Clinical Paper

European Urology

Eur Urol 1996;29:168–173

P.J.T. Davidson
D. van den Ouden
F.H. Schroeder

Department of Urology, Erasmus University and Academic Hospital, Rotterdam, The Netherlands

Radical Prostatectomy: Prospective Assessment of Mortality and Morbidity

Key Words
Radical prostatectomy
Complications
Morbidity

Abstract

Objective: To prospectively analyse the morbidity of radical prostatectomy. **Methods:** Morbidity data from 188 consecutive radical prostatectomy patients were collected prospectively. Mortality, intraoperative, early postoperative and late postoperative complications were analysed. **Results:** 1.5% mortality. 3.7% suffered an intraoperative complication. Early postoperative problems were common (43%). Of those with greater than 1 year follow-up, 5.9% remained with some incontinence, and a further 11 patients had artificial sphincters implanted; 32% had narrowing of the anastomosis, requiring at least 1 dilation; 43% of patients retained their potency. **Conclusion:** It is concluded that radical prostatectomy can be performed with minimal mortality and acceptable morbidity.

Introduction

The combination of modifications to the operation of radical prostatectomy and the prostate- specific antigen driven upsurge in early detection of prostate cancer have led to both an increase in the popularity and numbers of radical prostatectomies performed. At the authors' institution, radical prostatectomy is being performed since 1977. The complications from these procedures are reviewed.

Patients and Methods

The patient population consists of 188 patients with prostate cancer. Five of the earlier patients had a radical perineal prostatectomy, and the rest were treated by radical retropubic prostatectomy. In 1986, the modifications described by Walsh [1] were adopted. The patients were included in a prospective study; preoperative, perioperative and follow-up data were stored in a comprehensive database. The average patient age was 63 years (range 45–76) and the operations were all performed between 1977 and April 1991.

Clinical and pathological staging is according to the TNM classification of 1982. At follow-up, each patient was asked specific questions about continence and the presence or absence of obstructive symptoms. From the beginning of 1987 onwards, questions on potency were included in the follow-up questionnaire.

Continence was defined as being completely dry and requiring no pads. Grade 1 incontinence was where a patient needed 1–2 pads per day and grade 2 required more than 2 pads per day. Further, pads were weighed in those who were incontinent after initial removal of the catheter. Anastomotic stenosis was defined as symptoms of outflow obstruction requiring a dilatation. A patient was considered potent if he could attain an erection sufficient for intercourse. Impotence was the inability to attain such an erection. All patients were asked preoperatively as to whether they were sexually active.

Late complications were analysed for risk factors. Age (older or younger than 70), previous transurethral resection of the prostate (TURP), T stage, pT stage, experience of the surgeon, presence or absence of extravasation on postoperative cystogram, and timing of the operation (before or after 1987) were all assessed. The cutoff of

KARGER
E-Mail karger@karger.ch
Fax + 41 61 306 12 34

0302–2838/96/0292–0168$10.00/0

Fritz H. Schroeder, MD, Professor and Chairman
Department of Urology
Erasmus University and Academic Hospital
PO Box 1738
NL–3000 DR Rotterdam (The Netherlands)

1987 as a divider between an early and a late study group was chosen for two reasons: the first was that the number of radical prostatectomies performed each year rose to greater than 20 at that time. The second reason for this cutt-off date was that it was the first year where the technical modifications of the 'nerve-sparing' technique were universally adapted, having been introduced in 1986. The experience of the surgeon was assessed by comparing surgeon 1 (who had performed 58% of the operations) with the other surgeons collectively. Total number of units of blood transfused during hospital admission was chosen as a representation of operative blood loss. It was found that the recorded intraoperative blood loss was influenced by too many extraneous factors to be a reliable indicator.

The Fisher exact test was used to test the impact of the risk factors on late postoperative complications.

Results

There were 3 postoperative deaths in this series. One patient had an autopsy-confirmed pulmonary embolus on the th postoperative day. He had suffered a previous embolus at the time of vascular surgery 13 years before, and had both subcutaneous heparin and graduated compression stocking prophylaxis before his prostatectomy. The second patient collapsed at home on the 17th postoperative day. The cause of death was presumed to be a pulmonary embolus, although this was not confirmed by postmortem examination. He also had both heparin and stocking prophylaxis at the time of the operation. The last patient was one of the first in the series. He had considerable intraoperative blood loss and developed a hematoma postoperatively. Following this, he had prolonged drainage from his anastomotic site. He then became septic and died after a protracted intensive care. At postmortem examination he was found to have an aspiration pneumonia, myocardial infarction and peritonitis secondary to his drain perforating a loop of the ileum. All 3 of these deaths occurred in the early part of the series.

There were 7 intraoperative complications. Four of these were rectal injuries. Two of these were simply oversewn in two layers and 2 required colostomies. There were no sequelae from these injuries. Two external iliac vein injuries and 1 ureter injury were caused during lymph node dissection. All were immediately recognised and repaired without further consequences. The mean number of transfused units was 5.3, but this figure is skewed by 2 early cases requiring massive transfusions. The median number of transfused units was 4. Blood requirements decreased over the duration of the study.

The most common early postoperative complications are shown in table 1. The most common were wound infections, prolonged lymph drainage, lymphocele and bleeding. The other early postoperative complications are listed in table 2. Of the 188 patients, 81 had one or more complications, leaving 107 (57%) with a completely uncomplicated postoperative course. The number of early postoperative complications per patient decreased over the course of the study (fig. 1).

Table 1. The most common early postoperative complications seen in 81/188 consecutive patients after radical prostatectomy

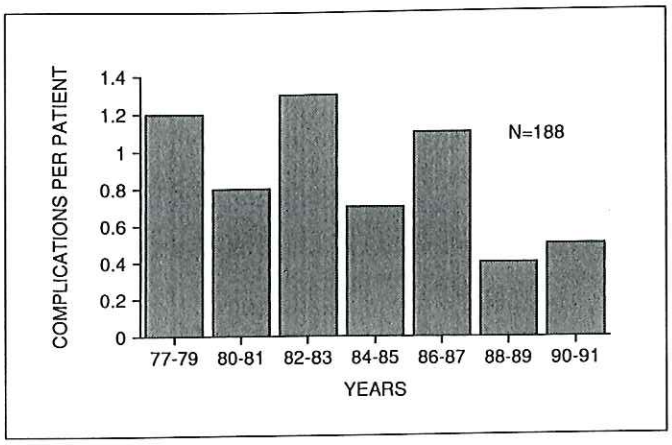
	Patients, %
Lymph drainage >2 weeks	17
Lymphocele drained	7
Postoperative bleeding	6
Thromboembolic	5
Pneumonia	2
Fistula	1
Myocardial infarction	2
Ureteric obstruction	1
Other	16

107/188 (57%) were free from complications.

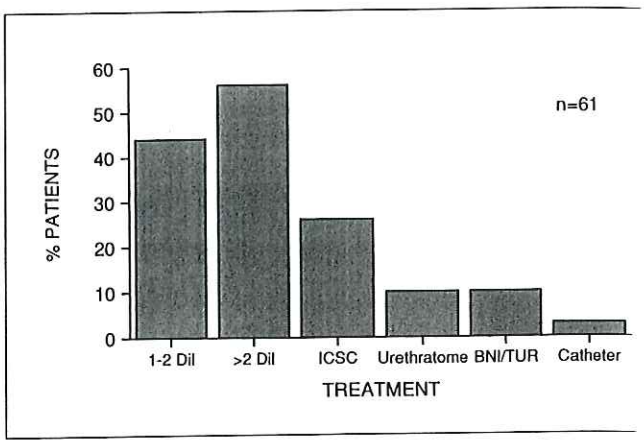
Table 2. Remaining postoperative complications of radical prostatectomy in 188 patients

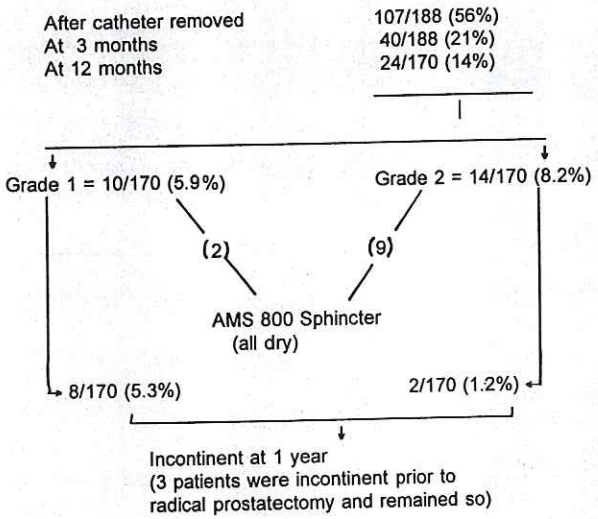
UTI	9
Pyrexia unknown origin	4
Epididymitis	2
Superficial thrombophlebitis	2
Lymphedema	2
Ulnar nerve palsy	1
Femoral nerve palsy	1
Obturator nerve neuropraxia	1
Acute atrial fibrillation	1
Temporary unexplained jaundice	1
Urethritis	1
Acute psychosis	1
Urosepsis (ICU)	1
Burst balloon (OT)	1
Appendicitis (OT)	1
Wound dehiscence (OT)	1
Total	30

OT = Returned to operating theatre; ICU = required transfer to intensive care unit.



1





2

Fig. 1. Average number of early postoperative complications patient, according to year of operation.

Fig. 2. Incontinence in 188 patients following radical prostate my.

Fig. 3. Percentage of 61 patients requiring treatment for ana motic stenosis who received each form of treatment. Some pati were treated by more than one modality. Dil = Dilatation; ICS intermittent clean self-catheterization; BNI/TUR = incision or tr urethral resection of anastomosis; catheter = permanent indwel Foley catheter.

Incontinence was very common after removal of the catheter, with 107 (56%) requiring pads. The mean measured urinary loss in these patients over 24 h was 226 ml. The amount of this initial loss did not predict time to regaining continence. Hundred and eighty-eight patients had been followed for 3 months and 40 (21%) were still incontinent; 170 patients had been followed for more than 12 months, and of these, 10 (5.9%) had grade 1 and 14 (8.2%) grade 2 incontinence. At the time of study, 11 of these patients had been implanted with AMS artificial sphincters and were continent. Three of the patients with grade 2 incontinence were incontinent prior to surgery, and if these are excluded, then of those with >12 months follow-up at the time of study 8 patients (4.7%) remain with grade 1 and 2 (1.2%) with grade 2 incontinence (fig. 2).

Sixty-one patients required at least one dilatation the anastomosis, and were therefore considered by defi tion to have a postoperative anastomotic stenosis. T majority of these were cured by simple dilatation (fig. All of those requiring a bladder neck incision, TUR of bladder neck or a permanent catheter were from the ea part of the series, before the modifications described Walsh [1].

Hundred and one patients had their potency sta assessed on follow-up. Fifteen of these were impotent p operatively and another 10 were potent but not sexu active. Intraoperative details of nerve sparing were available in 3 of the earlier patients. Of the remaining preoperatively potent patients, 42 had a bilateral ner sparing procedure; of these 18 (43%) were potent at time of the study. Four of 17 patients undergoing a uni

Table 3. Risk factors for complications in 188 patients after radical prostatectomy

	Anastomotic leakage	Age (<70 vs. >70)	TURP	Experience (surgeon 1 vs. others)	Date (<87 vs. >87)	T stage (<T_3 vs. >T_3)	pT stage (<pT_3 vs. >pT_3)
Stenosis	NS	NS	NS	$p < 0.01$	NS	NS	NS
Incontinence	NS	$p = 0.02$	NS	NS	$p = 0.02$	NS	NS
Impotence	NS	NS	NS	NS	N/A	NS	NS

NS = $p > 0.05$; N/A = not applicable.

eral nerve-sparing procedure (24%) and 4 of 24 (17%) with no attempted nerve sparing were also potent at the time of the study. Of the 26 patients regaining their potency, 18 (69%) had done so by 15 months. There were also 8 patients who regained their potency between 18 and 30 months postoperatively.

The analysis of risk factors for the various complications is presented in table 3. The operator seemed only to have an influence on the risk of developing an anastomotic stenosis. The year of surgery influenced both the risk of anastomotic stricture and incontinence. Being older than 70 years of age increased the risk of incontinence. Previous transurethral resection, T stage, pT stage and leakage on cystogram influenced neither incontinence nor stenosis or impotence.

Discussion and Conclusions

In the interpretation of these data, several pertinent points must be made. The first is that this is a prospective study with data collection that is likely to be more complete than in studies based on chart reviews. The second point is that we are currently undertaking a parallel study on the effectiveness of radical prostatectomy in patients with T_3 prostate cancer. For this reason, we have 31 and 75% patients who are clinically and pathologically, respectively, judged to be extracapsular. This large cohort of bulky tumors may introduce unrecognised biases. Lastly, this is not the series of one person, but rather represents the workload of 4–6 surgeons sharing 25–40 cases per year.

The mortality in the study is low. Two of the postoperative deaths were sudden deaths despite prophylactic measures, while the other was as a direct result of the procedure itself.

The intraoperative complications included 4 rectal injuries. In the early part of the series these were treated with defunctioning colostomy. With the more recent injuries we have simply oversewn the rectum and performed an anal dilatation as proposed by Borland and Walsh [2]. These patients have had uncomplicated courses. The intraoperative blood loss has decreased in the more recent part of the series compared with the earlier cases. Hypotensive techniques are not employed in these patients and the use of temporary hypogastric artery occlusion is not routine. Perhaps with these modifications blood loss could be further reduced although the effect of hypogastric occlusion has been debated [3]. Previous TURP was the only other factor influencing blood loss.

The decrease in early postoperative complications over the course of the series is more likely due to improvements in anesthesia and postoperative care than surgical technique. The high incidence of wound infections was a surprise. The patients did not routinely receive prophylactic antibiotics. All but 4 positive cultures grew *Staphylococcus aureus*, and gram-negative organisms were seen in only 2. In the earlier part of the series, all patients received both subcutaneous heparin and graduated compression stockings. The heparin may have contributed to the high number of patients needing drainage of a lymphocele or having prolonged lymph drainage in the early part of the series. It is interesting to note that not only did these complications decrease after ceasing the use of heparin, but that there was also no increase in the number of thromboembolic events, with 7 out of 10 (including the fatal events) occurring before this time.

Incontinence must always be interpreted with the definition kept in mind. The criteria in this series were strict. Continent patients were completely dry without use of a pad. A number of our grade 1 incontinent patients wore their pad for 'security', even though they claimed to be 'dry with an occasional drip'. Any patient wearing more than 2 pads per day were categorized grade 2 incontinent, regardless of how much urine was on those pads. Just over half the patients were considered incontinent on removal

of their catheter and by 3 months the proportion requiring pads had fallen to 21%. Over the study period, the immediate incontinence rate did not change. Both the 3-month and 12-month incontinence rates decreased as the study progressed. Of the 11 artificial sphincters implanted, 9 were in patients who had their radical prostatectomy prior to the adaptation of the 'nerve-sparing' technique, many of whom had concurrent problems with anastomotic stenoses. This improvement in both the incidence and severity of incontinence may be due to increasing experience, but is more likely a result of the modifications to the operative technique. Recent adoption of the further adaptations suggested by Walsh [4] should reduce the risk of incontinence even further.

All 11 patients who were implanted with artificial sphincters received the AMS800 device. Continence was achieved in all patients. This high success rate with this device for incontinence after prostatectomy was confirmed by others [5]. In all these patients, urodynamic studies were performed and showed sphincter weakness. In this small number of patients we did not see additional significant bladder dysfunction in contrast to Leach et al. [6] who found such dysfunction in 60% of their patients. We have, however, found low compliance in patients referred secondarily to us with postprostatectomy incontinence, suggesting that technical nuances may play a role. Presti et al. [7] found detrusor instability in 25% of their incontinent patients, but this was similar to their continent group, whereas measures of sphincteric integrity were significantly different between the two groups.

5 patients with grade 2 incontinence (including 3 who were incontinent preoperatively) did not wish to have a sphincter placed. They could possibly have benefitted from the peri-urethral polytetrafluoroethylene injections as suggested by Stanisic et al. [8]. Our finding that the patients over the age of 70 years were more at risk of becoming incontinent is in contrast to the findings of others [9–11].

Thirty-two percent of the patients required at least one dilatation of the bladder neck. The definition required that anyone having a sound passed be recorded as requiring a dilatation. Many of these patients had minor symptoms and the sounds passed with ease. Although the incidence of stenosis did not change with time, the severity did. All of the severe strictures requiring bladder neck incision, resection of the anastomosis or long-term catheters were operated on prior to 1987 and prior to the adaptation of the 'nerve-sparing' technique. The surgeon's experience decreased the likelihood of stenosis. In contrast to the findings of Surya et al. [12], we did not find that blood loss, extravasation of urine at the anastomoti site or prior contributed to the development of a stric ture.

In patients where either a bilateral or a unilatera nerve-sparing procedure was attempted, the potency rate of 43 and 24%, respectively, are lower than others quote in the literature [13–15]. This may in part be explained b the high incidence of pathological extracapsular extensio (75%) in this series compared with those of Catalona an Bigg [13], Leandri et al. [14] and Quinlan et al. [15], whic were 43, 55 and 42%, respectively. Extracapsular exten sion has been shown to decrease the likelihood of postop erative potency [13]. Although in the present series extra capsular extension was not statistically significantly dif ferent as concerns recovery of potency, this is almost cer tainly due to the small numbers, as a trend was indee seen. It was interesting to note that, although all patient were offered impotence therapy, only 21% of patient accepted the offer of treatment, suggesting that for man this is not an important issue. Of those who were treate with papaverine, an average of 66 mg (range 25–100 mg was required intracorporeally for an erection. Two pa tients were unable to achieve an erection on 100 mg. Thi suggests that the etiology of impotence in many patients i not entirely neurogenic, and that there is most likely a additional vasculogenic component, as proposed b Bahnson and Catalona [16]. In the current series, we dic not find that patient age, previous TURP, surgeon, o presence of extravasation impacted on potency. Again th small numbers may have masked any such impact. Final ly, we were surprised that almost a third of the patient who regained their potency did so more than 12 month after surgery.

In assessing the impact of radical prostatectomy on men 70 years and over, Middelton [9] found that the rates of both perioperative and postoperative complications were not different in those patients under 70 years when compared to those over 70. Our findings were similar in all aspects except incontinence. The impact of prior TURP has previously been addressed. We found that there was an increase in the median number of blood units transfused, but no change in risk for any of the complications assessed. This supports the concepts that TURP may make an operation more difficult, but does not make it more dangerous.

This series extended over a decade and a half. Over this period the operation has been performed more often. There have also been many modifications to the technique. These factors have decreased both the incidence and the severity of the complications. Although the expe-

rience gained with the larger number of patients operated on may be contributory, it is interesting to note that in all aspects except the risk of stenosis there was no difference between the most experienced surgeon (surgeon 1) and the other surgeons. This suggests that the decrease in morbidity should be ascribed to the improvements in the technique.

In summary, this prospective study shows that radical prostatectomy can be performed with minimal mortality and acceptable morbidity. Complications, if they occur, tend to be of limited duration or can be satisfactorily treated. Technical modifications have significantly decreased the morbidity of the procedure.

References

1 Walsh PC: Radical retropubic prostatectomy; in Walsh PC, Gittes RF, Perlmutter AD, Stamey TA (eds): Campbell's Urology, ed 5. Philadelphia, Saunders, 1986, vol 3, pp 2754–2775.

2 Borland RN, Walsh PC: The management of rectal injury during radical retropubic prostatectomy. J Urol 1992;147:905–907.

3 Kavoussi LR, Myers JA, Catalona WJ: Effect of temporary occlusion of hypogstric arteries on blood loss during radical prostatectomy. J Urol 1991;146:362–365.

4 Walsh PC, Quinlan DM, Morten RA, Steiner MS: Radical retropubic prostatectomy: Improved anastomosis and urinary continence. Urol Clin North Am 1990;17:679–684.

5 Gundian JC, Barrett DM, Parulkar BG: Mayo clinic experience with use of the AMS800 artificial urinary sphincter for urinary incontinence following radical prostatectomy. J Urol 1989;142:1459–1461.

6 Leach GE, Yip CM, Donovan BJ: Post-prostatectomy incontinence: The influence of bladder dysfunction. J Urol 1987;138:974–978.

7 Presti JC, Schmidt RA, Narayan PA, Carroll PR, Tanagho EA: Pathophysiology of urinary incontinence after radical prostatectomy. J Urol 1990;143:975–978.

8 Stanisic TH, Jennings CE, Miller JI: Polytetrafluoroethylene injection for post-prostatectomy incontinence: Experience with 20 patients during 3 years. J Urol 1991;146:1575–1577.

9 Middleton AW: Radical prostatectomy for carcinoma in men more than 69 years old. J Urol 1987;138:1185–1188.

10 Ramon J, Leandri P, Rossignol G, Gautier JR: Urinary continence following radical retropubic prostatectomy. Br J Urol 1993;71:47–51.

11 Steiner MS, Morton RA, Walsh PC: Impact of anatomical radical prostatectomy on urinary continence. J Urol 1991;145:512–515.

12 Surya BV, Provet J, Johanson KE, Brown J: Anastomotic strictures following radical prostatectomy: Risk factors and management. J Urol 1990;143:755–758.

13 Catalona WJ, Bigg SW: Nerve-sparing radical prostatectomy: Evaluation of results after 250 patients. J Urol 1990;143:538–544.

14 Leandri P, Rossignol G, Gautier JR, Ramon J: Radical retropubic prostatectomy: Morbidity and quality of life. Experience with 650 consecutive cases. J Urol 1992;147:883–887.

15 Quinlan DM, Epstein JI, Carter BS, Walsh PC: Sexual function following radical prostatectomy: Influence of preservation of neurovascular bundles. J Urol 1991;145:998–1002.

16 Bahnson RR, Catalona WJ: Papavarine testing of impotent patients following nerve-sparing radical prostatectomy. J Urol 1988;139:773–774.