Laparoscopic nephrectomy: comparison of dialysis and non-dialysis patients

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Abstract

**Background.** Laparoscopy is believed to result in possible clinical benefits for the patient. We report our experience with renal laparoscopy in dialysis patients and compare the results with those from non-dialysis patients.

**Methods.** Between December 1994 and April 1997, 19 dialysis patients underwent laparoscopic nephrectomy or nephroureterectomy at our hospital. The group consisted of 11 female and eight male patients (mean age 45 years). In nine patients the indication for nephrectomy was chronic pyelonephritis. Nephroureterectomy for vesicoureteral reflux with recurrent episodes of pyelonephritis or analgesic nephropathy for exclusion of transitional cell carcinoma of the upper urinary tract was considered in nine other patients. Laparoscopic bilateral nephrectomy for drug-resistant hypertension was performed in one patient. In comparison, a consecutive group of non-dialysis patients who had undergone renal laparoscopy was reviewed.

**Results.** In the dialysis group, one patient had to be converted to open nephrectomy due to bleeding. Six dialysis patients required blood transfusions compared with none in the non-dialysis group. There were four complications in the dialysis group and two in the non-dialysis group. Both groups had comparable results for operative times, analgesic consumption, postoperative start of oral intake and mobilization, and duration of hospitalization and convalescence.

**Conclusions.** Laparoscopic nephrectomy in dialysis patients has acceptable results. The higher transfusion rate is probably due to a lower preoperative haemoglobin and is not aggravated by possible affects of the clotting system in patients with chronic uremia.

Key words: bleeding; complications; haemodialysis; laparoscopy; nephrectomy; nephroureterectomy; uremia

Introduction

Laparoscopic nephrectomy was first performed in 1990 by Clayman and colleagues [1]. Since then, many urological centres have adopted this minimally invasive technique. Most complications of laparoscopic nephrectomy occur during the postoperative period [2,3]. A potential problem is bleeding during laparoscopy, which requires adequate control and, if not controlled during laparoscopy, immediate laparotomy. This bleeding has been shown to occur in 0.93 cases per 10,000 gynaecological laparoscopies [4,5].

Little is known about renal laparoscopy in dialysis patients. These patients are thought to possibly have an affected blood clotting system with increased occurrences of both bleeding and thrombosis when compared with non-dialysis patients. Bleeding, spontaneously or from tissue traumatization, is mainly associated with platelet dysfunction and reduced capillary resistance [6,7]. Thrombosis may be evident, however, due to arteriosclerosis, hypercoagulation or hypofibrinolysis [8,9].

In this paper we report our experience with 19 dialysis patients who underwent laparoscopic nephrectomy for benign diseases at the Medical University of Lübeck and compare the results with those from non-dialysis patients.

Subjects and methods

**Patients**

Between December 1994 and April 1997, 19 dialysis patients underwent laparoscopic nephrectomy or nephroureterectomy for various benign diseases at our institution (Table 1). The group comprised 11 female and eight male patients with a mean age of 45 years (range, 24–70). The mean duration of haemodialysis was 60 months (range, 6–180). Four patients had previously undergone renal transplantation but had lost allograft function due to chronic rejection. No patient received immunosuppressive medication at the time of laparoscopy.

Twelve patients had either laparoscopic nephrectomy \( (n = 9) \) or nephroureterectomy \( (n = 3) \) for chronic pyelonephritis...
with or without vesicoureteral reflux. Six patients with known analgesic abuse underwent laparoscopic nephroureterectomy for exclusion of transitional cell carcinoma of the upper urinary tract prior to a planned renal transplantation. One patient with drug-resistant hypertension was selected for laparoscopic bilateral nephrectomy.

In comparison, a consecutive group of non-dialysis patients was reviewed (Table 1). These patients underwent laparoscopy at our institution between September 1995 and March 1996. There were 12 patients who had a laparoscopic nephrectomy for non-functioning and chronically infected kidneys. Seven patients had a laparoscopic nephroureterectomy for vesicoureteral reflux. One renal transplant patient had a laparoscopic bilateral nephrectomy for drug-resistant hypertension.

### Preoperative investigations

Most patients were admitted the day before the operation for routine preoperative investigations. Patients had been instructed to discontinue drugs affecting platelet function (for example acetylsalicylic acid) during the week before the operation. None of the patients had a known dysfunction of the clotting system. Routine coagulation tests such as partial thromboplastin time, prothrombin time, thrombin time and fibrinogen were within the normal range prior to laparoscopy. Patients with vesicoureteral reflux had a reflux cystogram and a cystoscopy before the operation. Patients with known analgesic abuse had a cystoscopy to exclude transitional cell carcinoma of the bladder.

Haemodialysis was performed on the day before laparoscopy in all patients. A 10 mg suppository of bisacodyl was given on the evening before the operation and oral intake was stopped at least 10 h before laparoscopy. According to results from previous urine cultures, adequate antibiotic medication was given before laparoscopy.

### Statistics and follow-up

Statistical analysis for comparison of parameters for both groups was carried out using the Mann–Whitney U test. Follow-up data were obtained from patient charts, telephone interviews and patient visits to our outpatient department.

### Operative techniques

Following the induction of general anaesthesia, a nasogastric tube and bladder catheter were inserted in all patients. For unilateral nephrectomy the patients were placed in a supine or semiflank position. The arteriovenous fistula was padded carefully. The Verres needle was inserted periumbilically and carbon dioxide insufflated to an initial intra-abdominal pressure of 12–15 mmHg.

For simple nephrectomy 3–5 trocars were placed after transillumination of the inside abdominal wall using the endocamera. The operating table was rotated to the non-affected side. The peritoneum was incised along the line of Toldt and the colon mobilized and retracted medially. The ureter was identified above its cross over the iliac vessels and ligated using clips. Following the proximal ureter, the renal hilum was exposed and the renal vessels ligated. The renal artery was divided between clips and in most cases the vein was secured using a vascular stapler. Dissection of the remaining fat and connective tissue was completed for full mobilisation of the kidney.

For nephroureterectomy the patient was placed in a semi-flank position and 4–6 trocars were used. The kidney was mobilized completely followed by downward dissection along the ureter. The ureter was clipped at the vesicoureteral junction. A cuff on the bladder was not removed.

The technique of laparoscopic bilateral nephrectomy was as described previously [10].

In all cases the kidney and ureter were placed in an organ entrapment sack and removed through an extended skin incision. A morcellation of the kidney was not performed. Finally, the intra-abdominal pressure was reduced to 5 mmHg and the abdomen examined for bleeding. Trocars were removed one after the other under direct vision. The fascia of incisions larger than 5 mm were closed with interrupted absorbable sutures. The skin was approximated with non-absorbable sutures or clips.

A full blood count, clotting parameters, creatinine and electrolytes were taken 4–6 h after the operation and on a daily basis thereafter. In dialysis patients, intravenous or oral fluid replacement was restricted according to individual urine output. Haemodialysis was performed on the day of the operation when indicated (for example in cases of elevated potassium in serum or fluid overload), or routinely the day after. Indications for blood transfusions were either haemoglobin below 6.5 g/l or clinical symptoms such as angina or dyspnea.

### Results

#### Dialysis group

The mean operative time was 96 min (range, 40–170 min, Table 2). Mean estimated blood loss during laparoscopy was 180 ml. Owing to bleeding, one conversion to open surgery was necessary. This patient had an operative revision 2 days after laparoscopy and required a total of 10 units of blood.

In the dialysis group, mean preoperative haemoglobin was 116 g/l and dropped to 100 g/l 6 h after the operation and 91 g/l the day after (Table 3, all haemoglobin values after blood transfusion). Five patients received 2 units of blood on the first or second day after the operation (Table 3). Three patients had a postoperative haemoglobin below 6.5 g/l and two patients complained about angina and dyspnea despite a haemoglobin of 7.1 and 7.9 g/l, respectively.

A total of four postoperative complications occurred (21%). Two patients demonstrated postoperative elevation of body temperature. In these cases antibiotic
Table 2. Comparison of operative parameters in dialysis and non-dialysis patients

<table>
<thead>
<tr>
<th></th>
<th>Dialysis patients (n=19)</th>
<th>Non-dialysis patients (n=20)</th>
<th>P-value (Mann–Whitney U test)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean operative time, minutes (range)</td>
<td>96 (40–170)</td>
<td>110 (40–120)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Number of complications (%)</td>
<td>4 (21)</td>
<td>2 (10)</td>
<td>n.d.</td>
</tr>
<tr>
<td>Mean time before starting oral intake, hours (range)</td>
<td>11 (7–27)</td>
<td>12 (6–32)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Mean morphine equivalent, mg (range)</td>
<td>16 (0–88)</td>
<td>14 (0–40)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Mean hospital stay, days (range)</td>
<td>7.3 (2–45)</td>
<td>4.9 (2–14)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Mean time before resuming normal activities, days (range)</td>
<td>30 (9–144)</td>
<td>23 (8–44)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Mean follow-up, months (range)</td>
<td>12 (3–31)</td>
<td>18 (16–22)</td>
<td>n.d.</td>
</tr>
</tbody>
</table>

n.d.: not done; Mann–Whitney U test: statistical significance with P<0.05; n.s.: not significant.

Table 3. Comparison of blood loss from renal laparoscopy in dialysis and non-dialysis patients

<table>
<thead>
<tr>
<th></th>
<th>Dialysis patients (n=19)</th>
<th>Non-dialysis patients (n=20)</th>
<th>P-value (Mann–Whitney U test)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean perioperative blood loss, ml (range)</td>
<td>180 (50–750)</td>
<td>190 (100–350)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Number of patients receiving blood transfusions</td>
<td>6</td>
<td>0</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Mean number of blood transfusions (range)</td>
<td>3.3 (2–10)</td>
<td>0</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Mean preoperative haemoglobin, g/l (range)</td>
<td>116 (88–147)</td>
<td>131 (97–160)</td>
<td>0.002</td>
</tr>
<tr>
<td>Mean postoperative haemoglobin at 6 h, g/l (range)</td>
<td>100 (69–145)</td>
<td>111 (73–146)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Mean postoperative haemoglobin at 24 h, g/l (range)</td>
<td>91 (66–134)</td>
<td>112 (86–140)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Mean postoperative haemoglobin at 48 h, g/l (range)</td>
<td>88 (64–115)</td>
<td>119 (84–155)</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

n.d.: not done; Mann–Whitney U test: statistical significance with P<0.05; n.s.: not significant.

treatment was continued until the normalization of body temperature. Two patients had a thrombotic occlusion of the arteriovenous fistula that was treated conservatively (massage) in one patient and required surgical thrombectomy in the other.

Oral intake and mobilization after successful laparoscopy were started within 32 h after the operation. The hospital stay in this group was 5.2 days (range, 2–12) when excluding the patient who had a conversion, an operative revision 2 days later and a total hospital stay of 45 days. At a mean follow-up of 12 months (range, 3–31) all patients were alive and none demonstrated late complications.

**Non-dialysis group**

The mean operative time was 110 min (range, 40–210 min, Table 2). Mean estimated blood loss was 190 ml (range, 100–350) and no patient received a blood transfusion (Table 3). Mean preoperative haemoglobin was 131 g/l and reached a postoperative minimum of 111 g/l (Table 3).

Two postoperative complications occurred (10%). One patient developed a chest infection and required antibiotic treatment for 8 days. The patient made an uneventful recovery and the hospital stay lasted 14 days. Another patient had a urinary tract infection that was brought under control with oral ciprofloxacin. Data for consumption of analgesics, duration of hospital stay and convalescence, and follow-up period, as well as statistical analysis, are given in Table 2.

**Discussion**

Since the first laparoscopic nephrectomy in 1990 by Clayman and colleagues this procedure has become routine at many urological centres [1]. Most patients undergo laparoscopic nephrectomy for benign disease. However, at some centres patients with renal cell carcinoma or transitional cell carcinoma are also selected for laparoscopic nephrectomy [2]. Laparoscopic techniques can also be used efficaciously in the renal transplant population and in paediatric patients [11,12].

Based on our experience with laparoscopic nephrectomy in non-dialysis patients, we performed laparoscopic nephrectomy or nephroureterectomy in 19 dialysis patients. The results were compared with those for a group of 20 consecutive non-dialysis patients who underwent renal laparoscopy between October 1995 and March 1996. Various clinical parameters such as operative time, perioperative blood loss, consumption of analgesics and complications other than thrombosis of the fistula or blood transfusion rate were comparable for both groups. These results are in accordance with those from large series of laparoscopic nephrectomy in non-dialysis patients. Eraky et al. [13] reported on 106 patients who underwent a laparoscopic nephrectomy. In nine patients a conver-
sion to open surgery was necessary, in three cases this was due to bleeding. Four major and 28 minor complications were noted. The perioperative blood loss and the transfusion rate were not reported. In a multicentre review reported by Gill et al. [2] laparoscopic nephrectomy was carried out in 153 patients with benign disease and in 32 patients with renal malignancy. The complication rate was 16% and the conversion rate 5%. Perioperative blood loss and the number of blood transfusions were only reported for patients who had complications. The estimated blood loss ranged between 100 and 1500 ml in patients with benign disease and between 75 and 2000 ml in those with malignancy. The number of blood transfusions required ranged between 0 and 6.

In our study, only dialysis patients required blood transfusions. When compared with non-dialysis patients, however, dialysis patients had a significantly lower preoperative haemoglobin. Bleeding may result from an injury of the intra-abdominal vessels or organs, from the introduction of the Verres needle or trocars, or during operative dissection. In our series, no major haemorrhage was observed during the laparoscopic procedures. The mean perioperative blood loss of 180 ml was similar for both the dialysis and nondialysis group. Other reports also showed moderate blood loss or bleeding complications in dialysis patients. In 100 dialysis patients who underwent an open bilateral nephrectomy prior to a planned renal transplantation, the mean estimated blood loss for non-polycystic nephrectomy was 215 ml using the flank approach and 358 ml for the midline approach [14]. This resulted in a mean intra-operative transfusion volume of 195 and 321 ml, respectively. Another series investigated an open bilateral nephrectomy in 305 dialysis patients [15]. Renal bed bleeding occurred in six patients requiring a operative revision, and severe gastrointestinal bleeding requiring blood transfusions was observed in seven patients. The overall blood loss and the transfusion rate were not given.

Despite the fact that low preoperative haemoglobin in dialysis patients can be assumed to be a risk factor for a transfusion requirement, attempts must be made to reduce perioperative blood loss. Preparation of the patient should include the early withdrawal of drugs which affect platelet function such as acetylsalicylic acid or non-steroidal anti-inflammatory drugs [16]. During laparoscopy the renal artery is generally ligated between clips whereas the renal veins are secured using a vascular stapler. It has been shown in animal studies that clips are as safe as sutures and superior to staples when occluding the renal artery and applying supra-physiologic pressures [17]. These observations, however, are difficult to transfer to dialysis patients undergoing laparoscopy. In some cases the use of heparin-free dialysis might be helpful in reducing the risk of bleeding [18].

In our series, two dialysis patients had postoperative thrombosis of the arteriovenous fistula. Both patients had never before had problems with their fistula. On one hand, preoperative withdrawal of acetylsalicylic acid may have elevated the risk for thrombosis of the fistula. On the other hand, the arm was placed in a hanging position above the body during laparoscopy. However, as in all patients, the arm was carefully padded and no perioperative episodes of hypotension were present. In case of shunt thrombosis treatment options include balloon dilatation, thrombolysis and mechanical thrombectomy. In a series of 44 dialysis patients who underwent various open surgical procedures, three patients (6.8%) had shunt thrombosis [19]. These results are comparable to ours and we believe that shunt thrombosis is not a specific problem of laparoscopic nephrectomy in dialysis patients.

In summary, our results show that laparoscopic nephrectomy in dialysis patients is associated with an increased number of blood transfusions when compared with non-dialysis patients. This is probably due to a lower preoperative haemoglobin in the dialysis group. When perioperative haemostasis can be achieved, the known affects of the clotting system in patients with chronic uraemia do not seem to play a major role. Other operative and postoperative parameters are comparable with those from non-dialysis patients. Dialysis patients often have an increased risk for anaesthesia due to concomitant diseases. Despite this, laparoscopic nephrectomy is not associated with increased operative or postoperative morbidity in these patients. Finally, a shorter postoperative course can be assumed for patients undergoing a laparoscopic nephrectomy when compared with open surgical techniques.

References

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