findings could have been due to bias. The World Health Organisation is studying the risk of cancer in women using medroxyprogesterone at centres in Thailand, Kenya, and Mexico.¹ The most recent report from this case-control study (based on 39 cases who had used medroxyprogesterone) yielded a relative risk for all women using the drug of 1.0 (95% confidence interval 0.7 to 1.5).¹ Relative risks were not shown separately for women diagnosed as having breast cancer before age 35, for women who used the drug before age 25, or for women who reported using it recently; it will be important to see whether more detailed analyses replicate our findings and, if so, which of these groups are specifically at risk.

If our results are confirmed the indications for using medroxyprogesterone will need to be reassessed. The findings will also contribute to discussions about the relevance of the beagle model and about the pathogenesis of breast cancer.

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Outcome of elective prostatectomy

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Abstract

Objectives—To determine the symptomatic and urodynamic outcome of elective prostatectomy and to establish whether the outcome is influenced or can be predicted by preoperative urodynamic measurements.

Design—Prospective non-randomised study with follow up at a mean of 11 months after operation. Most men were assessed jointly by a urologist and a general practitioner.

Setting—Department of urology in a teaching hospital serving a large district population.

Patients—253 Men listed for elective prostatectomy because of symptoms and low urinary flow rates (<15 ml/s) and excluding those already on a waiting list or with acute urinary retention, clinically apparent prostatic cancer, and neurological or cerebrovascular disease; 217 (86%) were followed up.

Intervention—Elective prostatectomy.

Main outcome measure—Classification on the basis of relief of symptoms assessed by patients and urologist and general practitioner and of symptom scores obtained by questionnaire.

Results—Of the 217 men followed up, 171 (79%) had a satisfactory subjective review and 155 (72%) had a satisfactory review and also low symptom scores. An unsatisfactory outcome was associated with preoperative symptoms of urge incontinence, small prostatic size and resected weight, low voiding pressures, and low urethral resistance. Preoperative maximum urinary flow rates did not predict outcome. Men with poor outcome could be classified into two groups: those with irritative symptoms who were more likely before operation to have had urge

incontinence and detrusor instability and men with symptoms of poor urinary flow who were more likely before operation to have had a small prostate, low voiding pressures, and low urethral resistance. In patients in the second group flow rates or voiding pressures improved little after operation. Men with stable detrusors and either low urethral resistance or low voiding pressures were less likely to do well after prostatectomy, but despite these associations pre-operative urodynamic measurements were unable to predict outcome accurately.

Conclusions—Prostatectomy was satisfactory in relieving symptoms and improving urodynamic measurements in most men, but even in those with classic symptoms and low urinary flow rates a substantial minority experienced little improvement afterwards and urodynamic measurements did not accurately predict outcome in individual patients.

Introduction

Men in their 40s contemplating the one in 10 chance of future prostatectomy^{1,2} will be reassured that the operation is safe³ but may be disquieted by recent reports, which found that a fifth of men required a second transurethral operation within eight years,⁴ that many experienced little improvement in quality of life assessment,⁵ and that persistent urinary problems were commonplace.⁶

In about a fifth of men prostatectomy is performed for acute or chronic retention of urine,^{6,7} but in the remainder it is carried out for symptoms of bladder outflow obstruction that are difficult to assess. Moreover, similar symptoms may be produced by an un-

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obstructed and poorly contracting or unstable detrusor. Measurement of maximum urinary flow rates may identify men with obstruction who are likely to do well after prostatectomy.⁸

Several reports of urodynamic findings before and after prostatectomy have been published,⁹⁻¹² but most included only few men and some included men with acute retention of urine, whose preoperative urodynamic findings may be difficult to interpret. Moreover, none stated clearly the methods of defining outcome based on symptoms and urodynamic findings.

In 1984 we set up the present study^{13,14} to determine the outcome based on symptoms and urodynamic measurements of elective prostatectomy, to determine the proportion of men whose poor urinary flow was associated with normal or low pressure voiding, and to test the hypothesis that men with normal or low pressure voiding before operation have a less successful outcome after operation. We also wished to determine whether urodynamic measurements were useful in predicting the outcome of elective prostatectomy.

Patients and methods

Men listed for prostatectomy between January 1985 and September 1986 were asked to take part. We aimed at studying only men who were clear candidates for elective prostatectomy,¹³ and the following were excluded: men already on a waiting list (because those waiting for some time might not have been representative), men with acute retention, men with clinically apparent prostatic cancer, and men with neurological or cerebrovascular disease. The indications for operation were symptoms of poor flow, hesitancy, dribbling micturition, or incomplete bladder emptying with or without additional symptoms of frequency, nocturia, urgency, or urge incontinence. All had a maximum urinary flow rate <15 ml/s when measured in the outpatient department.

Two hundred and fifty three men were studied before their operation,^{13,14} and their urodynamic findings were not reported back to the referring clinician. After operation 217 men (86%) aged 48-97 (mean 69) were studied. Of the 36 men not studied, seven never had an operation, eight died before follow up (one postoperatively and seven incidentally after leaving hospital), and 21 did not attend the special follow up clinic. The length of history before operation was 2-3 years (range 3 months to 15 years). Consultant urologists listed 89 of the patients for operation and operated on 100; the remainder were listed either by senior registrars (50) or urological registrars (78) and operated on by senior registrars (74) or urological registrars (43). Transurethral prostatectomy was performed in 189 men, and the mean weight of tissue after formalin fixation was 23 (SD 24) g (range 5-140 g). Of the remainder (28), nine had either retropubic prostatectomy (weight of tissue removed 60-180 g) and 19 had transurethral incision of the bladder neck and prostate. The size of the prostate measured by ultrasonography before transurethral prostatectomy in the 120 men in whom scanning was performed was 48 (range 8-240) ml, and resected weight and preoperative prostatic volume were significantly correlated ($r=0.74$; $p<0.001$). Twenty four patients had incidental prostatic cancer on histological examination.

METHODS

The methods of performing the urodynamic study have been reported previously.¹³ The terminology used is that of the International Continence Society,¹⁵ and detrusor pressure at maximum flow was taken as being representative of voiding pressure. A standard questionnaire was used to measure obstructive and irritative symptoms (each scored out of a maximum of

10)¹³ and was based on that described by Frimodt-Moller *et al.*¹⁶ The patients were reviewed routinely about six weeks after their operation.

Two hundred and seventeen men were reviewed at least once more and at least three months after operation by a urologist (mean time 11 months, range 2-27 months), but most (164) were reviewed twice more. Of the 217 men, 10 agreed only to the review of symptoms, 26 men also had urinary flow rate and residual urine measured, and the remaining 181 had a full urodynamic evaluation.

Classification of outcome based on symptoms—At the final review the questionnaire was completed. After asking patients whether residual symptoms interfered with their usual activities they were placed in one of five categories (I no residual symptoms; II considerably improved but a few symptoms not interfering with usual activities; III improved but residual symptoms interfering with usual activities; IV no improvement; V worse). The final outcome was classified as satisfactory if the patient had a satisfactory subjective review category (I or II) in addition to both a low obstructive symptom score (0-3) and a low irritative symptom score (0-3).

Joint review by urologist and general practitioner—One hundred and sixty four patients were interviewed jointly by a general practitioner and consultant urologist who had not taken part in the previous interview. The format described above was repeated, but each interviewer gave his own subjective score for the patient (categories I to V) without informing the other. The patient was then asked to indicate his present urinary symptoms on a linear analogue scale extending from zero to 100 in steps of 10 (100 representing complete success after the operation with no symptoms and zero representing no improvement or worsening of urinary symptoms compared with before the operation).

Statistical analysis—Descriptive data are reported as mean (SD) values, and 95% confidence intervals for differences in proportions were calculated for paired and unpaired samples. For ordinal variables the confidence intervals for differences between the means were also calculated from the standard error, even when distribution free tests were used because distributions were roughly symmetrical and the confidence intervals were included for descriptive purposes only. For paired data differences between symptom scores or the incidences of various symptoms before or after the operation were assessed by the McNemar change test for proportions and the Wilcoxon signed rank test for ordinal data. Associations between independent categorical variables were assessed by χ^2 tests with Yates's correction. The Mann-Whitney U test and Kruskal-Wallis tests were used to assess the effect of individual factors on the outcome of the operation. To establish which factors might influence the outcome and estimate the extent of their impact a discriminant function was developed, based on a stepwise selection of variables. The statistical package for the social sciences program "discriminant" was used. Two tailed p values of 0.05 were taken as significant.

Approval for the study was obtained from the Newcastle District Ethical Committee.

Results

CLINICAL OUTCOME

Outcome based on symptoms

The severity of both obstructive and irritative symptoms decreased significantly after operation compared with before (symptom scores 1 (2) v 5 (2) for both; $p<0.001$). Table I gives details of the symptoms before and after operation. There was a significant improvement in all symptoms after operation ($p<0.001$), but

TABLE 1—Symptoms in 216 men before and after prostatectomy. Figures are percentages (numbers)

Symptoms	Before	After	Mean difference (95% confidence interval)*†
Poor stream	82 (177)	18 (39)	64 (57 to 71)
Hesitancy	75 (162)	12 (26)	63 (56 to 70)
Postmicturition dribble	78 (169)	39 (84)	39 (31 to 47)
Urgency	69 (149)	32 (68)	37 (28 to 46)
Nocturia	58 (125)	19 (41)	39 (31 to 47)
Urge incontinence	29 (63)	10 (21)	19 (12 to 26)

*Data analysed by McNemar's change test.

† $p < 0.001$ in each case.

some men after operation still had symptoms of poor flow (39), urgency (68), or urge incontinence (21).

On subjective review 171 men (79%) were satisfied with the operation (subjective category I or II). The distribution of the categories was: I—117; II—54; III—35; IV—10; V—1. The symptom scores also showed that 171 men had both obstructive and irritative scores < 4 but that 16 of the 171 men with a satisfactory subjective review had high symptom scores (≥ 4).

On final review 155 men (71%) satisfied all the criteria for a successful operation (171 with subjective category of I or II less 16 with high symptom scores).

Reason for poor outcome

The 62 men (29%) whose outcome was less than satisfactory could be classified into two main groups; 32 had persistent, severe urgency of micturition with episodes of urge incontinence, and 27 men had poor urinary flow and their obstructive symptoms had improved little. The three remaining men had developed a urethral stricture or stenosis of the bladder neck and had persistent problems because of this. Eight additional men had had problems soon after the operation but nevertheless had done well at the final review: two had mild, temporary stress incontinence, four developed urethral strictures but were symptomless at the final review after treatment, and two

with poor results had a further operation because it was thought that an inadequate operation had been performed by one particular trainee. No significant difference in outcome, however, was found among different surgeons, either in terms of who had listed the patient or who had performed the operation.

Relation between preoperative symptoms and outcome

Urge incontinence before operation (63 men) was the only symptom significantly associated with a poor outcome after operation, mainly because of persistent irritative symptoms and urge incontinence. Urge incontinence before operation was found in half (16/32) of those who subsequently had a poor outcome because of persistent irritative symptoms, in 30% (8/27) of those with a poor outcome because of persistent poor flow, and in a quarter (39/155) of those with a good outcome ($\chi^2 = 7.9$, $df = 2$; $p < 0.03$).

Assessment of outcome by urologist and general practitioner

Table II shows the results of the joint review by a consultant urologist and general practitioner; substantial agreement was found between the two assessors, 91% of the men (150/164) being classified similarly. The results of the linear analogue scale were broadly comparable with those of the subjective review, a good outcome (category I or II) being associated with a high analogue score (fig 1, $r_s = -0.75$; $p < 0.001$).

RELATION BETWEEN URODYNAMIC MEASUREMENTS AND OUTCOME

Volume of prostate removed and ultrasonography of prostate

Before operation the volume of the prostate (adenoma plus capsule) measured by ultrasonography was smaller in men who subsequently had a poor outcome because of persistent symptoms of impaired urinary flow (mean volume 36 (10) ml) than in men who did well (mean volume 56 (40) ml) and in men who had persistent irritative symptoms (mean volume 48

TABLE II—Comparison between urologist and general practitioner of subjective category and symptom score. Figures are numbers of men

Urologist					Urologist				
Category	I/II	III-V	Total		Symptom score	0-3	4-10	Total	
General practitioner	I/II	125	11	136	General practitioner	0-	117	10	127
	III-V	3	25	28		4-10*	5	32	37
Total	138	36	164	Total		122	42	164	

*Includes patients with either obstructive or irritative symptom score ≥ 4 .

FIG 1—Correlation between subjective category given by urologist and linear analogue scale in 164 men having had prostatectomy

(14) ml; Kruskal-Wallis H test 7.49; $p < 0.03$). This finding was supported by the observation that the amount of tissue resected by transurethral prostatectomy was significantly less (about 10 g) in such men (mean weight 13 (5) g) compared with that in men who did well (mean weight 24 (13) g) and in men with persistent irritative symptoms (mean weight 22 (14) g; Kruskal-Wallis H = 16.49; $p < 0.003$). The outcome of prostatectomy in men with incidentally diagnosed prostatic cancer was not different compared with that in men with benign hyperplasia.

Urinary flow rate and residual urine

Maximum urinary flow rates were significantly improved after operation (table III, figs 2 and 3; $p < 0.0001$). Preoperative maximum urinary flow rates and residual urine volumes, however, were not associated with the outcome of operation. Table IV shows the effect of flow rates on outcome in men with or without detrusor instability: in neither group was there a suggestion that men with lower flow rates had a particularly good outcome. Moreover, 16 men (7%) of

the total of 214 had flow rates ≥ 15 ml/s when assessed in the urodynamic clinic despite all patients having flow rates <15 ml/s in the outpatient department: the outcome after operation in these men was satisfactory, 15 patients having a good outcome (fig 2).

In men who had persistent symptoms of poor flow after operation (n=26) a small but significant improvement in flow rates was found (rate before operation 8.9 (4) ml/s, rate after operation 12.6 (7) ml/s

($p<0.002$), mean difference 3.7 ml/s (confidence interval 1.7 to 4.6 ml/s)). In contrast, in men who did well after operation maximum flow rates were improved compared with before the operation (8.9 (4) ml/s (n=157) v 18.8 (9) ml/s (n=150); mean difference 9.9 ml/s, confidence interval 8.6 to 11.2 (n=148); $p<0.001$) and in men who had persistent irritative symptoms (8.5 (3) ml/s (n=32) v 17.4 (8) ml/s (n=31); mean difference 8.9 ml/s, confidence interval 6.2 to 11.6 (n=31); $p<0.001$). Maximum flow rates after operation and the change in flow rates after operation compared with beforehand in men with symptoms of poor flow were significantly lower than in the remainder (Kruskal-Wallis, $p<0.001$).

TABLE III—Urodynamic evaluation of men before and after prostatectomy

	Before	After	Mean % difference (95% confidence interval)
% (No) with instability (on filling)	26 (56/216)	16 (28/178)	10 (2 to 18)*
% (No) with instability (provoked)	48 (104/216)	26 (46/179)	22 (13 to 31)*
Mean (SD) peak flow (ml/s) (n=205)	9 (6)	18 (12)	-8.9 (7.8 to 10)*
Mean (SD) voided volume (ml) (n=205)	221 (120)	340 (156)	-119 (96 to 142)*
Mean (SD) residual urine (ml) (n=207)	196 (350)	67 (160)	129 (88 to 170)*
Mean (SD) cystometric capacity (ml) (n=181)	330 (154)	412 (145)	-82 (63 to 101)*
Mean (SD) pressure rise (cm H ₂ O) during filling (n=181)	15 (15)	16 (13)	-1 (-3 to 1)†
Mean (SD) micturition pressure (cm H ₂ O) (n=179)	100 (44)	61 (31)	39 (32 to 46)*
Mean (SD) urethral resistance (cm H ₂ O.s ⁻¹ .ml ⁻¹) (n=179)	4.3 (9)	0.4 (0.6)	3.9 (2 to 6)*

* $p<0.001$. †NS.

FIG 2—Preoperative detrusor pressure at maximum flow and peak urinary flow according to final outcome after operation in 217 men

FIG 3—Postoperative detrusor pressure at maximum flow and peak urinary flow according to final outcome in 179 men (scale of horizontal axis is half that in fig 2)

Urodynamic findings

Table III shows changes in urodynamic measurements after operation. A poor outcome based on symptoms was associated with low voiding pressures or low urethral resistances before operation and low maximum urinary flow rates after operation (figs 2 and 3). These associations were clarified further when men with a poor outcome were classified into those with persistent poor flow or those with persistent irritative symptoms (table V). The group with poor flow had lower voiding pressures and urethral resistances before operation, lower flow rates after operation, and lower rates of detrusor instability compared with those with irritative symptoms. Tables VI and VII present these results in an alternative way and show the outcome in relation to the voiding pressures and urethral resistances subclassified according to the presence of detrusor instability. The relation among low voiding pressure, low urethral resistance, and a poor outcome because of symptoms of poor flow was confined to men with stable detrusors. In contrast, men with detrusor instability were likely to do less well after operation because of symptoms of urge or urge incontinence.

Ten men after operation still had increased voiding pressures (>80 cm H₂O) and low flow rates (<10 ml/s) and four had a poor outcome (fig 3).

TABLE IV—Relation between preoperative maximum urinary flow rate and outcome in men with or without detrusor instability

	Maximum flow rate (ml/s)	
	<10	>10
<i>With stable detrusor (n=111)*</i>		
Success (n=83)	64	19
Poor flow (n=16)	9	7
Irritative symptoms (n=12)	11	1
<i>With unstable detrusor (n=103)†</i>		
Success (n=73)	50	23
Poor flow (n=10)	8	2
Irritable symptoms (n=20)	14	6

* $\chi^2=5.0$, df=2; $p=0.08$.

† $\chi^2=0.6$, df=2; NS.

TABLE V—Urodynamic findings in men with poor outcome

	Men with persistent poor flow plus no better	Men with persistent irritative symptoms and others
Mean (SD) voiding pressures (cm H ₂ O):		
Preoperative	80 (39) (n=26)	106 (44)** (n=33)
Postoperative	53 (29) (n=26)	68 (45)* (n=31)
Mean (SD) postoperative flow rate (ml/s)		
	13 (5) (n=26)	17 (7)** (n=32)
% (No) with instability on filling:		
Preoperative	15 (4/27)	51 (18/35)**
Postoperative	17 (4/24)	42 (13/31)†
% (No) with provoked instability:		
Preoperative	37 (10/27)	66 (23/35)*
Postoperative	21 (5/24)	51 (17/31)*

* $p<0.05$, ** $p<0.01$, †NS.

Predicting outcome of prostatectomy

Before operation urge incontinence, low voiding pressures, low urethral resistance, detrusor instability, and small size of prostate were significantly associated with a poor outcome after operation because of either poor flow or persistent urgency. Table VIII shows the cumulative effect of these factors in developing a multivariate discriminant function and table IX the sensitivity and specificity of the discriminant function in predicting accurately the different outcomes of operation. The apparently high degree of specificity in defining the successful group is, in part, related to the large number of patients in the successful group compared with the small numbers in the other two groups. Most importantly, though, the sensitivity of the discriminant function in defining the successful group was only 48%.

Discussion

This prospective study confirms that for most men prostatectomy provides good relief of symptoms and is associated with satisfactory improvement in uro-

dynamic measurements. Furthermore, only one man died, and in only a handful was their condition unimproved or made worse: these reassuring findings agree with previous studies.^{3,6,8,9,12} An appreciable minority of men, however, despite recording some slight improvements were left with persistent symptoms of lower urinary tract dysfunction.

The second main finding was that urodynamic studies did not predict the outcome of prostatectomy, although when performed after operation they often explained why the patient had persistent symptoms. Certain variables measured before operation were associated with poor outcome, and in particular our initial hypothesis—that men with low or normal voiding pressure may not do as well after prostatectomy—was supported by the study. Defining the grade of obstruction by more advanced computer models relating pressure and flow¹⁷ may lead to better prognostic functions being developed.

Measuring outcome after operation is never easy because patient and surgeon are hoping for success, but the patients in our study were reviewed by a urologist and a general practitioner to try to obtain an independent and critical assessment of the results. Symptoms may persist after operation because of failure of operative technique, because of poor patient selection, or because the symptoms were not caused by abnormalities that the operation could correct. Poor technical performance seems unlikely to have been responsible in most patients who had persistent symptoms. No evidence was found relating outcome to the surgeon performing the operation. In addition, an inadequately performed operation would not explain the observation that certain findings before operation were associated with a poor result subsequently.

The main hypothesis was that men with low or normal voiding pressure before operation would not do as well after operation as those with high voiding pressures. Expressed simply, their symptoms might have been caused mainly by poor detrusor contraction rather than outflow obstruction and would not therefore respond to an operation designed to relieve obstruction. Few prospective studies have highlighted this group of men, although Jensen *et al* found a greater risk of a poor result when the preoperative urodynamic study suggested non-obstructed bladder outflow¹²; a smaller study failed to find an effect on outcome of preoperative voiding pressures.¹⁸ Rather to our surprise, in men who did not do well because of symptoms of poor flow the weight of the resected prostate was less, which was commensurate with their preoperative prostatic volumes.^{19,20} Though men with small prostates undoubtedly may have severe bladder outflow obstruction,²¹ a recent study found that men with small fibrous prostates were less likely to do well after prostatectomy.²²

The other main reason for a less than satisfactory outcome was that some men had persistent symptoms of frequency, urgency, and urge incontinence, and these were associated with detrusor instability before operation. This finding has been reported previously,^{23,25} though we found that most men with detrusor instability who had symptoms and a flow rate of <15 ml/s did well after operation.

In contrast with Abrams,⁸ we failed to find that low maximum urinary flow rates before operation were an important predictor of outcome. One of our criteria for selecting men for operation was a flow rate of less than 15 ml/s, and we might have selected out already the patients in whom this criterion was going to be important. Several reported findings, however, do not support this argument. Firstly, a study in North America, in which patients were selected primarily on the basis of symptoms, failed to show any effect of flow rates on outcome.²⁶ Secondly, several of our patients

TABLE VI—Relation between preoperative voiding pressure* and outcome in men with or without detrusor instability

Outcome	Voiding pressure (cm H ₂ O)		
	<80	80-100	>100
<i>With stable detrusor (n=111)†</i>			
Success (n=83)	31	14	38
Poor flow (n=16)	14	1	1
Irritative symptoms (n=12)	7	1	4
<i>With unstable detrusor (n=104)‡</i>			
Success (n=74)	23	15	36
Poor flow (n=10)	4	4	2
Irritative symptoms (n=20)	5	5	10

*Detrusor pressure at maximum flow.

† $\chi^2=14.5$, df=4; p=0.006.

‡ $\chi^2=3.7$, df=4; NS.

TABLE VII—Relation between preoperative maximum urethral resistance* in men with or without detrusor instability

	Maximum urethral resistance		
	<0.5	0.5-1.0	>1.0
<i>With stable detrusor (n=110)†</i>			
Success (n=82)	8	27	47
Poor flow (n=16)	8	4	4
Irritative symptoms (n=12)	0	4	8
<i>With unstable detrusor (n=103)‡</i>			
Success (n=73)	10	17	46
Poor flow (n=10)	0	3	7
Irritative symptoms (n=20)	4	1	15

*Detrusor pressure at maximum flow/maximum flow rate.

† $\chi^2=20.2$, df=4; p=0.0005.

‡ $\chi^2=5.4$, df=4; NS.

TABLE VIII—Multivariate discriminant analysis relating postoperative outcome to preoperative symptoms and urodynamic variables

	Changes in Rao's V	Significance
Urge incontinence	10.085	0.0065
Voiding pressure	8.380	0.0151
Urethral resistance	11.989	0.0025
Detrusor instability	7.279	0.0263
Volume of prostate resected	5.184	0.0749

TABLE IX—Sensitivity and specificity of predictive index derived from discriminant analysis

Outcome	Sensitivity (%)	Specificity (%)
Success	48.4	84.2
Poor flow and unimproved obstructive symptoms	69.2	74.2
Urgency and urge incontinence	51.6	74.6

had urinary flow rates of 15 ml/s or more despite our aiming at excluding them: the outcome in this group was satisfactory, in agreement with previous studies.²⁶⁻²⁸ On the other hand, Jensen *et al* recently reported that urinary flow rates above 15 ml/s were associated with a poor outcome (5/17) compared with the remainder (10/117),¹² but the numbers were small and most men with high flow rates did well.

Most men contemplating the prospect of prostatectomy should be reassured by our study. There is, however, a clear need to identify beforehand that quarter of men who do not benefit greatly from the operation. Though the performance of a speculative prostatectomy as a diagnostic test is unsatisfactory, urodynamic studies, as presently carried out, do not seem to hold the key to this problem.

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Independent effects of weight change and attained body weight on prevalence of arterial hypertension in obese and non-obese men

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Abstract

Objective—To assess the relations among prevalence of arterial hypertension, history of weight change, and current body weight in the range from normal weight to severe obesity.

Design—Retrospective analysis of medical records of men registered with Danish military authorities from 1943 to 1977 and followed up four to 40 years later.

Setting—Draft board of Copenhagen and surrounding counties and the rest of Sjælland and surrounding islands.

Subjects—964 Men who were severely obese (body mass index ≥ 31 kg/m² at the first examination) and 1134 random controls.

Main outcome measures—Blood pressure and weight.

Results—Hypertension was more prevalent in subjects with an unchanged body mass index as that index increased over the range studied. At any body mass index hypertension was more prevalent in subjects who had increased to this index and less common in those who had decreased to it than in those who had stayed the same weight since the first examination. Hypertension among controls was

most common in those subjects who had become obese during adulthood.

Conclusions—Changes in body weight have a great influence on arterial hypertension independent of the effect of attained weight, particularly in obese subjects.

Introduction

Several prospective clinical studies have shown a correlation between change in weight and blood pressure in severely obese patients treated with diet or a bariatric operation.¹⁻³ This effect is so pronounced that a reducing diet is considered a rational treatment of moderate hypertension in obese subjects.^{4,5} The mechanism of the close relation between body weight and blood pressure is not fully clarified.⁶ One major unsolved question is whether the blood pressure after changes in body weight corresponds to the predicted blood pressure for the attained body weight. If it does the body composition as such rather than the effects of the changes in body weight is essential to the blood pressure. This is particularly important in the understanding of the association between obesity and hypertension.

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