Paper II

Beisland C, Medby PC, Sander S, Beisland HO. Nephrectomy – Indications, complications and postoperative mortality in 646 consecutive patients.

Nephrectomy – Indications, Complications and Postoperative Mortality in 646 Consecutive Patients

Christian Beisland[a]   Per Christian Medby[a]   Sten Sander[b]
Hans Olav Beisland[b]

[a]Department of Surgery, Lillehammer Central Hospital, Lillehammer, and [b]Department of Urology, Aker University Hospital, Oslo, Norway

Abstract

Objective: To gain information about the indications for and complications of conventional nephrectomy, also to create standards for future evaluation of nephrectomies performed by minimal invasive techniques.

Methods: We present a historical 20 years' series of 646 consecutive nephrectomies performed in the period of 1978–1997. Malignant disease led to the operation in 437 cases, of which 98 were urothelial tumors in the renal pelvis or ureter. 209 kidneys were removed due to benign conditions. The incidence of nephrectomy for benign conditions has declined from 75 in the first 5-year period to 32 in the last.

Results and Discussion: Postoperative complications occurred in 100 patients (15.5%). Nephrectomy for malignant disease had a significantly higher rate of complications than operations for benign conditions (p<0.001), especially hemorrhagic complications and pneumonias were more frequent. There were no differences as a result of the operative approach. Reoperation was carried out in 3.0% of the cases. Overall mortality rate (<30 days) was 3.1%.

Copyright © 2000 S. Karger AG, Basel

Introduction

Nephrectomy is a common procedure in the surgical practice. For radical as well as for simple nephrectomy, there were only minor changes in regard to the approach and surgical technique until the early 1990s when nephrectomy by minimal invasive technique became possible. This new technique challenges the conventional method because of presumed advantages in regard to recovery and rehabilitation. However, so far this method is mainly applied in patients with benign conditions and with malignant tumors of limited size. It is therefore still uncertain whether the minimal invasive technique will replace the conventional methods or remain as an optional technique for selected cases.

Table 1. Diagnosis and age distribution in 646 nephrectomies

Diagnosis	Patient number[1]	Male:female ratio	Mean age[2]
Malignant disease			
Total	437 (67.7)		65.4 (8–90)
RCC	325 (50.3)	1.4:1	64.3 (15–90)
Urothelial carcinoma	98 (15.2)	1.7:1	70.2 (32–90)
Other malignancies	14 (2.2)	1:1.8	58.4 (8–84)
Benign disease			
Total	209 (32.3)		51.8 (0–89)
Benign tumors	10 (1.6)	1:4	54.7 (27–82)
Infectious conditions	135 (20.9)	1:3.1	51.2 (0–89)
Noninfectious conditions	52 (8.0)	1:1	53.5 (8–82)
Miscellaneous	12 (1.8)	2:1	48.3 (17–62)

[1] Figures in parentheses represent percentage.
[2] Figures in parentheses represent range.

This paper presents data from 646 conventional nephrectomies carried out during 20 years at two Norwegian hospitals. The purpose of the study was to gain reliable information about indications, complications and mortality for standard control by comparison to previous publications from other hospitals. Another aim was to establish result-based intrahospital standards for the future evaluation of nephrectomies performed with minimal invasive techniques.

Material and Methods

A retrospective study was done on 650 consecutive nephrectomies performed at the Lillehammer Central Hospital (n = 254) and Aker University Hospital (n = 396) between January 1, 1978 and December 31, 1997. Records of 4 patients, 2 at each hospital, were not found in the archives, leaving 646 records available for analysis.

The series were analyzed according to indications for nephrectomy, complications, reoperations and 30-day mortality. These data were further studied according to the different surgical approaches used. The indications for nephrectomy were divided into malignant disease and benign conditions. The first group was subdivided into renal cell carcinomas (RCC), urothelial carcinomas and other malignant tumors. Hence, the material even includes nephroureterectomies in patients with urothelial tumors of the upper urinary tract. The benign group was subdivided according to whether or not infection was present at the time of operation. Criteria for infection were defined to be preoperative pyuria, peroperative identification of infected material or histologically proven acute or chronic infection. A small subgroup is classified as miscellaneous, consisting of nephrectomies for anomalies, trauma and complications of prior operations.

The χ^2 test was used for statistical analysis. A p value <0.05 was considered statistically significant.

Results

Indications

Malignant tumor was the indication for nephrectomy in 437 cases (67.7%) whereas 209 kidneys (32.3%) were removed due to benign conditions (table 1). 98 (22.4%) of the malignant tumors were urothelial carcinomas. The small group of 14 other malignant conditions consisted of 9 primary renal tumors (sarcomas, nephroblastomas), 4 metastases (pulmonary cancer, melanomas) and 1 malignant lymphoma. 135 (64.6%) of the benign kidneys were infected at the time of operation. The infection was associated with renal stone problems in 27 cases, hydronephrosis in 26 cases and chronic pyelonephritis in 77 cases. Five kidneys were removed because of tuberculosis. The reasons for nephrectomy in the noninfected group were hydronephrosis, renal hypertension and severely decreased kidney function in 19, 15 and 18 patients, respectively. 10 benign tumors and 12 cases of miscellaneous conditions complete the range of indications.

No significant increase in nephrectomies for malignant tumor has been noted in our hospitals during these 20 years. The increase in the last 5-year period is due to an increase in the population using one of the hospitals. Nephrectomy for benign conditions, however, has declined markedly during the period. In the first 5-year period (1978–1982) 75 operations were performed compared to 32 operations in the last 5-year period (1993-1997) (fig. 1).

There were slightly more males with malignant tumor, but significantly more females with a benign infectious pathology (p<0.001) (table 2). Significantly more malig-

Table 2. Operative approaches in 646 nephrectomies

Diagnosis/operative approach	Thoraco-abdominal	Retro-peritoneal	Transab-dominal
Malignant disease (n = 437)			
RCC (n = 325)	27	67	231
Urothelial carcinoma (n = 98)	2	84	12
Other malignancies (n = 14)	2	1	11
Benign disease (n = 209)			
Benign tumors (n = 10)	1	5	4
Infectious conditions (n = 135)	0	121	14
Noninfectious conditions (n = 52)	0	43	9
Miscellaneous (n = 12)	0	6	6
Total	32	327	287

nant tumors were situated on the left side (p = 0.0004). No side difference was found in the benign groups. Patients operated for benign conditions were younger (mean age 51.8 years) than those with malignant tumors (mean age 65.4 years), the oldest being patients with urothelial carcinomas (mean age 70.2 years).

Surgical Approach

The transabdominal approach was chosen for radical nephrectomy in the majority of cases with malignant renal tumor. In cases with a large tumor in the upper pole, the thoracoabdominal approach was used. Retroperitoneal access was mainly used for simple nephrectomy in benign conditions and for nephroureterectomy in patients with urothelial carcinomas (table 2). No statistical significant differences between the different approaches in regard to postoperative complications, reoperations or mortality could be demonstrated (table 3).

Postoperative Complications

Postoperative complications occurred in 100 patients (15.5%) (table 4). Nephrectomy for malignant disease had a significantly higher rate of complications (17.6%) than operations for benign conditions (11.0%; p<0.001). Hemorrhagic complications and pneumonias were particularly more frequent in the RCC group compared to the other groups. Also, gastrointestinal complications occurred more often within the malignant group, but the difference is not statistically significant. Within the benign group there was no increased incidence of infectious wound complications among patients with a peroperative presence of infection.
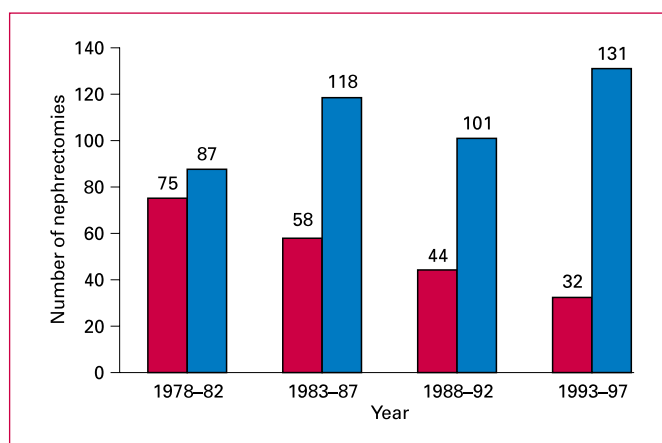

Fig. 1. Changes in 5-year incidence of nephrectomy for malignant disease (■) and benign conditions (■).

Reoperations

19 patients (3.0%) were reoperated for complications (table 5). 8 patients were reoperated for hemorrhagic complications, 6 for gastrointestinal and 5 for wound complications. All reoperations due to bleeding were in the malignant group, and 7 out of 8 were after operation for RCC. Reoperation for bleeding occurred 4 times after both left- and right-sided nephrectomy. On the right side, a caval tear had to be sutured. The spleen had to be removed in a patient with malaria due to capsule tears after a left-sided nephrectomy. The remaining cases were caused by bleeding from the suprarenal arteries or other small vessels.

Ileus was the reason for three of the gastrointestinal reoperations. Two of these were caused by adhesions after operations performed transabdominally, the third was a pseu-

Table 3. Adverse events according to operative approach in 646 nephrectomies

	Thoracoabdominal (n = 32)	Retroperitoneal (n = 327)	Transabdominal (n = 287)	Total (n = 646)
Postoperative complications, %	25	13.7	16.3	15.5
Reoperations, %	3.1	2.4	4.2	3.0
Postoperative mortality, %	3.1	3.7	2.4	3.1

Table 4. Postoperative complications in 646 nephrectomies

Diagnosis/complication	Hemorrhage	Gastrointestinal complications	Wound infection	Pneumonia	AMI	Other	Total
Malignant disease (n = 437)							
RCC (n = 325)	9	5	11	18	5	12	60 (18.5)
Urothelial carcinoma (n = 98)	1	2	5	5		4	17 (17.3)
Other malignancies (n = 14)							0 (0.0)
Benign disease (n = 209)							
Benign tumors (n = 10)			1		1		2 (20.0)
Infectious conditions (n = 135)	1		3		1	3	8 (5.9)
Noninfectious conditions (n = 52)	1		4	3	1	2	11 (21.2)
Miscellaneous (n = 12)	1		1				2 (16.7)
Total	10	10	25	26	8	21	100 (15.5)

The 'other' group includes deep vein thrombosis, pulmonary embolism and cerebrovascular incidents. Figures in parentheses represent percentage. AMI = Acute myocardial infarction.

Table 5. Reoperations in 646 nephrectomies

Diagnosis/complication	Hemorrhage	Gastrointestinal complications	Wound infection	Total
Malignant disease (n = 437)				
RCC (n = 325)	7	2	1	10 (3.1)
Urothelial carcinoma (n = 98)	1	1	2	4 (4.1)
Other malignancies (n = 14)				0 (0.0)
Benign disease (n = 209)				
Benign tumors (n = 10)				0 (0.0)
Infectious conditions (n = 135)		1	1	2 (1.5)
Noninfectious conditions (n = 52)		1		1 (1.9)
Miscellaneous (n = 12)		1	1	2 (16.7)
Total	8	6	5	19 (3.0)

Figures in parentheses represent percentage.

Table 6. Postoperative mortality (<30 days) in 646 nephrectomies

Diagnosis/cause of death	Death <30 days total	Death due to disseminated cancer	Cause of death in patients after reoperation	Cause of death in patients not reoperated
Malignant disease (n = 437)				
RCC (n = 325)	11	5	2 MOF	3 AMI, 1 perforated ulcer
Urothelial cancer (n = 98)	4	1	2 MOF, 1 Ileus	
Other malignancies (n = 14)				
Benign disease (n = 209)				
Benign tumors (n = 10)				
Infectious conditions (n = 135)	3		1 aortic graft infection	1 AMI, 1 respiratory failure 1 cerebrovascular incident
Noninfectious conditions (n = 52)	1			
Miscellaneous (n = 12)	1		1 MOF	
Total	20 (3.1)	6 (0.9)	7 (1.1)	7 (1.1)

Figures in parentheses represent percentage. AMI = Acute myocardial infarction.

doobstruction (Ogilvie's syndrome) after a simple retroperitoneal nephrectomy. 1 patient was reoperated because of a duodenal rupture and another patient because of strangulation of the greater omentum into the sutures. The last gastrointestinal reoperation was because of ileal-ileal anastomosis insufficiency in a patient who had undergone an unsuccessful attempt to create an ileal ureter substitute, with a subsequent need for nephrectomy.

Five wound infections had to be treated surgically. 2 patients had retroperitoneal abscesses and 2 had abscesses intra-abdominally. In the last case the ureter had been insufficiently ligated and an infected urinoma developed.

Mortality

20 patients (3.1%) died within the postoperative period (<30 days). 6 patients (0.9%) died of their advanced cancer disease (table 6). All but 1 had well-known distant metastases at the time of operation. In 2 cases the nephrectomy was performed prior to inclusion in the interferon trial protocols for metastatic renal cell carcinoma MRCC. 1 patient died after simultaneous thoracotomy for a solitary lung metastasis and 1 during radiation therapy instituted postoperatively against a vertebral metastasis to avoid spinal cord damage. None of these patients had complications specifically related to the operation. Hence, 14 (2.2%) patients died of complications related to the operation. In the RCC group 2 died of multiorgan failure (MOF) after reoperation, 1 because of hemorrhagic incident and the other because of

an injury to the duodenum with peritonitis. 3 patients died of acute myocardial infarction, and 1 patient died of a perforated duodenal ulcer, not recognized until autopsy. In the group with urothelial carcinomas 2 patients died of MOF after reoperation for bleeding and for a wound abscess, repectively. 1 patient died after reoperation for ileus.

In the benign disease group 5 patients (2.4%) died within 30 days. In 1 patient an aortic graft was infected and another previously mentioned, patient died of MOF after reoperation for ileal-ileal anastomosis leakage. Acute myocardial infarction, respiratory failure and cerebral stroke caused death in 1 patient each. In regard to postoperative mortality, no statistically significant differences could be demonstrated between the malignant and the benign group of patients.

Discussion

In the literature there are relatively few and not updated reports on complications and mortality from large consecutive series of surgical nephrectomies. This is found by Kerbl et al. [1] when they in 1994 presented a paper on laparoscopic nephrectomy. They mainly had to use live donor nephrectomy series for comparing the results.

Scott and Selzman [2] described in their work from 1966 29% neoplasms. In 1977 Schiff and Glazier [3] presented a neoplasia rate of 38%. In both series, nephroureterectomies

for urothelial carcinomas had been excluded. In our study, when excluding the urothelial carcinomas, we had 61% neoplasms. We could not demonstrate any significant increase in the incidence of malignant renal tumors. The relative increase in the malignancy rate is therefore due to the considerable decrease in nephrectomies for benign conditions. There may be several reasons for this: better antibiotics for the treatment of infectious diseases, better drugs for hypertension control and minimal or noninvasive techniques for the treatment of kidney stones (ESWL, percutaneous nephrolithotomy). In addition, patients are treated earlier than previously and thereby the risk for serious functional damage to the kidney with a need for nephrectomy is reduced.

The 3 times higher rate of nephrectomies for infected kidneys in females is not surprising, as women generally are more disposed to urinary tract infections than males. Other benign conditions are equally distributed between males and females. Swanson and Borges [4] reported a 12.4% splenectomy rate during operations for RCC. The upper midline incision was used routinely. Nurmi et al. [5] reported a splenectomy rate of 9.6% using mostly upper transverse abdominal incisions.

The latter is the most common operative approach in our patients when operating for RCC. 2 cases of peroperative splenectomy and 1 at reoperation give a total splenectomy rate of 0.9% in patients operated for RCC.

We found a significantly higher rate of pneumonia in the RCC group compared to nephrectomy for other conditions. Out of the 18 patients who developed pneumonias postoperatively, 17 had been operated on transabdominally. We could not prove any relation to age or tumor size. Explanations such as insufficient pulmonary ventilation due to abdominal meteorism or pain are likely, but not possible to prove by the retrospective review of this historical series. It is reasonable to assume that the transabdominal approach may increase the risk of gastrointestinal complications. However, the choice of the surgical approach has in our group not shown any significant differences in postoperative complications, reopertions or mortality (table 3). Schiff and Glazier [3] reported a lower incidence of complications when using an anterior retroperitoneal approach, while Scott and Selzman [2] found that the transperitoneal approach gave a lower complication rate. Swanson and Borges [4] reported 19.1% postoperative complications, using the midline incisions for renal carcinomas.

Nephrectomy has to be regarded as a major surgical procedure with a consistent risk of complications, reoperations and postoperative mortality, even when performed as a living donor nephrectomy in healthy humans or with minimal invasive techniques. In living donors major postoperative complications are reported in 1.4–3.5% [6, 7] and minor complications in 15–30% [6, 7]. Our figures for patients within the same range may therefore be considered to be satisfactory.

Ljungberg et al. [8] report a reoperation rate for bleeding after radical nephrectomy for localized RCC (pT1–pT2) of 2.2%. Our study shows a reoperation rate of 1.5% within a comparable group of patients.

Blohme et al. [6] reported a reoperation rate of 1% for postoperative hemorrhage after living donor nephrectomy. In the present study postoperative bleeding did not occur in the benign group. The overall 30-day mortality within the RCC group is 3.4%. When dividing these patients into metastatic and nonmetastatic disease the mortality rates are 9.1% (4/44) and 2.5% (7/281), respectively. Earlier reports have shown that nephrectomy for disseminated RCC may reach 6.3–11.4% mortality rate [9–11]. Swanson and Borges [4] had approximately 4% mortality rate within this group, but their figures are solely based on death during hospital stay, not 30-day mortality.

For nonmetastatic RCC mortality rates between 0 and 3–4% have been reported [8, 11, 12]. The 2.5% mortality rate in our study compares well to those reports, in particular when considering that our patients who died had a mean age approximately 12 years higher than the total RCC group (table 1). Patients operated on for urothelial carcinoma had a mortality rate of 4.1%. These patients were on average 6 years older than the RCC patients. Complete nephroureterectomy is often more time-consuming than radical or simple nephrectomy. This together with old age could be a possible explanation for the higher mortality rate.

A mortality rate of 2.4% (5/209) after nephrectomy for benign disease is not significantly higher than in other reports [2, 3]. 4 out of the 5 patients were considerably older (mean age 73 years) than the rest of the group. We were not able to demonstrate an influence of the surgical approach on postoperative mortality, neither totally nor within the groups. 7 out of 19 patients (37%) reoperated for complications died in the postoperative period. A complication with need for reoperation is therefore a bad prognostic sign in regard to survival. Another bad prognostic sign is the development of acute myocardial infarction. 4 out of 8 (50%) died postoperatively.

References

1 Kerbl K, Clayman RV, MacDougall EM, Gill IS, Wilson BS, Chandhoke PS: Transperitoneal nephrectomy for benign disease of the kidney: A comparison of laparoscopic and open surgical techniques. Urology 1994;43:607–613.
2 Scott RF, Selzman HM: Complications of nephrectomy: Review of 450 patients and a description of a modification of the transperitoneal approach. J Urol 1966;95:307–312.
3 Schiff M, Glazier WB: Nephrectomy: Indications and complications in 347 patients. J Urol 1977;118:930–931.
4 Swanson DA, Borges PM: Complications of transabdominal radical nephrectomy for renal cell carcinoma. J Urol 1983;129:704–707.
5 Nurmi MJ, Puntala PV, Tyrkko JE, Antila LE: Transabdominal and lumbar nephrectomy for renal adenocarcinoma. Scand J Urol Nephrol 1985;19:129–131.
6 Blohme I, Fehrman I, NordÇn G: Living donor nephrectomy. Complication rates in 490 consecutive cases. Scand J Urol Nephrol 1992;26:149–153.
7 Ruiz R, Novick AC, Braun WE, Montague DK, Stewart BH: Transperitoneal live donor nephrectomy. J Urol 1980;123:819–821.
8 Ljungberg B, Alamdari FI, Holmberg G, Granfors T, Duchek M: Radical nephrectomy is still preferable in the treatment of localized renal cell carcinoma. Eur Urol 1998;33:79–85.
9 Fowler JE: Failure of immunotherapy for metastatic renal carcinoma. J Urol 1986;135: 22–25.
10 Neidhart JA, Murphy SG, Hennick LA, Wise HA: Active specific immunotherapy of stage IV renal carcinoma with aggregated tumor antigen adjuvant. Cancer 1980;46:1128–1134.
11 Skinner DG, Colvin RB, Vermillion CD, Pfister RC, Leadbetter WF: Diagnosis and management of renal cell carcinoma. Cancer 1971;28:1165–1177.
12 Robson CJ, Churchill BM, Anderson W: The results of radical nephrectomy for renal cell carcinoma. J Urol 1969;101:297–301.