

A SURVEY OF HOSPITAL RECORDS ON ONE THOUSAND
TRANSURETHRAL PROSTATIC RESECTIONS

A Thesis

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CHAPTER I

THE PROBLEM AND SOURCES OF DATA

THE PROBLEM

Statement of the problem. Transurethral resection for the relief of bladder neck obstruction due to benign prostatic hypertrophy or prostatic carcinoma, is a popular method of treatment in this centre. The purpose of this study is to enquire into the preoperative state of the patient, the operative findings, and the post-operative hospital period. Data on post-discharge follow up is not included.

Importance of the study. Presentation of data on a series of this size can confirm previous impressions, bring to light new problems, and serve as a yardstick in comparing transurethral prostatic surgery done here to that done elsewhere. Bladder neck obstruction is a common cause of disability in the middle-aged and older male. The patient is still either the family breadwinner, or the retired head of the family. In either case, these patients are, or have been, responsible members of the community. The morbidity and mortality associated with this operation have been decreasing through the years. This is due in part, to the better understanding of the problem that reviews of this nature can stimulate. All surgical procedures can benefit from periodic review.

SOURCES OF DATA

The Winnipeg General Hospital records on one thousand consecutive cases of prostatism resected transurethrally during the years from 1944 to 1948, constitute the basis of this study. The cases were both public and private patients of the members of the Urological Department of the Winnipeg Clinic.

Age incidence, duration of symptoms, associated disease, urological appraisal, x-ray findings, operative blood loss, amount of tissue resected, repeat surgery, post-operative complications, mortality, and duration of hospital stay are reviewed and presented.

The records consulted, include the history, progress notes, laboratory and x-ray reports and operative summaries. Available in the staff cases were the Out-Patient Department records.

The Stern-McCarthy, Nesbit Modification of the Stern-McCarthy, and the Thompson resectoscopes were used for the operations in this series. The Davis-Bovie, or Wappler high-frequency units were used as the sources of current.

ORGANIZATION OF REMAINDER OF THESIS

The remainder of the thesis contains chapters on The History of Transurethral Resection, Review of The Literature, Report of The Study, Summary Conclusions and Recommendations, and an alphabetically arranged Bibliography.

The Report of The Study is presented under divisions corresponding to the three phases of the hospitalization period.

Chapters III to VII inclusive, are organized in such a manner as to enable the reader to quickly refer to the literature review, report of the study, and conclusions made on any one point of investigation, e.g., prostatic calculi.

CHAPTER II

THE HISTORY OF TRANSURETHRAL RESECTION

EARLY HISTORY

Catheterization has been practiced since before the period of recorded history began. In the sixteenth century Ambroise Pare developed and used a stricture dividing device for the relief of urinary obstruction.³⁶ In 1603, Turguet de Mayenne was censured by the Faculte' de Paris for practicing transurethral manipulation to overcome prostatism.⁴³ However it was not until the beginning of the nineteenth century that prostatism was generally recognized as a disease entity. From this point to the Listerian era all surgical approaches to the prostate were made via the urethral route.

In 1806, Sir William Blizard treated prostatism transurethrally via perineal urethrotomy. The first case report of a patient treated by trans-urethral surgery for prostatic hypertrophy was published by Stafford in 1831.⁵⁶ One year previously, Guthrie had described an instrument used only to incise median bars.²⁰

The contemporary French surgeons, Civiale, D'Etoilles, and Mercier, used modified lithotrites as cutting tools.⁶³ Their operations, like those of Blizard and Stafford, were essentially transurethral incisions of bladder neck obstructions and were not widely accepted.

In 1874, Bottini developed a galvano cautery incisor on the lithotrite frame. This instrument produced thermal destruction of tissue and later alough. In spite of the usual disadvantages of a blind procedure, this instrument was widely used in America and Europe.

In 1900, Freudenberg improved on Bottini's model by attaching a lens system and this modification was recommended by Meyer in America.

Bottini's model was further modified by Goldschmidt, Wishard, and Chetwood. Wishard operated through a perineal urethrotomy, using a large speculum and reflected light. Chetwood, using galvano cautery, was apparently the first to use a palpating rectal finger as a guide.

Hugh Young developed and discarded his modification of Freudenberg's instrument about 1899.

Starting about the turn of the century, the transurethral approach was abandoned because of poor visualization and lack of adequate hemostasis. The open surgical approach to the prostate came into vogue and flourished without serious challenge for twenty-five years. As will be seen later, the open surgery of the Listerian era was supplanted to a large degree in America by the perfection of the resectoscope.

HISTORY OF THE CYSTOSCOPE

As early as 1805, unsatisfactory urethroscopes and cystoscopes had been made. Following the invention of the incandescent lamp in 1879, Nitze and Leiter in collaboration produced and marketed a satisfactory cystoscope in Europe. The lamp was first incorporated into an indirect cystoscope with a magnifying lens system by Du Rocher in 1885.

The first American cystoscope was made by Dr. Otis and Mr. Wappler in 1900. The modern American cystoscope is chiefly the result of the work of Young, Buerger, Brown, Braasch, McCarthy and Lewis with the cooperation of skilled technicians and instrument makers.

Although the history of the cystoscope is made interesting by many brilliant later modifications, the purpose here will be served by mentioning in what direct ways the cystoscope contributed to the modern resectoscope.

The so called cold punch as used today, developed from the direct-vision, non-magnifying cystoscope of Braasch; the present day, high-frequency

resectoscopes all incorporate the foroblique lens system of the McCarthy cystoscope.

DEVELOPMENT OF THE COLD PUNCH

During the quarter century that witnessed the rise of open prostatic surgery it became apparent to several surgeons that this form of attack left something to be desired. Patients were subjected to shocking open surgery for the treatment of median bars or contracted bladder necks. Both of these conditions, it has been shown since, are better treated transurethtrally.

The three important developments that made resectoscopes possible were, the incandescent lamp, the fenestrated sheath, and the high-frequency current.

Probably more is owed to Hugh Young for his development of the fenestrated sheath than to any other pioneer in this field. Young, in 1909 created the first successful instrument purposefully designed for prostatic resection. With this instrument, tissue was engaged in a fenestra near the distal end of a tubular sheath. The tissue was cut with a sliding tubular knife contained within the sheath. The actual cutting manoeuver was blind, and there was no method of controlling bleeding.

This instrument he modified in 1911 by the substitution of a cutting loop made of platinum heated by an electric current. In 1917, Young reported 156 punches performed under local anaesthetic with no deaths.

Workers on both continents developed high-frequency current of two fundamental types. Undamped cutting current was used to excise tissue. Highly damped coagulating current was used for hemostasis. In 1914, Luys of Paris and Stevens and Bugbee in America had developed a technique of using high-frequency coagulating current to destroy tissue through a urethroscope.

In 1920, Caulk further modified the Young resectoscope by the addition of an electrocautery tip to control bleeding. He used this instrument a great

deal, and by 1933 had incorporated the McCarthy foroblique lens system.

Braasch modified Young's instrument to include a window. This enabled the procedure to be done entirely under vision and under water.

In 1925, Rose combined Braasch's and Caulk's model to present a visual cautery punch.

Walker introduced the bakelite sheath to protect the tissues from thermal trauma.

In 1926, Bumpus added a flexible wire electrode to the Braasch instrument and is given credit by Nesbit for designing the first completely unified instrument for use in transurethral prostatectomy.

The Braasch-Bumpus model was refined and used enthusiastically by Thompson. Refinements and changes such as Foley's pneumatic principle have been made since but the Thompson model (1935) of the Braasch-Bumpus cold punch is today the most widely used by those who favor this type of resectoscope.

DEVELOPMENT OF THE HIGH-FREQUENCY RESECTOSCOPE

The first application to Urology of the high-frequency current was made by Beer in 1910. He described its use in the coagulation of bladder tumors and thereby paved the way for electroresection under water.

The first use of the cutting current for the treatment of prostatism was reported by Keyes and Collings in 1924. This was apparently limited to incision of median bar.

In 1926, Stern presented a lens system resectoscope, using the fenestra, but replacing the tubular knife with a cutting wire loop, activated not by heat but by high-frequency current. To him has been given the credit for the introduction of the term "resectoscope".

In 1931, Davis and Kerwin, working independently, brought out loop resectoscopes both of which used the fenestrated sheath. Davis reported

enthusiastically that he was able to resect large glands with his instrument.

In 1932, McCarthy brought out his model which immediately rendered all other electro-resection models obsolete. It incorporated the bakelite sheath, the magnifying foroblique lens system, and a semicircular cutting loop. The fenestra was situated at the end of the sheath. This provided a large operating area and allowed resected tissue and irrigating fluid to escape easily.

Recent modifications have been introduced by Nesbit, Foley and others. The most widely used modification is that of Nesbit. The newest model is the roller-bearing, Nesbit Modification of the Stern-McCarthy Resectoscope. This allows the operator to resect tissue and fulgurate bleeding points under continual vision in running water with one hand. The index finger of the other hand applies rectal pressure which aids greatly in the complete excision of tissue widely practiced today.

CHAPTER III

REVIEW OF THE LITERATURE

SOURCES OF DATA

All relevant available literature appearing during the years from 1945 to date has been utilized. Comments of a general nature have not usually been included. An attempt has been made to refer only to those reports which were accompanied by facts and figures. Several good, earlier reports by well known authorities were consulted. Most reports appearing prior to 1945 are of lesser significance when compared to those of more recent origin. Much of this is due to the fact that it took about ten years to develop the able resectionists operating today. These men were largely self-taught and it is felt that most of their early surveys are not comparable to recent reports.

PREVALENCE OF RESECTION

In the United States and Canada, most large centers, especially teaching hospitals, practice transurethral resection on a large proportion of prostatic cases.^{39, 37, 38, 5, 54} A recent authoritative survey of prostatic surgery states that more resections are done than all other methods of prostatic surgery combined.³⁶

INCIDENCE OF BENIGN PROSTATISM

The incidence of benign prostatic hypertrophy in men over fifty is very high. This has been estimated at 50 per cent of men at the age of fifty, and 75 to 80 per cent of men over eighty.^{47, 36}

INCIDENCE OF PROSTATIC CARCINOMA

The incidence of carcinoma of the prostate in patients seeking relief from prostatism has been found in various series to be:

PER CENT	REFERENCE
7.6	... 14
<u>10.2</u>	... 54
<u>10.3</u>	... 37
10.6	... 45
11.0	... 6
<u>12.0</u>	... 29
<u>12.1</u>	... 25
12.4	... 5
13.0	... 3
<u>13.4</u>	... 46
<u>14.0</u>	... 7
14.0	... 55
14.0	... 12
14.4	... 33
<u>14.6</u>	... 39
<u>15.0</u>	... 35
<u>15.2</u>	... 24
16.0	... 59
16.6	... 31
16.8	... 40
<u>17.0</u>	... 62
17.0	... 9
17.0	... 60
18.0	... 36
18.7	... 41
23.0	... 52
24.5	... 21

The underlined figures represent series of over one thousand cases. Of the twenty-seven estimates of incidence, fifteen, or over half, fall within 13.0 to 17.0 per cent. This group of fifteen contains four of the six series of over one thousand cases. However, the largest group studied was made up of 12,500 cases with a 12 per cent incidence of cancer.²⁹ Therefore, on the basis of this review, it is reasonable to say that the incidence of prostatic carcinoma in cases coming to surgery is from 12.0 to 17.0 per cent. Young, in a frequently quoted statement, said that 17 per cent of all

prostatism was due to cancer.²⁶ It appears that this is the upper limit.

AGE INCIDENCE OF PROSTATISM

The average age in cases of prostatism seeking relief has been estimated at:

AGE IN YEARS REFERENCE

<u>65.3</u>	....	16
<u>66.0</u>	....	55
<u>66.0</u>	....	29
<u>66.5</u>	....	54
<u>66.6</u>	....	31
68.0	....	40
68.0	....	5
68.3	....	9
<u>68.9</u>	....	35
70.1	....	21
71.0	....	52
74.0	....	12

The underlined ages represent series of over one thousand cases. Of the group of twelve ages, nine fall within a five year group from 65 to 69 years. This group of nine contains all of the five series of over one thousand cases. The largest group was 12,500 cases with an average age of 66 years.²⁹ The high value of 74 represents staff cases only. These patients do not, as a rule, seek treatment until quite ill.

The average age in cases of benign hypertrophy alone has not often been reported. Two references set this figure at 68.8 and 69.8 years.^{53, 38}

More figures for carcinoma are available. The average age was found to be 62.6, 66.1, 68.4, 69.4, 71.0, and 77.6 years.^{36, 57, 5, 50, 18, 38} It is evident that this is a somewhat older age group with half the values being over 69 years. One study reports over half the cases in the seventh decade and one quarter over 70 years.⁶² Although it has been said that the age incidence is the same for both forms of prostatism,¹ there is general agreement

that those with carcinoma do fall into an older age group.

ASSOCIATED DISEASE

The reviewed literature contains very few references to duration of symptoms and associated disease, especially to associated disease of a type likely to influence risk. General statements are made to the effect that prostatics suffer from diseases affecting the male age group into which they fall. Most of these are degenerative cardiovascular diseases due to hypertension, arteriosclerosis, or diabetes. A series of 314 prostatics showed evidence of heart disease on clinical examination or electrocardiogram in 35 per cent of the cases.²⁷ These were unselected cases with a subsequent mortality rate within the present accepted range. Hypertension was found in 15.5 per cent of a series of 400 cases.⁵⁷ This statement was not qualified.

An admission diagnosis of uremia was made on 20 per cent in a series of 560 cases.³⁸ Whether uremia was diagnosed clinically or on the blood urea nitrogen levels is not stated. One author states that very few of his patients were admitted with advanced uremia.³²

URINARY RETENTION

The incidence of acute retention in cases admitted to hospital has been said to be, "greater than 50 per cent", 28 per cent and 23 per cent.^{35, 52, 21} The estimate of over 50 per cent comes from a series 1458 cases. Patients admitted with acute or chronic retention were found to be 34 per cent of another series.⁴⁰ No statement was found which compared carcinoma and benign hypertrophy in this regard.

RENAL FUNCTION

The blood urea nitrogen levels reported in the literature are sometimes hard to interpret. Usually the value accepted as the upper limit of normal is

not given. At other times it is not clear whether the values given are admission levels or operative levels. One series of 86 malignant cases had admission values of under 20 mgm. per cent in over half the cases.⁴⁴ Elevated non-protein-nitrogen was reported in 16 per cent of 200 cases of prostatism.²¹

X-RAY INVESTIGATION

Hydronephrosis. Preoperative routine x-ray investigation revealed hydronephrosis either unilateral or bilateral, in 2 per cent of a series of 100 patients with benign prostatism.⁵³ In a series of 408 excretory urograms, a 37.9 per cent incidence of hydronephrosis was found. This was broken down to 53 per cent for the malignant cases and 36 per cent for the benign.²⁵

Urinary calculi. Urinary tract calculi were found in 7 per cent of patients in a series of 100 cases.⁵³ Ureteral calculi were found in 1 per cent, and bladder calculi in 5 per cent of a series of 200 cases.²¹ Two other series present an incidence of bladder calculi of 3.6 per cent and 5.1 per cent respectively.^{52, 25}

Diverticula. Bladder diverticula have been found in 2.6, 4.0, 6.0 and 12.7 per cent in various series.^{52, 53, 21, 25} It is clear that the diagnosis of diverticula was made on urographic findings alone in 13.7 per cent. No data was found on the incidence of diverticula at operation, nor were comparisons made between carcinoma and benign prostatism.

Prostatic calculi. Prostatic calculi were found in 13.5 per cent of 1458 cases. Of this group, the malignant cases showed an incidence of 7 per cent.³⁵ In two series presenting a total of 140 cases of prostatic calculi, the co-existing diagnosis was carcinoma in only four patients.^{62, 19} We are not told whether the diagnosis was made on x-ray findings alone,

operative findings alone, or on a combination of the two. One series of 408 urograms reports an incidence of 7.8 per cent.²⁵ Two independent investigators came to the conclusion that there was no difference between the incidence of prostatic calculi in benign and malignant cases.^{23, 13}

Metastases. Regarding the incidence of metastases in patients with malignant prostatism, an unqualified statement sets this figure at 10.2 per cent for a series of 560 cases.³⁸ For two series of similar size, spinal and pelvic metastases were found on x-ray in 60 per cent and 42.6 per cent.^{57, 48} It is presumed that these figures represent the incidence of metastases found in patients when the diagnosis of carcinoma was first made.

PYURIA

Only one reference to preoperative pyuria was found. This was an unqualified statement to the effect that pyuria was demonstrated in more than half of 560 patients.³⁸

HEMOGLOBIN

No reference to anemia nor to preoperative hemoglobin levels was found.

AMOUNT TISSUE RESECTED

The average amount of tissue resected is stated in most reports. Whether large prostates are commonly resected and whether resection to the capsule is usually carried out is generally not stated in the literature. Average values for weights of tissue resected in mixed series are, 26.8, 30.0, 30.27, 30.95, 33.4, and 44.3 grams.^{40, 35, 52, 21, 12, 9} The last weight is reported in a recent series by an author who is known to resect

to the capsule. The other figures are unqualified.

The average weight from benign resections is said to be, and usually is, greater than that from the resection of carcinomatous glands. Benign series reported are 17.7, 29.0, and 32.8 grams.^{53, 38, 41} These few figures do not bear out the above statement. This may be because they include resections on contracted and fibrosed vesical necks. It is assumed that secondary resections or "revisions" are not included.

Tissue weights in malignant cases are reported as 17.8, 19.3 and 23.0 grams.^{5, 38, 45} The series reporting 23 grams is by a group who state that they resect large glands by choice.

OPERATIVE BLOOD LOSS

Measurement of operative blood loss is recommended by most authors. The method of measurement is usually not given, apparently because it is simple and easy. The few references to amount of blood loss give average losses of 168, 180, and 253 cc.^{39, 9, 12} The first figure is the most acceptable because it represents a series of over 1100 cases. The last figure represents a series in which the operation was most often performed by hospital residents. Operative loss in benign glands only is reported in two series to be 128, and 180 cc.^{40, 41} No figures for loss in malignant cases were available, although it is the general experience that this figure is low. It is also generally stated that blood loss in large glands is higher. Reference to post-operative blood loss measurement was not found in the current literature.

REPEAT RESECTION

Repeat resection is referred to in most of the reports because of the fact that the need for revision is one of the main criticisms levelled at transurethral resection. Resection more than once is given in various

series as:

PER CENT REFERENCE

2.2	...	14
<u>3.3</u>	...	39
<u>4.0</u>	...	55
<u>4.5</u>	...	40
5.0	...	16
7.0	...	52
13.0	...	21
<u>19.3</u>	...	54
21.0	...	9

The underlined averages represent series of over 1000 cases. The highest value represents a series by an operator known to resect some large glands in two stages by choice.

Figures given for repeat surgery in benign glands only, are 11.2, 11.4 and 20.2 per cent. ^{37, 38, 51} The last figure represents the number of multiple resections in a series of 8508 cases. It represents the response to a questionnaire circulated to members of the American Urological Association.

One series reports that in malignant cases, repeat resection was done in 19.3 per cent. ³⁸

In comparing large and small glands, two authors say that revision is commoner following resection of large glands. ^{36, 46} One reference gives a ratio of 8.4 per cent revision in large glands to a 3.7 per cent revision in small glands. ⁴⁵ In a series of 560 patients, prostatic surgery of some kind, previous to admission, had been performed on 8.8 per cent of the benign and 15.6 per cent of the malignant cases. ³⁸ In another series of 1066 cases, 12.1 per cent of the patients were readmitted for "delayed resections". It appears that this figure, combined with their finding that 19.3 per cent of the cases had more than one resection during the admission under surgery, gives a total revision rate of 31.4 per cent. ⁵⁴ No other series mentions the number of cases admitted with a history of previous resection.

POST-OPERATIVE MORBIDITY

The causes of post-operative morbidity are not usually discussed at length in the reviewed reports. In order to compare with the series to follow in this thesis, no post-operative complications not occurring in hospital will be reviewed.

Hemorrhage. Interpretation of exact meaning lends confusion to statements about post-operative hemorrhage. Severe bleeding up to three days after operation has been estimated to occur in 1.7, 5.0, and 8.0 per cent.^{54, 14, 21} An unqualified statement sets post-operative hemorrhage at 5.3 per cent.⁵² Hemorrhage necessitating treatment of some kind is estimated at 9.0 per cent.⁵³ Delayed hemorrhage was found to occur in 5 per cent of cases.²¹ Large glands hemorrhaged in 15.5 per cent compared to 3.7 per cent of small glands in one series.⁴⁵ A comparison of benign to malignant glands gave figures of 9.2 and 10.5 per cent respectively.³⁸

Urosepsis. Remarks on post-operative inflammatory conditions are largely confined to the incidence of epididymitis. This incidence is given as 4.0 and 10.0 per cent for mixed resections.^{30, 37} Large glands showed a ratio of 8.4 per cent to 1.6 per cent for small glands.¹ Benign prostates showed a ratio of 10.0 per cent to 3.5 per cent for malignant prostates.³⁸ Bilateral vasectomy has been frequently shown to decrease the incidence of epididymitis significantly.¹⁴ The only reference to urosepsis in general, gives an incidence of 4.0 per cent for "pyelonephritis or severe infections".¹⁴

Myogenic bladder. The one reference to what we call the myogenic bladder states that "post-operative atonic bladder" occurred in 5.0 per cent of cases.²¹

Size of gland. Prolonged morbidity and increased incidence of hemorrhage and epididymitis are said to be commoner following multiple resections and resections of large glands.^{46, 51} Most of the above references do show that these post-operative complications are less common following single resections of small glands.

Other complications. An unqualified statement is made to the effect that the commonest complications are cardiac and cerebral. This series comprised over 1400 cases.³⁵

MORTALITY

It is not uncommon, during the last few years, to accumulate a series of one to two hundred cases with no deaths. Therefore, the mortality rate in small series will not be quoted here.

Mortality rate. The rates on 27 series of mixed benign and malignant cases are as follows:

PER CENT	REFERENCE
.5	54
.6	12
.9	16
1.0	51
1.1	29
1.2	49
1.29	9
1.3	15
1.3	39
1.3	41
1.3	17
1.48	42
1.5	55
1.6	52
1.8	14
1.81	40
1.9	27
2.2	51
2.4	32
2.5	51
2.55	17
2.8	35
2.9	34
3.1	37
3.7	45
7.5	7
7.7	22

Fourteen, or over one-half the rates are underlined and represent series of 1000 or more cases. It is of interest to note that 17 or 63 per cent of the series of 27 values represent mortality rates under 2 per cent. The average value of the 14 rates representing the large series, is 1.56 per cent. This latter average is of the most value since it represents such a large number of cases.

Rates of 1.29 per cent for 15,000 cases and 1.1 per cent for 12,500 cases represent the two largest series.^{9, 29} One series presents a death rate of 2.2 per cent 6782 single resections, and 2.5 per cent for 1726 multiple resections.⁵¹

One reference is made to benign rates alone. This was 3.1 per cent.³⁸ The general statement is made that the mortality rate in resection for benign prostatism varies from 1 to 2 per cent.²⁶

The mortality rate following resection for malignant obstruction is given in three series as 5.3, 7.5, and 10.6 per cent.^{38, 57, 46}

Intravascular hemolysis. Much has been written on the use of isotonic solutions in the prevention of the intravascular hemolytic syndrome.^{2, 4, 10, 28, 61, 12} There is general agreement that the incidence of lower nephron nephrosis can be decreased greatly if not eradicated entirely. In one series of 500 cases, no deaths were attributed to this syndrome.¹⁴ In a series of 986 cases in which isotonic solution was used, the mortality rate was .6 per cent.¹²

That irrigating solution does enter the blood stream is demonstrated by two ingenious methods. In one, after resection, Diodrast solution was instilled into the bladder. After a time, x-ray films showed typical excretory urograms.⁵⁸ The other method was to culture venous blood at the end of the resection. This report found positive blood cultures in 45.0 per cent of 350 resections.¹¹

Miscellaneous causes. Only two detailed analyses of the causes of death other than that due to the oliguria syndrome were found. ^{54, 34} These represent twenty-one deaths and are detailed as follows:

septicemia	...	8 deaths
cardiovascular	...	5
oliguria syndrome	...	3
hemorrhage	...	1
extravasation	...	1
"miscellaneous"	...	3.

One of the foremost authorities on transurethral resection states that more than one-third of the post-operative deaths are caused by infections complicating the decompensated bladder. ⁴²

PERIOD OF HOSPITALIZATION

Preoperative hospitalization. Preoperative hospital stay is reported as 2.5, 4.4, and 4.9 days. ^{21, 39, 40}

Post-operative hospitalization. Average post-operative stay is given as:

DAYS	REFERENCE
7.5	.... 52
8.0	.... 8
8.5	.... 21
8.6	.... 55
10.0	.... 35
10.3	.... 9
10.6	.... 53
11.1	.... 39
11.3	.... 40

Total hospitalization. Total hospital stay is reported as:

DAYS	REFERENCE
------	-----------

9.5	....	29
10.0	....	35
11.0	....	21
15.5	....	39
16.3	....	40

In no series is type of practice given. Public ward patients, and those coming largely from rural areas, for obvious reasons would be expected to require longer hospitalization than private cases resident in urban centres.

CHAPTER IV

PREOPERATIVE PERIOD

FREQUENCY OF RESECTION

Table I indicates the total number of patients operated on for bladder neck obstruction during the five year period under survey. The operation of choice was transurethral resection in 95.8 per cent, suprapubic prostatectomy in 2.8 per cent and .45 per cent underwent perineal prostatectomy. The latter approach is used only for the radical removal of localized carcinoma. Retropubic transcapsular prostatectomy was not used during this period.

INCIDENCE OF CARCINOMA

Of the thousand resections, 86.1 per cent were done for benign prostatism, and 13.9 per cent for carcinoma.

AGE INCIDENCE

The average age was found to be 67.2 years (Tab. II). The youngest patient was 46 and the oldest, 106. These two extremes were both reported by the Department of Pathology as carcinoma, grade III. The patient of 106 years underwent castration at age 107 and died at 109. The youngest is still living eight years after diagnosis. Patients with carcinoma fall into an older age group than those with benign obstruction, even though, as will be seen later, they present themselves for treatment sooner after onset of symptoms than do the benign cases. The ratio of staff cases to private cases was not recorded.

DURATION OF SYMPTOMS

Some prostatics are quite certain as to the date of onset of symptoms. Most, however, are vague. This makes it difficult to obtain an

TABLE I

1,122 PROSTATIC OPERATIONS IN 5-YEAR PERIOD

Transurethrales	1,086 or 95.8 %
Suprapubics	31 or 2.8 %
Perineals	5 or 0.45%

1,000 TRANSURETHRALES ANALYZED

Benign prostatic hypertrophy	861 or 86.1 %
Carcinoma	139 or 13.9 %

TABLE II

AGE INCIDENCE

Oldest	106.0 years
Youngest	46.0 years
Average age	67.2 years
Average age of carcinoma	72.1 years
Average age of benign	66.3 years

| 46.5% Carcinoma between 70 - 80 years | |
| 43.5% Benign between 60 - 70 years | |

accurate estimation of duration of symptoms. Relatives are routinely questioned when possible.

A short history of under six months was given by one patient in five (Tab. III). The greatest number gave a history of over one year. It is not uncommon for a patient of seventy or eighty to give a ten year history of urinary difficulty. Following the commencement of symptoms, those with carcinoma seek treatment earlier than those with benign hypertrophy.

ASSOCIATED DISEASE

Approximately one-third of the cases suffered from associated disease of a type, or to a degree considered sufficient to influence operative risk, and/or, post-operative morbidity (Tab. IV).

Blood pressure of over 150 mm. Hg systolic and 100 mm. Hg diastolic was recorded as hypertension. It is known that relief of urinary retention with consequent subsidence of pain and release of renal back pressure will often result in lower blood pressure. Where the record demonstrated that this had happened, hypertension was diagnosed only on the lowered reading.

Coronary sclerosis was diagnosed on the history and electrocardiographic findings.

Diabetes mellitus was diagnosed on the fasting blood sugar level, and not on the presence of glucosuria alone.

Uremia is diagnosed on the Urological Service on clinical grounds, and not on elevation of blood urea over an arbitrarily set level. However, fitness for surgery is determined by fall to normal levels or demonstration of a fixed level, however high.

The miscellaneous group consisted of patients with cancer other than that of prostatic origin, senile cases, arthritics, hemiplegics, and

TABLE III

LENGTH OF SYMPTOMS

TIME IN MONTHS	CARCINOMA	BENIGN	TOTAL
	%	%	%
6 and under	25.0	21.5	22.0
Under 12	44.6	36.5	37.7
Over 12	55.2	63.5	62.5
	CARCINOMA	BENIGN	
Longest	9 years	20 years	
Shortest	2 months	24 hours	

TABLE IV

ASSOCIATED DISEASE

DISEASE	CARCINOMA %	BENIGN %	TOTAL %
Hypertension	20.1	15.2	15.9
Coronary Sclerosis	8.6	4.7	5.3
Diabetes	2.8	1.7	1.9
Clinical Uremia	0.7	1.3	1.3
Stricture	1.4	0.8	0.9
Miscellaneous			7.0
Total cases with associated disease			32.3

cases of severe Parkinsonism.

There was a higher proportion of associated disease in the patients with carcinoma of the prostate.

URINARY RETENTION

Those patients with acute, complete urinary retention as proved by history and catheterization, were classified as acute retention regardless of the interval since the last satisfactory voiding. Classified as having chronic retention were those who, when examined, had overflow incontinence, or were able to pass only small amounts in the presence of a large residual urine. In practice, there has been no limit set to the amount of residual urine, above which a diagnosis of chronic retention can be made. However, from the case records, it was seldom difficult to distinguish acute from chronic retention. Cases in doubt were subjected to gradual decompression.

One-third of the series suffered acute retention at least once (Tab.V). About 19 per cent were admitted in acute retention. There was no apparent difference here between benign and malignant prostates. Chronic retention was about twice as common in the benign group.

RENAL FUNCTION

Normal blood urea nitrogen is considered to be under 20 mgm. per cent. Over two-thirds of the cases were admitted with a normal value (Tab. VI). The average blood urea nitrogen was well within normal limits. The malignant group had urea retention more frequently.

X - RAY INVESTIGATION

An intravenous pyelogram or a flat plate of the kidneys, ureters and bladder is routinely ordered on all patients with prostatism. Some of the referred cases came in with "negative" x - ray reports and without submitted

TABLE V

ACUTE RETENTION

	CARCINOMA %	BENIGN %	TOTAL %
Once	28.2	26.7	26.9
More than once	7.6	8.6	8.4
Total	35.8	35.3	35.4
Admitted in acute retention .	19.8	18.5	18.7

CHRONIC RETENTION

	6.4	12.0	11.3
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TABLE VI

RENAL FUNCTION

BLOOD UREA NITROGEN	CARCINOMA %	BENIGN %	TOTAL %
Under 20	57.4	68.7	67.4
Over 20	43.0	31.1	33.4
Over 40	36.4	4.6	9.4
Average	24.3	16.4	17.6
Highest	131.0 mgm. per cent		
Lowest	7.0 mgm. per cent		

films. These are not included in the x - ray survey.

Detailed reports were available in 793 cases (Tab. VII). 92 per cent of the flat plate films were negative. In 30 per cent of the excretory urograms, no abnormality was noted.

Calculi. Bladder calculi were much more common than upper tract calculi. On cystoscopy, a total of 5 per cent of the operative summaries reported bladder calculi. Non-opaque stones and very small stones were therefore missed on x - ray in .9 per cent of cases. Urinary tract stone was commoner in benign cases. Prostatic calculi were commoner in malignant cases.

Hydronephrosis. Unilateral or bilateral hydronephrosis secondary to bladder neck obstruction was demonstrated in 7 per cent of 666 intravenous pyelograms. Hydronephrosis was commoner in the malignant cases.

Bladder filling defect. A prostatic filling defect was demonstrated in only about one-third of the cases. The defect was usually more pronounced in the benign cases.

Pyelonephritis. The pyelographic signs of chronic pyelonephritis were found in only .5 per cent of the urograms.

Diverticula. Vesical diverticulum was demonstrated on x - ray in 4.3 per cent of the intravenous pyelograms.

Metastases. In the malignant cases, osseous metastases were reported only when demonstrated on routine films. These films include the spine from T11 to the coccyx and all, or almost all the bony pelvis. Evidence of bony metastases was found in 16.5 per cent. Approximately 90 per cent of these were osteosclerotic in type. The remainder were osteolytic lesions.

TABLE VII

X-RAY FINDINGS

PATHOLOGY	CARCINOMA %	BENIGN %	TOTAL %
Renal and Ureteral Calculi ...	0.7	1.2	1.5
Bladder Calculi	0.7	4.6	4.1
Prostatic Calculi	12.9	5.6	6.7
Hydronephrosis	14.2	5.8	6.9
Filling Defect	15.4	34.7	32.3
Pyelonephritis			0.5
Diverticulum			4.3
Metastases	16.5		
Plain Film only			127 cases
Intravenous Pyelogram			666 cases
Total X-rayed			793 cases

URINALYSIS

Routine admission urinalysis revealed pyuria in about one-third of the cases (Tab. VIII). Hematuria was much less common and is often unreliable as a finding. This is because pre-admission catheterization may cause the appearance of red cells in the routine admission urinalysis. The criterion for the diagnosis of either pyuria or hematuria, was the presence of ten or more cells per high power field in centrifuged urine.

Over 40 per cent of the urinalyses were negative. Patients with benign prostatism had a higher incidence of negative reports. Albuminuria was reported when present. No differentiation was made between true albuminuria and that due to the presence of pus and blood in the urine.

HEMOGLOBIN

Most of the patients were admitted with satisfactory hemoglobin levels (Tab. IX).

TABLE VIII

URINALYSIS

FINDINGS	CARCINOMA %	BENIGN %	TOTAL %
Pyuria	34.6	31.4	32.8
Haematuria	13.0	10.7	11.1
Albuminuria	38.4	26.4	28.2
Negative	34.6	43.9	42.5

TABLE IX

HAEMOGLOBIN

Over 70%	.....	93 %
Over 80%	.....	81 %

CHAPTER V

OPERATIVE PERIOD

WEIGHT OF TISSUE RESECTED

The average weight of tissue resected was higher in the benign cases (Tab. X). Revisions or repeat resections are not included in the table. Large glands, that is those estimated to weigh over 60 grams, are not usually resected here. In some American centres, great care is said to be taken in resecting to the capsule. This is not the case here. Generally, the operation is considered complete at a stage when resection of more adenomatous tissue is technically possible.

OPERATIVE BLOOD LOSS

Operative blood loss was measured with the colorimetric standards (15 gm Hbg per 100 cc) prepared by the Lamotte Chemical Company of Baltimore. All the fluid discharge during the resection was collected, and the hemoglobin content estimated. The fluid consisted of irrigating solution, blood, and urine. A negligible amount of hemoglobin remains on the drapes in trans-urethral resection. There is likely no surgical procedure in which it is as easy to collect extravasated blood.

There was a considerable difference in the amounts of blood lost by the two groups (Tab. XI). In the malignant, as in the benign group, over two-thirds of the patients lost less than the average for their group. The occasional large hemorrhage therefore, pushed the average up considerably. This table gives the blood loss in 434 cases only. Routine blood loss measurement was started about half way through the series.

In thirty cases, the hemoglobin content of the irrigating waste was measured for the first post-operative twenty-four hours. The average operating loss for this group was 154 cc. The average post-operative loss

TABLE X

AMOUNT TISSUE RESECTED

Average Weight, total cases	21.0 gm.
Average Weight Carcinoma	15.8 gm.
Average Weight Benign	22.0 gm.
Maximum	107.0 gm.
Minimum	1.0 gm.

was 67 cc., or less than half the operating loss.

REPEAT SURGERY

It was found necessary to resect more tissue on 9 per cent of the total cases in this series (Tab. XII). Including those cases admitted with a history of having had a transurethral resection here or elsewhere, a total of about 18 per cent had more than one resection. Repeat surgery was much more common in the carcinomatous group.

TABLE XII

REPEAT OPERATIONS

	Carcinoma%	Benign%	Total%
Admissions for 2nd, 3rd, etc..	17.5	7.3	8.9
Repeats While in Hospital.....	9.9	7.5	9.0
Total Repeats.....	27.4	14.8	17.9

CHAPTER VI

POST-OPERATIVE PERIOD

POST-OPERATIVE MORBIDITY

Post-operative complications, excepting those with fatal termination, are indicated in Table XIII. Only hemorrhage of sufficient severity to necessitate readjustment of, and/or traction on the Foley bulb, or requiring transfusion, and/or fulguration, is reported in this series.

Hemorrhage. Immediate hemorrhage is that occurring within 48 hours of operation. Delayed hemorrhage is that occurring any time after this. Post-operative hemorrhage of both kinds was commoner in the benign group.

Urosepsis. Inflammatory changes include pyelonephritis, cystitis, peri-prostatitis, peri-urethritis, periurethral abscess, and epididymitis. Preoperative vasectomy, or vasectomy at the time of operation was done in few of the 1000 cases. Also, vasectomy, when done, was not always noted on the operative summary. Therefore, for practical purposes, this series represents non-vasectomized patients.

Because the quality of progress notes was often poor, it was often not possible to break down urosepsis to pyelonephritis, epididymitis, etc. Therefore, in Table XIII, fever not explained by pulmonary findings, nor by thrombophlebitis, was put down under the heading "Inflammatory", meaning urosepsis in general.

Cardiovascular. Cardiovascular complications include myocardial infarction, thrombophlebitis, pulmonary embolism, and cerebro-vascular accidents. These were more common in the carcinoma group.

TABLE XIII

POSTOPERATIVE MORBIDITY

COMPLICATION	Carcinoma %	Benign %	Total %
Haemorrhage:			
Immediate.....	0.7	1.3	1.2
Delayed.....	2.1	3.2	3.0
Total	2.8	4.5	4.3
Inflammatory	9.9	9.1	9.2
Cardiovascular	3.0	1.4	1.7
Pulmonary	1.5	0.67	0.80
Myogenic Bladder	2.3	3.0	2.9

Pulmonary. Pulmonary complications include atelectasis and the pneumonias.

Myogenic bladder. The term myogenic bladder is applied to those cases with a large amount of post-operative residual urine, with or without difficulty in voiding, and with neither residual obstructing tissue nor large diverticula. These patients had usually a long preoperative history of chronic retention. This complication was more common on the older public ward group.

MORTALITY

Hemolytic syndrome. The intravascular hemolytic syndrome resulting from prostatic venous absorption of hypotonic irrigating fluid accounted for .9 per cent of the deaths (Tab. XIV). Several of the deaths were first recognized as resulting from this syndrome when the records were consulted during the development of this survey. These deaths had been variously diagnosed before this syndrome was reported in the literature. Only typical cases of clear cut sustained anuria or marked oliguria have been included.

Comparison of groups. The malignant group had a mortality rate of 4.3 per cent compared to 1.5 per cent for the benign group.

Miscellaneous causes. Miscellaneous causes of death are listed in Table XV. Case 1. may have been due to the lower nephron nephrosis of the hemolytic syndrome because death occurred on the 16th day. Cases 6. and 10. could not have been due to this syndrome because of the time interval between operation and death. The remaining cases require no particular comment. The methods of death were those common to this age group whether post-operative or not. No case of fatal pulmonary embolism was found. In the whole series, only two cases of recognized pulmonary embolism were found.

TABLE XIV

MORTALITY RATE

Intravascular Hemolytic Syndrome.....	9 deaths
Miscellaneous Causes.....	10 deaths
<hr/>	
Total Deaths.....	1.9 % or 19 deaths
<hr/>	
Benign Cases	13 deaths
Malignant Cases	6 deaths

TABLE XV

MISCELLANEOUS CAUSES OF DEATH

CASE NUMBER	POSTOPERATIVE DAY OF DEATH
1 Chronic Nephritis and Uremia	16
2 Pneumonia and Cardiac Failure	57
3 Pyelonephritis and Coronary Thrombosis	79
4 Bronchopneumonia and Cardiac Failure	30
5 Cerebral Vascular Accident	31
6 Chronic Nephritis and Uremia	60
7 Bowel Obstruction and Cachexsia	120
8 Coronary Occlusion	3
9 Pneumonia Following Hip Fracture	51
10 Chronic Nephritis and Renal Failure	60

PERIOD OF HOSPITALIZATION

Preoperative. Preoperative hospital stay depends on the operability of the patient after the general preoperative investigation has been completed. Many cases, especially those on the public wards, were admitted for treatment of congestive heart failure or for surgery other than urinary. Many of these did not develop prostatism of a degree requiring surgery until they were hospitalized. Consequently these were inoperable for some time. Table XVI shows that over half the cases were hospitalized only long enough for the investigation to be completed. In general, the malignant cases were not operable as soon as were the benign.

Post-operative. Over two-thirds of the patients were discharged under three weeks post-operatively. There was no significant difference here between the two groups. Post-operative stay was the length of time measured from the first resection if more than one resection was done during the admission in question.

Total. Over 75 per cent of the patients spent less than 28 days in hospital.

TABLE XVI
PERIOD OF HOSPITALIZATION

PREOPERATIVE PERIOD			
DURATION	Carcinoma %	Benign %	Total %
1 - 3 Days	18.3	28.1	26.4
Under 1 Week	43.3	58.5	56.1
Under 2 Weeks	70.4	83.0	81.0
Under 3 Weeks	85.8	90.8	90.2
Over 3 Weeks	13.9	9.0	9.8
Longest	120 Days	100 Days	
Shortest	1 Day	1 Day	
POSTOPERATIVE PERIOD			
1 - 10 Days	24.4	29.8	29.0
Under 3 Weeks	74.7	78.0	77.5
Under 1 Month	92.0	92.6	92.5
Over 1 Month	7.8	7.2	7.3
Longest	90 Days	117 Days	
Shortest	3 Days	3 Days	
TOTAL HOSPITALIZED PERIOD			
Under 4 Weeks	72.4	77.2	76.5
Over 4 Weeks	27.6	22.8	23.5
Longest	210 Days	149 Days	
Shortest	7 Days	8 Days	

CHAPTER VII

SUMMARY CONCLUSIONS AND RECOMMENDATIONS

SUMMARY

Similarity in form of presentation between the Review of the Literature and the Report of the Study permits easy comparison of this survey to those previously reported elsewhere.

A breakdown of all forms of prostatic surgery during a five year period is recorded. As in most centres on this continent where transurethral resection is practiced, this form of approach was used in the majority of cases. Since the end of this series, retropubic prostatectomy has slightly decreased the number of cases resected.

An analysis of the hospital records on one thousand consecutive transurethral prostatic resections is presented. Pathology, age incidence, history, associated disease, frequency and degree of urinary retention, laboratory and x - ray findings, amount of tissue resected, operative blood loss, incidence of repeat surgery, morbidity, mortality, and period of hospital stay are surveyed.

CONCLUSIONS

Some comparisons are made between benign and malignant prostatism. In general, the latter are forced to seek treatment sooner, have more associated disease, more urinary tract pathology, and a higher morbidity and mortality rate. It is impossible to say to what degree these factors are due to the fact that the malignant cases are older.

Age incidence. Because staff patients commonly seek help only when in extremis, the inclusion of these cases likely raises the average age.

Duration of symptoms. Malignant cases seek treatment sooner after the onset of symptoms because this form of prostatism is not characterized by

exacerbations and remissions as is benign prostatism.

Urea retention. Surprising findings were the low incidence of elevated blood urea nitrogen levels, and of clinical uremia, even though it is known that many patients with prostatic obstruction are adjusted to high blood urea levels before seeking treatment. Other renal function tests were not done because operability is the prime consideration. Blood urea nitrogen levels serve as an excellent rough guide to operability.

Blood urea levels were higher in the carcinomatous cases because of the subtrigonal and ureteral infiltration of the malignant process. The ureters are mechanically blocked far more often in malignant than in benign cases.

Stricture. External meatal narrowing and true urethral stricture was not routinely recorded. It is felt that the incidence should have been higher. These present an operative and post-operative hazard because operation is seldom performed here through perineal urethrostomy.

Urinary retention. The distinction between acute and chronic retention is all-important when type of surgical procedure and expected post-operative course are considered. The cases of post-operative myogenic bladder might have been avoided had this distinction been made and had preliminary cystostomy been done. Chronic retention is commoner in benign hypertrophy due to the larger size and intravesical protrusion of the gland.

Filling defect. In the two years since the end of the survey, negative intravenous pyelogram reports have become rare. It is almost always possible, with present technique, to demonstrate a filling defect due to the prostatic hypertrophy. Definition is better in benign prostatism due to the usual intravesical protrusion of the gland.

Urinary calculi. Bladder calculi are more common than upper tract calculi because the stasis factor does not usually include hydronephrosis and hydroureter. There is no method of determining whether urinary calculi were

present before the onset of prostatism.

Prostatic calculi. Not found in the literature is the demonstration of a much higher incidence of prostatic calculi in carcinoma of the prostate. It is felt that the incidence of these calculi would have been higher had their presence been routinely noted on the operative sheet. The same applies to diverticula.

Hydronephrosis. The low incidence of hydronephrosis was a surprising finding. Some cases of early hydronephrosis were undoubtedly missed because of the length of time allowed for regression on catheter drainage before renal function was good enough to permit adequate visualization on excretory urography.

Hydronephrosis was commoner in carcinoma for the same reason that blood urea levels were higher.

Urinalysis. A higher incidence of negative urinalyses than expected was found. There is a definite clinical impression that patients with prostatism and residual urine do not show pyuria until they have been instrumented or catheterized.

Hemoglobin. Most of the patients showed an unexpectedly high hemoglobin level on admission. This correlates with the findings of low urea nitrogen levels and low incidence of hydronephrosis because the usual cause of secondary anemia in prostatics is chronic retention of nitrogenous wastes and not hematuria.

Amount resected. More tissue is resected in the benign group. The better definition between the adenomatous tissue and the false capsule in this group makes wide resection possible. In malignant disease, the infiltration and fixation of the gland make wide resection unnecessary.

For comparison, notes are made on size of gland usually resected and on completeness of resection.

Operative blood loss. The difference between operative blood loss in carcinoma and benign cases is due to the smaller size of the gland and the comparative avascularity of the former. Estimation of blood loss is of great value because it permits accurate replacement. Measurement of post-operative loss was discontinued because of the added strain on an already overworked and short-handed nursing staff.

Repeat surgery. Revision was more common in the malignant group because of regrowth and because of voiding difficulty due to infiltration and fixation of bladder neck and trigone.

Post-operative hemorrhage. Post-operative hemorrhage is commoner in benign prostatism for the same reason that operative blood loss is higher.

Post-operative urosepsis. Post-operative inflammatory complications are diagnosed on symptoms and signs alone. All post-operative resections have pyuria for a considerable time even when asymptomatic and afebrile. Cystitis, peri-prostatitis, peri-urethritis, periurethral abscess, and epididymitis are easily diagnosed on symptoms and local signs. A swinging temperature in the absence of these lower tract complications, and in the absence of pulmonary or thrombophlebitic complications, led to a diagnosis of pyelonephritis even in the absence of costo-vertebral tenderness.

Other complications. Thrombophlebitis, pulmonary embolism, and atelectasis were quite uncommon causes of morbidity due to the general surgical practice of early ambulation.

Lower nephron nephrosis. Lower nephron nephrosis as a cause of death is stressed because of the current belief that it can be either entirely

prevented, or rendered much less common by the use of isotonic irrigating solution.

Period of hospitalization. For many reasons, the length of hospital stay is of interest to patients. This is also of great interest to both hospital management and surgeon because of the current bed shortage and long waiting list. Both the pre and post-operative stay in this series is lengthy because of the lack of adequate convalescent and nursing home accommodation. This applies particularly to ward patients who must remain in hospital until quite well.

RECOMMENDATIONS

1. A series of comparable size reviewing post-discharge course would be desirable. The period should be at least 6 months and preferably two years. This should include duration of pyuria, recurrence and duration of symptoms and of inflammatory complications. The review could be combined with survival records on the malignant cases.

2. Comparison of mortality and post-operative morbidity rates in large and small glands should help in forming a policy regarding decision on best operative route in this centre.

3. A workable discharge summary sheet is most desirable for any future surveys of this nature using Winnipeg General Hospital records. Completion of such a form depends primarily on accurate and complete operative notes and on well-kept progress notes.

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