special points concerning retroperitoneal dissection by laparoscopy

To start with, the «dissecting» effect of the peritoneum in this space should be underlined. It can be seen right from the peritoneal incision phase when the C02 infiltrates beneath the peritoneum held under traction, and detaches it. Subsequently as the various pelvic spaces are approached, the gas always travels along the cleavage planes. This effect can be seen thanks to the creation of «bubbles» caused by the gas expanding the connective tissues which originally filled these virtual spaces. In practice, these «bubbles» are

Diagram of the pelvic visceral ligaments. Upper view.
Bubbles and pneumoperitoneum

These «bubbles» are formed when the pneumoperitoneum dilates the retroperitoneal attachment surfaces. By their existence, cleavage planes for spaces that were originally virtual become visible on the screen. So they indicate the direction to follow to open and dissect these spaces. In case of difficulty in accessing a space, the operating field should be scrutinised in order to find them. These little bubbles are thus of real help to the laparoscopist by allowing dissection to be more «intuitive».

In addition, divergent traction using the operator’s two instruments is frequently used to help progress in the dissection of these spaces. They reproduce the opening and closing movements of traditional surgical scissors, although of greater amplitude due to the greater leverage afforded by the fixed points provided by the trocars. So these movements be must limited by any resistance felt, because otherwise there will be tissue damage and bleeding.

Spaces, septums and median ligaments

Spaces, septums and median ligaments

Vesico-uterine and vesico-vaginal septums

These separate in perfect continuity the supravaginal part of the posterior surface of the bladder followed by the anterior vagina from the bladder trigone. They finish at the bottom in the dense connection between urethra and vagina. Their lateral limits are formed by the vesico-uterine ligaments. Access is gained via the vesico-uterine pouch (figure 2.11) after using the manipulator to push the uterus towards the promontory.

The peritoneum is incised at about 10 mm below the vesico-uterine peritoneal fold. The first assistant uses grasping forceps to draw the prevesical peritoneum and underlying bladder vertically. Provided there is no scar from prior caesarean section, the first cut of the scissors (placed perpendicular) allows the vesico-uterine septum to be opened, arriving opposite the pericervical fascia. Then the surgeon’s two instruments, in contact with the fascia, push the bladder along the midline in order to carry out vesico-vaginal dissection (figure 2.12).

2.7 Lateral space and «ligaments». Operative view.

A reminder of the principle of strict and meticulous haemostasis is appropriate here, with the aim of ensuring good anatomical vision throughout dissection to the deepest limits of the spaces concerned by the operation. This is why the surgeon should have a haemostatic instrument such as a bipolar forceps in one of his hands almost constantly, and all the more so since the technological progress made with these instruments provides them with new functions in terms of grasping and dissection.

Finally, for ergonomic reasons which must be constantly borne in mind by all laparoscopic surgeons, it may be necessary to improve exposure by transparietal tissue fixation. Various organs can be fixed quite simply, using needles and suture: the perisigmoid fatty tissues when approaching the promontry, the ovaries in case of endometriosis of the rectovaginal septum, the mesentery during lumbo-aortic lymphadenectomy, or again the bladder during dissection of the ureter and the parametrium.
2.8
Right visceral «ligaments».
2.9
Left paracervix after partial exeresis and exposure of the vaginal vessels.

2.10
Right intraligamentary ureter covered by the parametrium and vesico-uterine ligament.

2.11
recto-uterine pouch; 8:
The dotted line represents the line for peritoneal incision to access the vesico-uterine and vesico-vaginal septums.

2.12
Vesico-uterine and vesico-vaginal septums

The lateral resistance related with the vesico-uterine ligaments is distinctly perceptible via the instruments during this procedure. During dissection, the vesico-uterine ligaments are sectioned level with their anterolateral cervico-vaginal insertions in order to remain well away from the ureters that run through their posterolateral portions.
How far the vesico-vaginal dissection needs to go depends on the operative indication. While 30 to 40 mm is adequate for simple total laparoscopic hysterectomy, dissection will need to go lower close to the trigone and include dissection of the ureters for hysterectomy with conservation of a vaginal cuff, and for cystocele repair with fixation of a
prosthesis in the reclined portion of the vesico-vaginal septum (figure 2.12).

**Rectovaginal septum**

This separates the posterior vagina from the rectum and is accessed via the recto-uterine pouch between the vaginal insertions of the uterosacral ligaments. Here too there are two levels for dissection depending on the type of indication:

- during excision surgery (deep endometriosis, total hysterectomy), it is necessary to dissect the vagina from the rectum and uterosacral ligaments;
- during reparative surgery (promontofixation), dissection can be taken laterally as far as the levator ani muscles with respect to their pubo-rectal and pubo-coccygeal portions. In this indication the aim is to fix the rectovaginal strap of the prosthesis to these muscles in order to correct or prevent rectocele.

With the uterus anteverted, the first assistant draws the anterior surface of the rectum backwards and the peritoneal incision is made above it (figure 2.13). We can then identify the posterior surface of the vagina and continue separating it from the rectum along the midline (figure 2.14). In case of any doubt about the exact position of the vagina, there must be no hesitation to make it visible by a vaginal touch in the posterior fornix.

In order to reach the pubo-rectal and pubo-coccygeal portions of the levator ani (figure 2.15), we need to move laterally while still remaining in contact with the posterior vagina. The bundles of muscles running parasagittally are identifiable in most cases (figure 2.15) and if not it is the feeling of reaching a fixed plane perceived via the laparoscopic instruments which will allow them to be detected.

**Retropubic cave of Retzius**

This space is filled with fatty tissue and is located between the pubis, to the front, and the bladder to the rear. We access it through the anterior abdominal wall. The peritoneal incision is started on the midline (median umbilical fold) between the bulge of the symphysis and the midline operating trocar (figure 2.16). It is continued in each direction as far as the umbilical arteries (median umbilical fold). In order to enter the space, we have to cross the umbilicovesical fascia (figure 2.17), below which run the two umbilical arteries to the front of the bladder. It shows as a greyish membrane which is thinner here that at the origin of the umbilical arteries. One of the possible errors is to dissect too close to the peritoneum without going above this fascia, with a consequential risk of bladder injury.
2.15  Recto-vaginal septum and levator ani muscles to the left.
(1: vagina; 2: rectum; 3: left pubo-rectal and pubococcygeal
portions of the levator ani muscle; 4: uterosacral ligament).

2.16  Approach to the retropubic space. Anterior abdominal
wall
(1: medial umbilical ligament; 2: pubic symphysis; 3: left
umbilical artery)

2.17  Opening the retropubic space. Umbilicovesical fascia
(1: pubis; 2: umbilicovesical fascia)

**Umbilicovesical fascia**

This is a fibrous layer stretched between the two umbilical
arteries, the apex of the bladder and the umbilicus. The
intraperitoneal approach to the retropubic space needs this
fascia to be crossed. This is why the anterior abdominal
wall must be incised deep enough in order to gain access
to it. In addition, this fascia is often broken down during
total hysterectomy, during dissection of the paravesical
fossa and the origin of the uterine artery.

2.18  Retropubic space (Cave of Retzius).
(1: pubic symphysis; 2: pectinate ligament; 3: bladder;
4: internal right obturator muscle; 5: tendinous arch of the
levator ani).
2.19
Identifying the right umbilical artery after hysterectomy and prior to opening the right paravesical fossa.

Once the posterior surface of the pubic symphysis has been exposed with the bladder to the rear, we clear the lateral portions of this space (figure 2.18). The superior ramus of the pubis can then be identified, covered with the pectinate ligament (Cooper ligament) then the lateral abdominal wall with the internal obturator and ilio-coccygeal muscles separated by the tendinous arch of the levator ani muscle which fuses towards the front with the tendinous arch of the pelvic fascia. Behind this lateral portion, it is possible to see the foramen filled with the obturator pedicle.

**Lateral spaces and ligaments**

The paravesical and pararectal fossae run from the broad ligament to the abdominal walls. They are separated from each other by the lateral visceral ligaments.

**Paravesical fossa**

This can be approached after section of the round ligament and the suspensory ligament of the ovary if associated with hysterectomy and adnexectomy. If the uterus and ovary are conserved, the approach then uses an incision, parallel to the external iliac vessels, in the peritoneum stretching between the round ligament and suspensory ligament of the ovary. In either case the umbilical artery within the broad ligament is the standard landmark for the entry point (figure 2.19). If this artery is difficult to find, traction should be applied to it immediately above the pelvis in the anterior abdominal wall, in order to make it stand out in the broad ligament. Once it has been identified, it is pulled medially by the assistant and the fossa is opened laterally to it, and inside the external iliac vessels (figure 2.20). Dissection progresses by divergent traction by the instruments, following the trail of the gas in the cleavage plane.

This ensures that we remain strictly latero-vesical (umbilicovesical fascia) leaving the sub-venous cellulo-lymphatic layer containing the obturator pedicle towards the outside, lying against the external iliac vessel and abdominal wall.

2.20
Opening the right paravesical fossa (arrow).

**Umbilical artery**

This is the essential anatomical landmark when approaching the paravesical fossa, and also when searching for the origin of the uterine artery. If it is difficult to locate in the broad ligament, traction must be applied to it at the anterior abdominal wall so that it protrudes lower down.

This space is bordered medially by the lateral wall of the bladder and lateral ligament of the bladder, laterally by the internal obturator muscle with the superior ischiopubic ramus above it, and downwards and to the rear by the iliac-coccygeal muscle and parametrium-paracevix structure. Once it has been opened (figure 2.21), we are in contact with the lateral abdominal wall. At this point two muscles can be seen: the internal obturator muscle upwards, and the iliac-coccygeal part of the levator ani muscle downwards, separated one from the other by the tendinous arch of the levator ani muscle. In figure 2.21, the fusion of the aponeurosis of these two muscles, which gives rise to this arch, is perfectly visible. Relative to the skeletal structures,
the arch starts level with the ischial (sciatic) spine. Starting from this landmark, it is possible to continue dissection backwards to expose the ischiococcygeal muscle joined to the sacrospinous ligament. It is then possible to find the pudendal pedicle prior to its point of exit from the pelvis. This pedicle leaves the pelvic cavity via the infrapiriform foramen before entering the ischiorectal fossa behind the ischial spine and sacrospinous ligament.

In order to isolate the origin of the uterine artery within the parametrium during total hysterectomy, this paravesical space should also be enlarged inwards from the umbilical artery, and the umbilicovesical fascia broken down. It may also be useful to control this artery at its origin in a context of benign lesions. This is the case, for example, during excision of large myomas or during a hysterectomy when the ascending portions of the uterine pedicles are difficult to see.

In this type of situation, the artery and underlying ureter can be searched for via a limited opening at the surface of the paravesical fossa, inwards from the umbilical artery, and by allowing the gas to «work» once the surface connective tissue of the broad ligament has been spread apart (figure 2.22).

Origin of the uterine artery
The uterine artery arises from the anterior division of the internal iliac artery, either independently between the origin of the umbilical and obturator arteries, or frequently from a common umbilico-uterine trunk. Various techniques can be used to reach it. The most simple consists in moving down along the umbilical artery to its point of origin. It is also possible to follow the retroligamentary ureter, after first locating it in the broad ligament, to the point where it crosses the uterine artery. Finally, a more specifically laparoscopic method is to use the gas and «bubbles» which allow the search to proceed without taking the landmarks above into account but by making a limited opening in the paravesical space inwards from the umbilical artery.

Opening the paravesical space is the first phase in pelvic lymphadenectomy. Figure 2.23 shows a general view after complete pelvic lymphadenectomy. It is during this type of procedure that we can view certain somatic nerves running to the lower members. By pulling the external iliac vessels medially (figure 2.24) we can see, outside the primitive iliac vessels, the iliolumbar fossa containing the pelvic entry of the obturator nerve on the surface and deeper below, that of the lumbosacral trunk, protected by the iliolumbar vessels.
2.23
Right external iliac vessels after lymphadenectomy.

2.24
Left ilio-lumbar fossa.

2.25
Left ilio-lumbar fossa.
(1: obturator nerve; 2: lumbo-sacral trunk; 3: abdominal wall)

Pararectal fossa

This is narrower and also more «vascular» than the paravesical fossa, due to the presence of the internal iliac vessels and their collaterals in contact with the cleavage plane. So greater care is needed when opening it, and here even more than elsewhere the rule must be observed of progression through the tissues without perceiving any resistance. It is important from the functional point of view because it contains autonomic nervous system structures. Dissection starts between the retroligamentary ureter and the rectum, medially, and the anterior trunk of the internal iliac artery, laterally (figure 2.26). The pelvic peritoneum, already incised, is grasped by the assistant just above the ureter using a grasping forceps, and is drawn towards the midline. The operator uses two instruments to slip between the lateral surface of the rectum and the internal iliac artery, bearing in mind that it is easier to find the correct cleavage plane in the area around the origin of the uterine artery if the latter has previously been freed (figure 2.27). The instruments used may be a combination of bipolar forceps and scissors, or better still the lavage-aspiration cannula, in particular when freeing the lower part of the fossa. The limits of this space are: the pubococygeal bundle of the levator ani muscle downwards (figure 2.28), the rectum and uterosacral ligament medially, the abdominal wall (piriformis muscle) laterally, and to the fore, by the parametrium, paracervix and lateral ligament of the rectum.

From the vascular point of view, the middle rectal artery (figure 2.28) generally marks the lower limit for dissection.
after the uterine artery and one or more vaginal arteries have been exposed further up.

2.26
Approach to the right pararectal fossa (arrow).
(1: ureter; 2: rectum; 3: internal iliac artery (anterior trunk); 4: umbilical artery; 5: obturator nerve; 6: external iliac vein)

2.27
Approach to the right pararectal fossa (arrow).
(1: rectum; 2: internal iliac artery; 3: uterine vessels; 4: obturator nerve)

2.28
Deep inside the right pararectal fossa.
(1: rectum; 2: levator ani muscle, pubococygeal bundle; 3: middle rectal artery; 4: pelvic splanchnic nerve)

2.29
Right paravesical fossa. Hypogastric nerve.

In the upper part of the fossa, about 2 cm below the ureter, the hypogastric nerve runs along the lateral surface of the rectum (figure 2.29). It issues from the superior hypogastric plexus and carries the sympathetic innervation responsible for bladder compliance, among other things. It then travels through the dorsolateral part of the uterosacral ligament prior to its anastomosis with the pelvic splanchnic nerves at the inferior hypogastric plexus, from where efferent branches of the autonomic nervous system are distributed to the pelvic viscera. There is consequently a risk of damaging the hypogastric nerve during extensive resection of these ligaments.
Deeper into the dorsolateral part of the pararectal fossa and below the level of the middle rectal artery can be found the pelvic splanchnic nerves (figure 2.30). They arise from the anterior S2, S3, S4 rami and are mostly parasympathetic, governing the contractility of the detrusor with respect to micturition. To the right in Figure 2.30 can be seen the origin and divisions of one of these nerves, with the underlying sacral ramus. Given their proximity to the lateral ligaments, it is easy to understand the potential damage they may suffer during section of these ligaments.

2.30  
Right paravesical fossa. Pelvic splanchnic nerve  
(1.: rectum; 2: pelvic splanchnic nerve; 3: anterior sacral ramus).

2.31  
Left lateral view of the pelvis after opening the fossae.  

2.32  
View of the right paravesical and pararectal fossae with conservation of uterus and ovaries.  

2.33  
Complexity of the lateral «ligaments» on the right (arrow)  
(1: parametrium with sectioned uterine artery; 2: ureter; 3: paracervix with a vaginal artery; 4: umbilical artery)

After opening the paravesical and pararectal fossae, we have thus isolated the upper and lower surfaces of the parametrium and paracervix, centred around the umbilical-uterine trunk at the surface (figure 2.31). Finally, it should be noted that if the uterus and ovaries are conserved, these spaces can be approached with an adequate opening, as shown in figure 2.32.
Lateral «ligaments»: parametrium, paracervix

Figure 2.33 is a reminder of the close connections between these ligaments. The fossae have been opened, and to the right traction is pulling the parametrium upwards, with the ureter we can see the paracervical tissue along with a vaginal artery. Outwards, the close relationship between parametrium and paracervix is evident in this operative view.

The standard treatment for these ligaments during total hysterectomy consists of sectioning them after carrying out haemostasis away from their parietal insertions, with the distance depending on how wide an opening is desired. Laparoscopic haemostasis is usually achieved by successive steps of coagulation-section using the bipolar forceps and scissors, starting at the origin of the uterine artery.

As the laparoscopic approach allows the extremely fine autonomic nervous system structures in the pararectal fossa to be perceived, it is clear that this approach offers the possibility of improved control during procedures with respect to these nerves, compared with open surgery. Identification of the autonomic nervous system in the pelvis is the prerequisite for nerve-sparing, or preservation of these structures. The aim of this is to reduce morbidity, especially in terms of micturitional function during surgery for cancer and also for deep endometriosis. The concept has long existed, originating in Japan (Kobayashi, 1961) and initially described by laparotomy. While certain recent works [4] are still carried out using this approach, with ever greater accuracy, laparoscopy with its advantages concerning the anatomy seems to be an ideal tool.

These nerve-sparing techniques result from the nature of these lateral ligaments. Given that they consist of connective tissue, it is possible to carry out partial excision without having to section them completely. This means that the intraligamentary vessels and surrounding nerves can be preserved. In addition they contain lymph node elements and it is very interesting to observe, using the endoscopic approach, that the traditional limit inwards described for the obturator nerve during external iliac lymphadenectomy is purely virtual, because there is an obvious anatomical continuum at this point between the tissues on each side of this nerve. Excision of these tissues consequently obeys the same rules as during lymphadenectomy, hence the term also used of parametrial or paracervical lymphadenectomy [2]. Excision of the parametrial tissue starts at the umbilical-uterine trunk (figure 2.34) at the origin of the uterine artery. Dissection continues in the paracervix (figure 2.35) between the vaginal vessels and in contact with the lateral abdominal wall. Figure 2.35 perfectly illustrates once again the fusion between the parietal insertions of these ligaments. The final view is given in figure 2.36, where the lateral pelvic spaces have been made continuous thanks to removal of the connective tissue. Nevertheless, the feasibility of these nerve-sparing techniques is not so evident beyond the inferior hypogastric plexus, notably for the branches destined for the bladder which travel through the deep posterior-lateral part of the vesico-uterine ligaments. So the innovative idea of associating endoscopic dissection with peroperative electrostimulation is no doubt another step towards optimisation of these techniques [3].

2.34
Left parametrium after separation from the origin of the uterine artery.
(1: umbilical artery; 2: uterine artery; 3: ureter; 4: parametrium)

2.35
Left paracervix after partial excision and exposure of the vaginal vessels.


PELVIC URETER

Three sections will be described successively by endoscopy: a parietal and retroligamentary section, from its entry into the pelvis until the point where it crosses the uterine artery, an intraligamentary section between the parametrium upwards and the paracervix downwards, and finally a retrovesical section before it joins the bladder.

Only the parietal and retroligamentary section can be viewed transperitoneally (figures 2.3, 2.4, 2.37), where it can be identified thanks to its peristaltic movements. In this area it lies against the lateral pelvic peritoneum and consequently remains in a superficial position relative to the various internal iliac vessels. It enters the pelvis and crosses over the origin of the external iliac artery then runs above the internal iliac artery (figure 2.4) to move inwards from the umbilical artery and run medially relative to the origin of the uterine artery before crossing it.

It must be paid particular attention during any procedure involving haemostasis of the ovarian and/or uterine pedicles, and also during conservative treatment of adnexal lesions with a pathological peritoneum, which may alter its anatomical relationships. In this connection, during hysterectomy one of the specific steps of the laparoscopic approach consists of creating a window in the broad ligament (see chapter 9, page 158). There are two points to note about this window, which can be seen in figure 2.37: it enables a pedicle to be created for the proximal part of the adnexa and suspensory ligament of the ovary, making bipolar haemostasis easier, but above all leaves the ureter laterally within the broad ligament well away from the areas to be coagulated. Associated with the distance created by stenting with the cannula, this procedure contributes greatly to ensuring the safety of the ureter, and we can do no other than recommend carrying it out, even in cases of simple adnexectomy.

In figure 2.38, the ureter has been deliberately exposed in the broad ligament in order to show its relationships with the ascending portion of the uterine pedicle during simple laparoscopic hysterectomy. The safety distance visible here between these two structures is quite adequate when the uterus is cannulated, and after the various phases in the operation that result in control over the ascending portions of the uterine pedicles. Note in this example that the left uterine artery has been coagulated at its origin. Finally it is possible in this figure to see the left retrovesical portion of the ureter located laterally and to the rear of the previously dissected vesico-uterine ligament.

When the peritoneum is pathological, as in case of endometriosis, the need to dissect the ureter in order to protect it during treatment is a situation encountered very frequently. In this case do not hesitate to look for it and incise the peritoneum high above the lesions, in the region of the promontory, for example, especially on the left side where loops of bowel may get in the way.

2.38
Relationship between the left ureter and uterine pedicle in a hysterectomy.

The ureter leaves the surgeon's field of vision as soon as it goes under the parametrium, from whence it becomes intraligamentary (figure 2.39). From then on it is covered by the proximal parametrium and the vesico-uterine ligament, and here we can see the extremely intricate relationship. In this view, exposure has been completed by transparietal fixation of the vesical peritoneum. Dissection of the intraligamentary and retrovesical ureter should be envisaged mainly in a context of total hysterectomy. It consists of creating a tunnel inwards from the ureter, in contact with its adventitious sheath (figure 2.40).

2.39
Right intraligamentary ureter covered by the parametrium and vesico-uterine ligament.

2.40
Dissection of the intraligamentary and retrovesical ureter.
(1: retroligamentary ureter; 2: uterine artery and parametrium; 3: start of the intraligamentary tunnel; 4: vesico-uterine ligament).
Final view after dissection of the intraligamentary and retrovesical ureter.


The roof of this tunnel, corresponding to the parametrium with the uterine artery then the vesico-uterine ligament, is coagulated then sectioned progressively, always inwards from the ureter. This ureteral segment is thus freed right up to the bladder (figure 2.41).

Identifying the pelvic ureter

This is indispensable for most pelvic gynaecological surgical procedures. While the ureter can be palpated in order to identify it in open abdominal surgery, with laparoscopic surgery the only possibility relies on direct vision by the surgeon. To begin with we will attempt to identify the parietal and intraligamentary portion by transperitoneal vision. Its peristaltic movements at this point will help it stand out from the adjacent vascular structures. If this identification is difficult and if the indication so requires, notably in case of a pathological peritoneum, the search must continue retroperitoneally, after incision of the broad ligament located between the point where the suspensory ligament of the ovary emerges in the pelvis and the line of the external iliac vessels. Once it has been identified, it can then be followed and dissected as required by the surgical procedure to be carried out.

CONCLUSION

Thanks to its specific nature, laparoscopic surgery today enables us to enjoy an extremely accurate and detailed view of the living tissues. It offers the surgeon the possibility of real «anatomical control» over his movements, fully meeting the requirements of today’s surgery, whether for excision or for repair. In addition to its minimally invasive nature, this anatomical advantage has become without question one of its major advantages. However, familiarity with the pelvic retroperitoneum along with total control of the laparoscopic environment remain indispensable for the success of this surgical approach.

To conclude, from the educational point of view and thanks to the provision of these in vivo images, laparoscopy is a very attractive new tool for the teaching of pelvic anatomy.

Bibliography


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