Direct Carbon Dioxide Insufflation of the Retroperitoneum under Laparoscopic Control for Renal and Adrenal Surgery

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ABSTRACT

Objective: Assessment of the videoscopic approach to the retroperitoneal space in the vicinity of the kidney and the adrenal gland.

Design: Open study.

Setting: University hospital, Belgium.

Subjects: 10 patients who underwent 11 operations (adrenalectomy, n = 3, nephrectomy, n = 5, partial nephrectomy, n = 2, and renal cystectomy, n = 1).

Interventions: Direct CO2 insufflation of the retroperitoneal space in order to obtain a convenient retroperitoneal working space for renal and adrenal surgery.

Outcome Measures: Feasibility, morbidity and mortality.

Results: 8 patients were operated on exclusively by the retroperitoneoscopic approach; 2 required the retroperitoneal and transperitoneal routes to be combined to complete an adrenalectomy. No patients required blood transfusion and no patient died. Median postoperative stay was 3 days.

Conclusion: The CO2 insufflation technique of the retroperitoneum is safe and reproducible. Nevertheless, far from excluding each other, both approaches—laparoscopic and retroperitoneoscopic—are complementary in difficult cases, particularly for adrenal endoscopic surgery and for larger renal lesions.

Key words: laparoscopy, retroperitoneum, adrenalectomy, nephrectomy.

INTRODUCTION

Surgeons who are starting to do endoscopic renal or adrenal surgery are advised to use a transabdominal technique. Once familiar with endoscopic surgical anatomy of the retroperitoneal space, we think an experienced laparoscopic surgeon will find some advantages from the retroperitoneal approach for selected patients (3, 4, 7). As in open surgery the videoscopic extraperitoneal approach to the kidney or the adrenals allows it to be done without interference with intraperitoneal organs. Even if the working space is less, the retroperitoneal approach is more direct and obviates the need for transperitoneal dissection of the overlying colon, liver, spleen, or pancreas, which can be both tedious and time consuming. Furthermore direct access to the kidney or adrenal probably causes less postoperative peritoneal adhesions. We hypothesised therefore that the videoscopic retroperitoneal approach would be an interesting alternative to the laparoscopic approach to the retroperitoneal space, and here we describe our preliminary results with this approach. We also report the technical changes we made that led us to our current technique for direct carbon dioxide (CO2) insufflation of the retroperitoneum, allowing us to transform the virtual (and potential) space of the retroperitoneum into an actual (and anatomical) space in which we could safely do retroperitoneoscopic procedures.

PATIENTS AND METHODS

The feasibility of the retroperitoneoscopic approach for renal and adrenal surgery using insufflation of the retroperitoneum with CO2 was initially assessed and the technical aspects were developed on an experimental model (1, 3, 9). After we had gained expertise with retroperitoneoscopic surgery in this animal model, we proposed this approach to 10 patients between September 1993 and December 1995. Specific informed consent to the planned procedures was obtained.

Operative technique

The patient is placed in the lateral decubitus position with the side to be operated on upwards. At the
beginning of our experience a Verres needle was introduced under ultrasonographic control in the lumbar triangle (between the twelfth rib and the iliac crest on the posterior axillary line) and advanced under continuous sonographic control until its tip lay just behind the posterior plane of the lower pole of the kidney. At this level the needle is assumed to reside well within the perirenal fat inside Gerota’s fascia. The retroperitoneal space is then insufflated with CO₂ at a rate of 1L/minute with a preset pressure limit of 12 mm Hg. After instillation of 1.5 L of CO₂, the Verres needle is replaced by a 10 mm disposable trocar. An operating telescope with a working channel (Olympus A5240A® coaxial laparoscope 10 mm in diameter) is inserted through this initial trocar. The retroperitoneal space already created by the pneumoretroperitoneum is easily widened by blunt dissection with the telescope. Gerota’s fascia is then opened with the coagulator hook or scissors introduced through the working channel of the operating telescope. Once a bloodless dissection of the loose perirenal fat has been obtained—separating the peritoneal layer from the fat tissues of the retroperitoneal space—two or three other trocars can be introduced under direct vision.

The sonographic controlled technique of insertion of the Verres needle was used at the beginning of our experience in two patients. Currently we have changed our technique of creating the pneumoretroperitoneum somewhat. An anterior Verres needle is introduced below the costal margin and a pneumoretroperitoneum created just as for routine laparoscopy, the only difference being that the patient is placed in the lateral decubitus position. Once the pneumoretroperitoneum is achieved, the peritoneal cavity is examined with a laparoscope introduced through a trocar replacing the subcostal Verres needle. A second Verres needle is introduced in the lumbar triangle and carefully advanced to the perirenal space (Figure 1a). A bump is felt when the Gerota’s fascia is crossed. The correct positioning of the retroperitoneal posterior Verres needle can be clearly controlled by the laparoscopic optic when the atraumatic needle tip slightly raises the retroperitoneal layer without perforating it. The retroperitoneum can then be insufflated with CO₂ at a rate of 1L/minute with a preset pressure limit of 12 mm Hg. The progressive development of the pneumoretroperitoneum can clearly be seen through the laparoscopic optic (Figure 1b). By the time the pneumoretroperitoneum has raised the colon, the pneumoretroperitoneum is progressively exsufflated allowing the pneumoretroperitoneum to progress further without increase in the retroperitoneal pressure above 12 mm Hg.

This modification of our initial technique has the advantage that it allows us to instill up to 4.0 L of CO₂ safely into the retroperitoneum instead of only 1.5 L of CO₂ as it was the case with the ultrasonographic technique of positioning the Verres needle. The direct benefit is that a wider retroperitoneal working space is obtained and that the posterior Verres needle can be replaced by a posterior 10 mm disposable trocar without risk to the retroperitoneal or peritoneal structures. As for the initial ultrasonographic technique, the retroperitoneal working space can be widened if necessary by blunt dissection with the operating telescope with a working channel introduced through the posterior trocar. Furthermore, two or three additional trocars can be introduced under direct vision through this posterior telescope and under intraperitoneal control through the initial subcostal laparoscope. Those additional trocars are placed as close as possible to the peritoneal compartment without entering it to space them out as much as possible and in this way avoid the tedious “knitting effect” of endoscopic instruments. For these reasons we changed from the
ultrasonographic technique of positioning the Verres needle (even if it was simple and did not result in any complications in the two first cases we managed this way) to retroperitoneoscopic positioning of the Verres needle under laparoscopic control.

Dissection of the kidney is started by identification of the ureter, which is cut between two ligatures or clips. The proximal ureter is pulled upward to facilitate exposure of the renal pedicle. The posterior aspect of the renal pedicle is dissected and the renal artery is ligated or secured with titanium clips. After ligation of the vein and liberation from all remaining adhesions, the kidney is extracted in a self-sealing plastic through a short lumbar incision.

For adrenalectomy the procedure is basically the same. The adrenal is identified at the internal side of the upper pole of the kidney. The entire upper pole of the adrenal is carefully dissected. Each small peripheral vessel is clipped to obtain a bloodless dissection of the upper portion of the adrenal. Once this has been done the dissection can be completed by liberation of the lower portion and clipping of the main vessels in the vicinity of the renal vein (for the left adrenal) or the inferior vena cava (for the right adrenal). The adrenal is extracted in a self-sealing bag through one of the trocars.

RESULTS

We have currently done 11 videoscopic retroperitoneal procedures in 10 patients (one female and nine male, median age 50 years; range 8–73); one adrenalectomy was for primary hyperaldosteronism, one for an isolated metastasis from an adenocarcinoma of the lung operated on four years before, and one for a non-functioning adenoma in a 116 kg man. Five nephrectomies were for end-stage infected hydronephrosis and two partial nephrectomies for well-circumscribed lesions of the kidney (small hypernephroma) in high risk patients (American Society of Anesthesiologists class III). One partial nephrectomy was associated with the resection of a cyst 10 cm in diameter at the upper pole of the kidney. The initial approach was retroperitoneal using the retropneumoperitoneal insufflation technique in all 10 patients.

The renal operation in seven patients and the adrenal operation in one were done exclusively by the retroperitoneoscopic approach. Two patients were operated on by a combined approach using the retroperitoneal and transperitoneal routes for dissection of adrenal lesions (primary hyperaldosteronism and non-functioning adenoma). For these two patients the retroperitoneal technique was conveniently transformed into an intraperitoneal procedure by simply incising Toldt’s fascia (for one patient we could not properly identify the adrenal by the retroperitoneal approach and for the second patient the peritoneal layer was slightly lacerated which caused a leak of the pneumoretroperitoneum toward the peritoneal cavity). Nevertheless all 10 procedures were successfully completed endoscopically. No patients required blood transfusion.

The median duration of the procedure was 250 minutes (range 145–360 minutes), and median postoperative hospital stay was 3 days (range 2–4 days). Satisfactory postoperative analgesia was obtained in all cases with intravenous paracetamol. Patient-controlled analgesia was not required after these operations, and patients were mobilised 12 hours after surgery. No patients died.

In five patients, we noticed an intraoperative increase in arterial CO2 (median 50 mm Hg, range 46–58) associated in some cases with a discrete acidosis (median pH 7.3, range 7.25–7.34). This hypercapnia appeared at the beginning of the procedure (mean time 22 minutes) and disappeared completely at the end of CO2 insufflation without any clinical consequence for the patients.

DISCUSSION

Conventional renal and adrenal operations usually require long incisions that cause postoperative pain and morbidity. The relatively small size of most adrenal tumours contrasts oddly with the long laparotomy or lumbar incisions. Available data suggest that renal and adrenal lesions can safely be excised by laparoscopic techniques (2, 5–7, 11). We hypothesised that the videoscopic retroperitoneal approach would be an interesting alternative to the laparoscopic approach to the retroperitoneal space, because, even if the working space is less, the retroperitoneal approach is more direct and therefore potentially less time-consuming. Our current experience with it suggests that there is no appreciable difference in operative time compared with reported data about laparoscopic approach, at least for adrenal lesions (4–8, 10, 11).

Although the retroperitoneoscopic approach, mainly for the kidney, seems to be safe and does not interfere with the intraperitoneal organs, there have been instances of intraperitoneal damage when the laparoscopic approach has been used (for example, splenic injury has been reported) (10). The retroperitoneal working space allows direct access on the kidney with good posterior exposure of its pedicle. If necessary, dissection can be extended down to the pelvic ureter or up to the diaphragm. Combining the retroperitoneal approach with initial and temporary intraperitoneal insufflation with CO2 (to introduce an intraperitoneal
trocar which allows safe control of the progressive development of the pneumoretroperitoneum) does not rule out all the benefits of the retroperitoneal approach, because this surgical strategy obviates the need for transperitoneal dissection of the overlying colon, liver, spleen, or pancreas. We found that for certain patients who had previously undergone intraperitoneal operations (colonic operation in one of our patients), the retroperitoneal approach was convenient. On the other hand, we found that it was safe and comfortable to have an intraperitoneal trocar in place if anything did go wrong during the retroperitoneal dissection of the upper pole or the inner face of the kidney (after previous nephropexy in one other patient). Indeed, should any difficulties arise when the retroperitoneoscopic approach has been chosen, it can immediately be converted to a laparoscopic approach without any consequence or delay for the patient. The laparoscopic dissection of the kidney or the adrenal can be easily completed as a retroperitoneal working space has been previously developed by the technique of pneumoretroperitoneum. Therefore far from excluding each other, the two approaches are complementary. We would, however, reserve the retroperitoneal approach for small renal lesions or atrophic kidneys because of the difficulties of manipulating bigger masses in a relatively small space.

Among the disadvantages is the fact that the retroperitoneal working space is small. If the trocars are too close, the instruments will become tangled. Another disadvantage is related to the accidental loss of the pneumoretroperitoneum when the peritoneal layer is lacerated or when suction has to be used in the case of bleeding. The retroperitoneal approach, therefore, requires meticulous dissection and thorough haemostasis. Laceration of the peritoneal layer is a potential pitfall during a retroperitoneoscopic procedure that can be easily overcome by transforming the retroperitoneal technique into an intraperitoneal procedure by simply incising the Toldt’s fascia. This is rapidly done if an intraperitoneal trocar has been placed at the beginning of the procedure, as we currently do for the retroperitoneoscopic positioning of the Verres needle under laparoscopic control. Laceration of the peritoneal layer during a retroperitoneoscopic procedure does not carry the risk of injuring the intraperitoneal organs, as the laceration will most likely be at the level where the peritoneal layer is thin and fragile not being covered by overlying peritoneal viscera.

A third disadvantage is that sometimes it is difficult to achieve good orientation in the retroperitoneal space where there are few visual anatomical landmarks in a smaller working space. Moreover, trocar placement in the lumbar triangle changes the angle of view from the optic and alters the surgeon’s accustomed perspective.

For adrenal surgery we found that the retroperitoneoscopic dissection was difficult, because of the proximal location of the gland and because movements of endoscopic instruments are often impaired by the closeness and the stiffness of the costal margin and the iliac crest. We advise endocrine surgeons or urologists who are starting to do laparoscopic nephrectomy or adrenalectomy to use a transperitoneal approach to begin with. Orientation is much easier to maintain and the technique allows for a larger working space (2). Once familiar with the endoscopic surgical anatomy of the retroperitoneum an experienced laparoscopic surgeon will find the retroperitoneal approach interesting for selected patients.

Several explanations of the transient and moderate hypercapnia that we noticed in five patients can be suggested. The lateral position of the patients may cause a ventilation—perfusion mismatch, or higher CO₂ diffusion in the interstitial and dissected tissue of the retroperitoneal space. Gaz crackling was felt in three patients in the lumbar area, thoracic wall, or neck. The only way of resolving the intraoperative hypercapnia is to overventilate the lungs with a raised minute volume in such a way as to clear the additional CO₂ and keep open the basal segments of the lungs. Monitoring of the end-tidal CO₂ during operation is safe and simple as it correlates well with arterial CO₂. The discrete hypercapnia started at the beginning of the procedure and completely disappeared at the end of insufflation of CO₂ without any clinical consequence for the patients.

Satisfactory pain control was obtained by giving only paracetamol intravenously for the first 36 hours postoperatively. There were no differences between patients who underwent the retroperitoneoscopic procedure and patients who had their procedure converted or not to a combined laparoscopic and retroperitoneoscopic procedure. Although the operating time can be longer than that for open operations (at least when experience is gained), the analgesic requirements and the time to resumption of full diet and mobilisation are shorter for both the retroperitoneoscopic and combined approach.

Some authors (2, 8, 9) have proposed that balloon-assisted dissection of the retroperitoneum is the procedure of choice for a wide array of operations that can be attempted by experienced laparoscopic surgeons in the near future. We think it is too early to be so definite. So far we are impressed and satisfied with our CO₂ insufflation technique of the retroperitoneum under laparoscopic control. This technique is bloodless, atraumatic, and probably safer than the
balloon technique, which is a relatively blind approach at least during the initial steps of the procedure.

Reports of the experience of surgical teams from all over the world are required before definite and convincing answers can be given to many questions raised by the minimally invasive approach to renal and adrenal diseases.

REFERENCES


RéSUMÉ

Type d’étude: Ouverte.
Provenance: Hôpital universitaire, Belgique.
Patients: Dix patients ayant eu 11 interventions (3 surrenalectomies, 5 néphrectomies, 2 néphrectomies partielles, et une kystectomie rénale).
Méthodes: Insufflation directe de CO2 dans l’espace rétroperitonéal de façon à obtenir un espace de travail suffisant pour opérer le rein et la surrenale.
Principaux critères de jugement: La faisabilité, et la mortalité.
Résultats: Huit patients ont été exclusivement opérés sous rétropéritonéoscopie; chez deux patients les voies rétro et intrapéritonéales ont du être associées pour réaliser une surrenalectomie. Aucune transfusion n’a été nécessaire et il n’y a eu aucun décès. La durée médiane d’hospitalisation postopératoire a été de 3 jours.

Conclusions: La technique d’insufflation de CO2 dans l’espace rétropéritonéal est sûre et reproductible. Néanmoins, loin de s’exclure l’une l’autre, les deux voies rétropéritonéoscopique et coelioscopique, sont complémentaires dans les cas difficiles, notamment pour la chirurgie surrenalienne endoscopique et pour des lésions rénales plus volumineuses.
Mots-clés: Coelioscopie, rétropéritoine, surrenalectomie, néphrectomie.
доступом для выполнения полноценной адреналэктомии. Ни в одном случае не потребовалось переливания крови, также не было отмечено случаев летальности. Средняя послеоперационная продолжительность пребывания в стационаре составила 3 дня.

**Выводы:** Техника инсuffляции CO₂ в ретроперитонеальное пространство является безопасным и легко выполняемым методом. Тем не менее лапароскопический и ретроперитонеоскопический доступы не исключают, а напротив, взаимодополняют друг друга в сложных случаях, особенно для эндоскопической хирургии надпочечников и при больших повреждениях почек.

**Ключевые слова:** Лапароскопия, ретроперитонеум, адреналэктомия, нефрэктомия.

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Design: Open study.
Setting: University hospital, Belgium.
Subjects: 10 patients who underwent 11 operations (adrenalectomy, n = 3, nephrectomy, n = 5, partial nephrectomy, n = 2, and renal cystectomy, n = 1).
Interventions: Direct CO₂ insufflation of the retroperitoneal space in order to obtain a convenient retroperitoneal working space for renal and adrenal surgery.
Outcome Measures: Feasibility, morbidity and mortality.
Results: 8 patients were operated on exclusively by the retroperitoneoscopic approach; 2 required the retroperitoneal and transperitoneal routes to be combined to complete an adrenalectomy. No patients required blood transfusion and no patient died. Median postoperative stay was 3 days.
Conclusion: The CO₂ insufflation technique of the retroperitoneum is safe and reproducible. Nevertheless, far from excluding each other, both approaches—laparoscopic and retroperitoneoscopic—are complementary in difficult cases, particularly for adrenal endoscopic surgery and for larger renal lesions.

Key words: laparoscopy, retroperitoneum, adrenalectomy, nephrectomy.

INTRODUCTION
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PATIENTS AND METHODS
The feasibility of the retroperitoneoscopic approach for renal and adrenal surgery using insufflation of the retroperitoneum with CO₂ was initially assessed and the technical aspects were developed on an experimental model (1, 3, 9). After we had gained expertise with retroperitoneoscopic surgery in this animal model, we proposed this approach to 10 patients between September 1993 and December 1995. Specific informed consent to the planned procedures was obtained.

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The patient is placed in the lateral decubitus position with the side to be operated on upwards. At the
beginning of our experience a Verres needle was introduced under ultrasonographic control in the lumbar triangle (between the twelfth rib and the iliac crest on the posterior axillary line) and advanced under continuous sonographic control until its tip lay just behind the posterior plane of the lower pole of the kidney. At this level the needle is assumed to reside well within the perirenal fat inside Gerota’s fascia. The retroperitoneal space is then insufflated with CO\(_2\) at a rate of 1 L/minute with a preset pressure limit of 12 mm Hg. After instillation of 1.5 L of CO\(_2\), the Verres needle is replaced by a 10 mm disposable trocar. An operating telescope with a working channel (Olympus A5240A\(^{\circ}\) coaxial laparoscope 10 mm in diameter) is inserted through this initial trocar. The retroperitoneal space already created by the pneumoretroperitoneum is easily widened by blunt dissection with the telescope. Gerota’s fascia is then opened with the coagulator hook or scissors introduced through the working channel of the operating telescope. Once a bloodless dissection of the loose perirenal fat has been obtained—separating the peritoneal layer from the fat tissues of the retroperitoneal space—two or three other trocars can be introduced under direct vision.

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This modification of our initial technique has the advantage that it allows us to instill up to 4.0 L of CO\(_2\) safely into the retroperitoneum instead of only 1.5 L of CO\(_2\) as it was the case with the ultrasonographic technique of positioning the Verres needle. The direct benefit is that a wider retroperitoneal working space is obtained and that the posterior Verres needle can be replaced by a posterior 10 mm disposable trocar without risk to the retroperitoneal or peritoneal structures. As for the initial ultrasonographic technique, the retroperitoneal working space can be widened if necessary by blunt dissection with the operating telescope with a working channel introduced through the posterior trocar. Furthermore, two or three additional trocars can be introduced under direct vision through this posterior telescope and under intraperitoneal control through the initial subcostal laparoscope. Those additional trocars are placed as close as possible to the peritoneal compartment without entering it to space them out as much as possible and in this way avoid the tedious “knitting effect” of endoscopic instruments. For these reasons we changed from the
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RESULTS

We have currently done 11 videoscopic retroperitoneal procedures in 10 patients (one female and nine male, median age 50 years; range 8–73); one adrenalectomy was for primary hyperaldosteronism, one for an isolated metastasis from an adenocarcinoma of the lung operated on four years before, and one for a non-functioning adenoma in a 116 kg man. Five nephrectomies were for end-stage infected hydronephrosis and two partial nephrectomies for well-circumscribed lesions of the kidney (small hypernephroma) in high risk patients (American Society of Anesthesiologists class III). One partial nephrectomy was associated with the resection of a cyst 10 cm in diameter at the upper pole of the kidney. The initial approach was retroperitoneal using the retropneumoperitoneal insufflation technique in all 10 patients.

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Several explanations of the transient and moderate hypercapnia that we noticed in five patients can be suggested. The lateral position of the patients may cause a ventilation—perfusion mismatch, or higher CO₂ diffusion in the interstitial and dissected tissue of the retroperitoneal space. Gaz crackling was felt in three patients in the lumbar area, thoracic wall, or neck. The only way of resolving the intraoperative hypercapnia is to overventilate the lungs with a raised minute volume in such a way as to clear the additional CO₂ and keep open the basal segments of the lungs. Monitoring of the end-tidal CO₂ during operation is safe and simple as it correlates well with arterial CO₂. The discrete hypercapnia started at the beginning of the procedure and completely disappeared at the end of insufflation of CO₂ without any clinical consequence for the patients.

Satisfactory pain control was obtained by giving only paracetamol intravenously for the first 36 hours postoperatively. There were no differences between patients who underwent the retroperitoneoscopic procedure and patients who had their procedure converted or not to a combined laparoscopic and retroperitoneoscopic procedure. Although the operating time can be longer than that for open operations (at least when experience is gained), the analgesic requirements and the time to resumption of full diet and mobilisation are shorter for both the retroperitoneoscopic and combined approach.

Some authors (2, 8, 9) have proposed that balloon-assisted dissection of the retroperitoneum is the procedure of choice for a wide array of operations that can be attempted by experienced laparoscopic surgeons in the near future. We think it is too early to be so definite. So far we are impressed and satisfied with our CO₂ insufflation technique of the retroperitoneum under laparoscopic control. This technique is bloodless, atraumatic, and probably safer than the
balloon technique, which is a relatively blind approach at least during the initial steps of the procedure.

Reports of the experience of surgical teams from all over the world are required before definite and convincing answers can be given to many questions raised by the minimally invasive approach to renal and adrenal diseases.

REFERENCES


ZUSAMMENFASSUNG

Ziel: Die Beurteilung des videoskopischen Zugangs zum retroperitonealen Raum im Bereich der Niere und der Nebenniere.

Studienanordnung: Offene Studie.

Studienort: Universitätskrankenhaus, Belgien.

Patienten: 10 Patienten, bei denen 11 Operationen durchgeführt wurden (Adrenalektomie n = 3, Nephrektomie n = 5, partielle Nephrektomie n = 2, renale Cystektomie n = 1)

Material: Die direkte CO₂-Insufflation des retroperitonealen Raumes, um einen günstigen retroperitonealen Arbeitsraum zur operativen Versorgung der Niere oder Nebenniere zu erzeugen.

Endpunkte: Durchführbarkeit, Morbidität und Mortalität.


Schlussfolgerungen: Die CO₂-Insufflationstechnik des Retroperitoneums ist sicher und wiederholbar. Trotzdem, sind beide Zugänge, die Laparoskopie und die Retroperitoneoskopie, in schwierigen Fällen komplementär zu betrachten, insbesondere für die endoskopische Chirurgie der Nebennieren und für größere renale Läsionen.

Schlüsselwörter: Laparoskopie, Retroperitoneum, Adrenalectomie, Nephrektomie.

РЕЗОГМЕ

Цель: Оценка видеоскопического доступа к ретроперitoneальному пространству в области почек и надпочечников.

Характер исследования: Открытое исследование.

Клиника: Университетский госпиталь, Беларусь.

Пациенты: 10 пациентов, которые подверглись 11 оперативным вмешательствам, в 3 случаях адrenalectомия, в 5 случаях нефректомия, в 2 случаях порционная нефректомия, в 1 случае удаление кисты почки.

Методы исследования: Прямая инсуффлирование CO₂ в ретроперitoneальную область с целью получения необходимого рабочего пространства для почечной и надпочечной хирургии.

Задачи исследования: Изучение возможности выполнения подобных операций, а также последовательных осложнений и летальности.

Результаты: 8 пациентов были оперированы исключительно из ретроперitoneоскопического доступа, у 2 пациентов была выполнена комбинация ретроперitoneального с трансперitoneальным
доступом для выполнения полноценной адреналэктомии. Ни в одном случае не потребовалось переливания крови, также не было отмечено случаев летальности. Средняя послеоперационная продолжительность пребывания в стационаре составила 3 дня.

Выводы: Техника инсуффляции СО₂ в ретро-перитонеальное пространство является безопасным и легко выполнимым методом. Тем не менее лапароскопический и ретрооперитонеоскопический доступы не исключают, а напротив, взаимодополняют друг друга в сложных случаях, особенно для эндоскопической хирургии надпочечников и при больших повреждениях почек.

Ключевые слова: Лапароскопия, ретроперitoneум, адреналэктомия, нефэктомия.

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