INCONTINENCE OF URINE IN THE ELDERLY

by

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PREFACE

The purpose of this thesis is to investigate the causes of incontinence of urine in elderly men, and to evaluate methods of treatment which are available at present. The main points to be considered in relation to the incontinence are the presence of mental confusion, physical illness, obstruction to the outflow of urine, bacterial infection of the urinary tract, and the function of the bladder muscle.

The treatment employed consisted of drug therapy to improve mental alertness, to diminish bladder spasm, and to eradicate infection of the urine. Catheterisation was done in order to measure the bladder capacity and its response to filling; the instrument being used for this purpose being a cystometer. Where there was obstruction to the outflow of urine with bladder distension, decompression was performed; and if the bladder was small an attempt was made to distend it with increasing volumes of water.

It is intended to compare the results obtained with those of other workers in this field, which has been sadly neglected. There are many old people suffering from this distressing condition, and with the expected increase of the elderly population, it will become a greater problem in the future unless increased knowledge and improved methods of treatment become available.

The writer is greatly indebted to Dr. W. Ferguson Anderson, Regional Consultant for Diseases of the Elderly and the Chronic Sick, for permission to carry out the investigations in his wards in Stobhill General Hospital, and for his advice and encouragement.

The University of Glasgow supplied the necessary equipment for the cystometric examinations, and the Library of Stobhill Hospital and the Library of The Royal College of Physicians and Surgeons of Glasgow provided access to required references.

I should also like to express my gratitude to the nursing staff of the ward for their assistance in preparing the patients and the equipment, and for keeping the records so efficiently.

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CONTENTS

INTRODUCTION

One of the main hazards of growing old is the development of difficulty in micturition, which may vary from slight frequency to extreme urgency, and eventually lead to incontinence.

The onset of incontinence is a matter of great importance to the patient personally, and to the hospital service. It is injurious to the morale of the patient, who becomes apathetic and resigned to his discomfort, and it is often the last straw which makes a family unable to cope with the problem of home care, and causes the elderly person to be admitted to hospital.

In hospital, incontinence of urine is responsible for much of the heavy and unpleasant work associated with nursing the elderly, and it is an important economic item because of the time spent by the nurses, and the changes of linen required. It may also be the main reason which prevents a patient from returning home or going to a local authority home, and causes an elderly person to require long-term hospital care.

The cases which make up the series occurred in the Geriatric Assessment Unit of Stobhill General Hospital, in the male ward of 29 beds. The function of this unit is to admit patients from their own homes for investigation and treatment. Patients who required rehabilitation or long-stay hospital care were transferred from other wards in the hospital when their acute illness was treated.

When treatment is completed in the Assessment Unit the patients are discharged home, or if this is not possible, accommodation is found for them in a long-stay hospital or a local authority home.

In 300 consecutive admissions to the ward it was found that 37 patients (12%) were doubly incontinent, and 87 patients (29%) were incontinent of urine, a total of 41% of admissions being incontinent. It can thus be seen that the amount of incontinence in geriatric practice is considerable, and it is a major problem to physicians and nurses engaged in the treatment of the elderly sick.

In order that treatment may be most effective, it is important to determine the cause of the incontinence, and here more than one factor may exist. A complete general examination is essential, with an accurate assessment of the patient's mental state. A digital examination of the rectum should not be omitted as dyschezia is often present in these cases. Special attention should be paid to the urinary system with regard to infection or the presence of a block to the outflow, and the neuro-muscular function of the bladder should be assessed by cystometric examination.

The most common cause of incontinence of urine in my series is cerebral disease which leads to a lessening of the cerebral control of the bladder, which becomes hypertonic and of a smaller capacity than normal. Other causes of incontinence encountered were blockage to the urinary outflow, damage to the bladder sphincters, and urinary infection.

In acute illness in elderly people incontinence of urine may occur temporarily; and the use of diuretics, especially in high dosage, may also produce incontinence. In terminal illness, incontinence can occur as a manifestation of the failing powers of the body, especially when the kidney loses its concentrating power with a consequent polyuria.

This series consists of 106 male patients who were admitted to hospital with various complaints and who were all incontinent of urine. Their ages ranged from 61 years to 90 years, with a mean age of 75.7 years. The results obtained were that one third of the cases were cured or improved and two thirds were not improved. It was possible to discharge approximately 30% to their own homes or to local authority accommodation, 20% died, and the remaining 50% required long-stay hospital accommodation. These figures illustrate the high mortality rate which accompanies this disability, and also that many of these patients will require long-stay beds.

CHAPTER I

THE ANATOMY OF THE URINARY BLADDER

The urinary bladder acts as a reservoir for urine and its normal maximum content of urine is about 300 ml. It has a base triangular in shape, and a vertex which is covered with peritoneum and is in relation to the pelvic colon and the terminal coils of the ileum.

When the bladder is empty it is entirely within the pelvis and as it fills its superior surface rises into the abdomen, the base being only slightly lowered.

The mucous membrane which lines the bladder is loosely attached to the muscular coat and appears folded when the bladder is contracted; it is composed of transitional epithelium and has no true glands. Over a small triangular area near the base of the bladder called the trigone, the mucous membrane is closely bound to the muscular coat and is always smooth. At the anterior angle of the trigone is the internal orifice of the urethra, the most dependent part of the bladder, and at its postero-lateral angles are the orifices of the ureters.

The muscle coats consist of three layers of smooth muscle fibres, an external and internal layer of longitudinal fibres and a middle layer of circular fibres. The fibres of the external layer pass up the inferior surface of the bladder over the vertex and descend across the fundus to become attached to the prostate gland and its capsule; some fibres are

carried on to the front of the rectum, others are attached to the lower part of the pelvic surface of the os pubis, at the sides of the bladder the fibres intersect one another. The fibres of the middle circular layer are very thinly and irregularly scattered and mostly arranged obliquely, around the internal urethral orifice they are arranged in a thick circular layer forming the sphincter vesicae continuous with the muscular fibres of the prostate. The internal longitudinal layer is thin and its fasiculi lie for the most part longitudinally.

The arterial supply is from the superior and inferior vesical arteries derived from the anterior trunk of the hypogastric artery. The venous drainage is to the hypogastric veins. The nerve supply of the bladder is from the autonomic nervous system and it has a sympathetic and a parasympathetic supply.

The parasympathetic supply is derived from the 2nd and 3rd sacral nerves which form the Pelvic nerves which end in the hypogastric ganglion on either side. The post-ganglionic fibres are distributed to the bladder musculature and mucous membrane as a fine network of nerves.

The sympathetic supply is from the Superior mesenteric ganglion, Renal and Semilunar ganglia and lateral roots from the 1st, 2nd, 3rd and 4th lumbar ganglia; which together form the Pre-Sacral nerve which in turn divides into two hypogastric nerves. These nerves end in the Hypogastric plexuses which lie on each side of the rectum. (Learmonth 1931).

The external urethral sphincter and the accessory muscles are all supplied by the Pudic nerves, from 1st and 2nd Sacral nerve roots.

The bladder empties into the urethra which in the case of the male is 20 cm. long and consists of three portions. The most proximal portion is the prostatic which is 3 cm. long and passes through the substance of the prostate gland and this is the widest portion of the urethra. The next portion of the urethra is the membranous which is 2 cm. long and is surrounded with fibres of the sphincter urethrae membranaceae. The most distal portion of the urethra is the cavernous portion which is 15 cm. long. The mucous membrane of the urethra is continuous with the bladder; it becomes columnar and then stratified. It is generally held that there are two sphincters, an internal one of smooth muscle which acts in conjunction with bladder contractions, being open when the bladder contracts and shut when it relaxes. The external sphincter is of striped muscle and can be relaxed voluntarily and is normally in a state of tonic contraction.

CHAPTER II

THE PHYSIOLOGY OF MICTURITION

Stimulation of the sympathetic nerve supply in man causes closure of the ureteric orifices, contraction of the internal sphincter, increase of the tone of the trigone and vaso-constriction in this region. Stimulation of the parasympathetic nerve supply causes relaxation of the internal sphincter, stimulation of the detrusor muscle and emptying of the bladder.

There is a centre for co-ordination of bladder contractions situated in the sacral portion of the spinal cord and if this centre is damaged or destroyed, the contractions of the bladder become ineffectual. (Denny-Brown & Robertson, 1933a)

A higher centre is present in the hypothalamus or immediately anterior to it, stimulation of which causes bladder contractions. This centre is thought to control the tone and increase the strength of the bladder contractions and to render the discharge of urine more complete. (Ranson, Kabat, Magoun, 1935)

These two centres are controlled by a centre in the cerebral cortex which lies at the upper end of the motor area of the cortex on the medial aspect of the hemisphere in association with the centres for the perineal structures.

The afferent nerves from the bladder run in the posterior column and the path for the motor fibres lies lateral to the pyramidal tracts intermingled with the spino-cerebellar fibres. Injury to the centre in the conus medullaris causes inco-ordination of the bladder contractions

and proper evacuation is not possible. Damage to the nerve tracts in the cord or to the cortical centre causes a diminution of control with urgency and this type of bladder is called the Uninhibited Neurogenic Bladder. More extensive damage results in a bladder which empties reflexly when a certain volume has been reached, about 100 ml., and sensation is abolished; this is called the Reflex Neurogenic Bladder. If the posterior sacral roots alone are affected, as in tabes dorsalis, then sensation will be lost and the efferent nerves do not receive their proper stimulus and the bladder becomes atonic with a large residual urine.

The spinal centres are reflex in nature; the filling of the bladder causes stretching of the wall and small contractions occur which can be controlled by the cortical centres. In the normal bladder these contractions occur early but are usually unaccompanied by pain. With higher volumes, e.g. 500 ml., the contractions are severe and are associated with sharp rises in pressure but can still be controlled by an effort of the will. If the cortical control is impaired or lost, the bladder becomes a reflex organ, as is seen in transection of the cord, when after a period of paralysis and atony, it develops a rhythm and empties at a constant volume, usually about 100 ml.

Bors & Parker (1956) state that sensation to touch and pin-prick in the bladder are similar; a blunt rod stimulated more pain perceptors and it was found that in a paraplegic patient there was a

reduced number of receptors and these were more irritable. They also found that detrusor contraction depended on a mucosal-spinal reflex and demonstrated this by instilling 60 ml. of sterile ice water into the bladder, which caused a contraction of the detrusor muscle in patients with cord lesions above the conus. This reflex could be abolished by topical or spinal anaesthesia, and was absent when the conus or cauda equina had been destroyed. These workers could discover no thermo-receptors in the bladder.

CHAPTER III

PREVIOUS STUDIES IN INCONTINENCE

The earliest work on the study of micturition was done on experimental animals, especially on cats, and by studying patients who had sustained injury to the brain or spinal cord.

In 1921, Barrington published his reflexes of micturition which were as follows:-

1. Distension of the bladder to a given volume leads to contraction of the bladder.
2. Movement of fluid within the urethra causes contraction of the bladder.
3. Increasing pressure within the posterior urethra causes contraction of the bladder.
4. Fluid running through the urethra causes a fall in its ability to resist fluid pressure.
5. Increasing pressure in the bladder will lead to a relaxation of the urethra.

Normal function was investigated by Denny-Brown and Robertson (1933b), who found that the primary factor in micturition was contraction of the bladder musculature associated with relaxation of sphincters. The control of the bladder above a capacity of 50 ml. depends on control by the cerebral cortex of the bladder musculature, assisted by voluntary contraction of the external sphincter. Normally the bladder fills

gradually without the occurrence of sufficiently powerful vesical contractions to cause relaxation of the internal sphincter until control by the cortex is released voluntarily.

The existence of incontinence in the elderly has long been recognised but it has been regarded as a natural concomitant to old age and the attitude to it has been one of acceptance.

T.S. Wilson (1948) carried out an investigation into 68 elderly people who had difficulty in micturition or incontinence of urine, and found that the cause of frequency, precipitancy and incontinence of urine was due to overactivity of the neuro-muscular mechanism of the bladder, and that weakness of the sphincters was important in only a small minority of cases. He was of the opinion that the neuro-muscular dysfunction was due to impaired cortical control associated at times with irritative conditions of the bladder and its outlet. He also stated that in people who were demented, the bladder function may be good as measured by cystometric examination. He noted that improvement in bladder function followed cystometric examination and attributed this to re-education of the inhibiting function of the cerebral cortex, as if the bladder contracts and the fluid cannot escape during cystometric examination, severe pain results, and feels that this is analogous to training a spastic limb to function again. He also stated that an important factor was the sleepy state into which aged people fall when confined to bed and thought that it was important to keep them out of bed as much as possible.

Brocklehurst (1951), in a series of cystometries in 24 patients, 20

of whom were incontinent, showed that the senile incontinent bladder had the following characteristics:

1. Large volume of residual urine.
2. Diminished capacity.
3. Slow accommodation to increasing volume.
4. High resting pressure before filling.
5. High resting pressure after filling.
6. Spontaneous contractures are present.
7. Onset of pain and desire to void at a small volume of bladder contents.

In a series of 2,223 cases he found the incidence of incontinence in Forresthall Hospital, a long-stay hospital, to be 22.9%, and 10.8% in four general hospitals. Ninety-three per cent. of these patients were suffering from senile incontinence, and of this group, 33% suffered from organic nervous disease, 29% from mental confusion (excluding those suffering from organic nervous disease) and 3.8% were suffering from psychological disease, such as mental defectives. Thus a total of 65.8% of incontinence was due to disease of central nervous origin.

He found that three important precipitating factors were:

(1) Cerebro-vascular accident.

(2) The patient becoming bedfast.

(3) Increasing mental confusion.

CHAPTER IV

THE CYSTOMETER

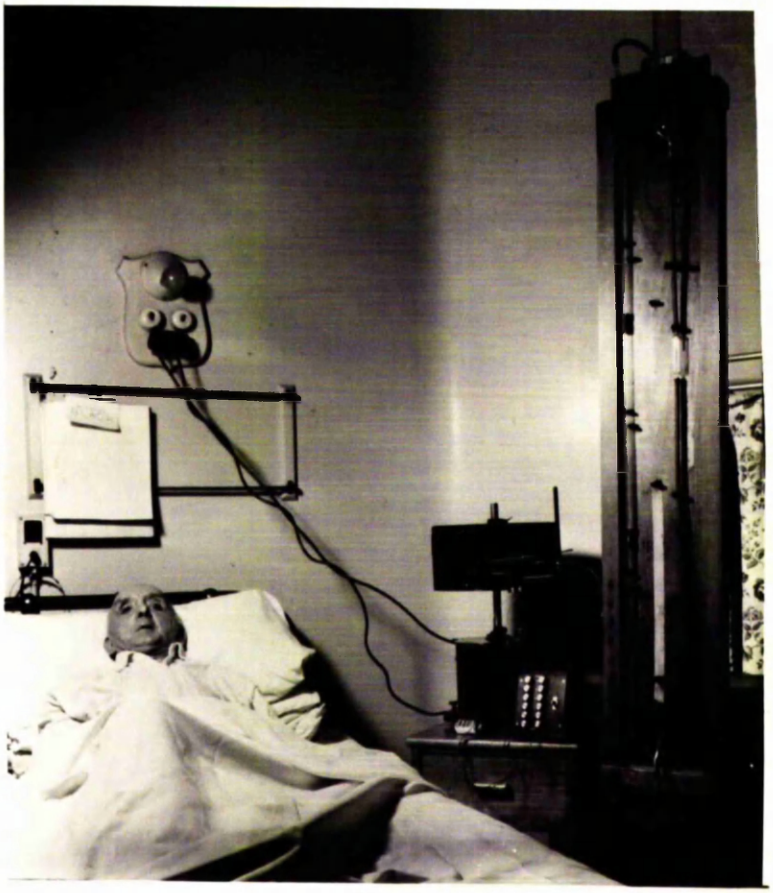
In attempting to find the cause of incontinence in elderly men and to institute a rational treatment, a cystometric examination was carried out. This provided much useful information; firstly, passing the catheter showed that there was no severe obstruction present; secondly, the amount of residual urine present gave a good indication of the degree of subacute prostatic blockage; thirdly, a catheter specimen of urine could be obtained for culture if residual urine was present; and, fourthly, the bladder volume could be estimated, the irritability of the muscle could be ascertained and the degree of cerebral control evaluated.

The method employed was to ask the patient to empty his bladder at the commencement, and following this a soft rubber catheter was passed and the residual urine, if any, was withdrawn.

The catheter was then connected to the cystometer which consisted of a graduated container connected by rubber tubing to a drip chamber, the flow of fluid being controlled by a gate clamp. A further length of rubber tubing led to a Y-connection, one arm of which led to an open glass manometer consisting of three pieces of 40 cm. in length joined together by small pieces of rubber tubing and the other arm was joined by rubber tubing to the catheter. An expansion chamber was attached to the open end of the manometer and from this chamber a rubber tube led to a tambour which carried a lever to record the changing pressures on a smoked drum which revolved at 0.04 mm. per second. This tube also had a glass T-tube inserted so that

pressures could be equalised if necessary. This apparatus was fastened by clips to a board on which was marked a scale in centimetres on the manometer side, the whole being moveable, so that the zero mark could be levelled with the symphysis pubis of the patient. The fluid used was sterile water.

Before joining the tube to the catheter, the tubing from the drip chamber and that leading to the catheter were filled with fluid, and the fluid in the manometer was brought to zero. Junction with the catheter was then made and the resting bladder pressures were recorded.



THE CYSTOMETER.

The patient was instructed to give information about his symptoms and was asked not to pass fluid, and to try to control any tendency to do so.

The fluid was then allowed to run into the bladder at a rate of 10 ml. per minute and the resulting pressures were recorded on the drum.

The whole of the apparatus, apart from the board and the tambour, was sterilised by boiling, this being the reason for the division of the manometer into three pieces. The end-point of the operation was when micturition occurred or when pain became too severe, or when a large distension had been achieved.

A normal examination shows absence of any obstruction to the passage of the soft rubber catheter, a low or absent residual urine and a low resting pressure, 0-5 cm. of water. As the bladder fills there should be a slow and steady rise of pressure, with no discomfort until about 300 ml. has been reached, and no spontaneous contractions should occur. Spontaneous contractions are contractions of the bladder outwith the control of the will, which cause a sharp rise of intra-vesical pressure usually resulting in micturition.

When filling goes beyond 300 ml. the rise of pressure in the bladder increases steadily, associated with discomfort and a desire to micturate, but this can be controlled by the higher centres. However, if the filling goes beyond 500 ml. the pain becomes severe, spontaneous contractions will occur and the patient will micturate.

In order to illustrate these points, the cystometrograms of two continent elderly men will be discussed.

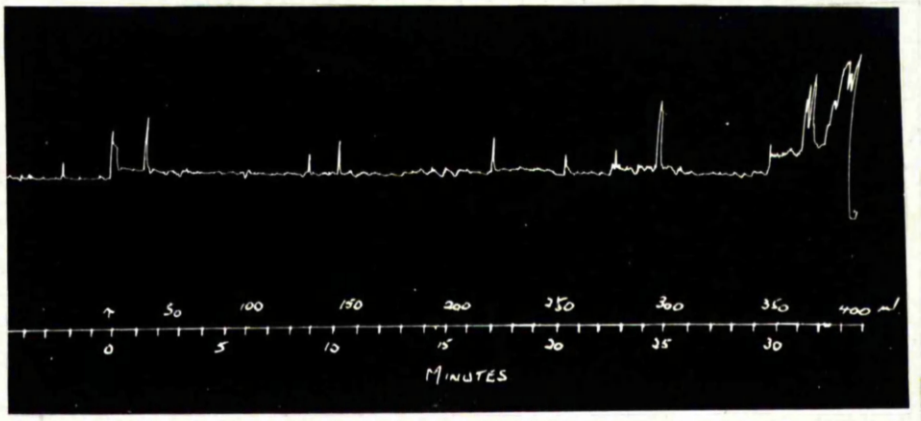


Figure 1.

M.D. was a male of 88 years who complained of frequency of micturition of 2 years duration.

Cystometrogram shows a bladder capacity of 400 ml. with desire to micturate occurring at 300 ml. giving a long warning period. The sharp elevations on the tracing are due to elevations of the intra-abdominal pressure because of the patient coughing. There was a residual urine of 120 ml. present due to a benign prostatic hypertrophy (Figure I).

Pressures (in Cm. of water)

0 ml. - 0	250 ml. - 3
50 ml. - 1	300 ml. - 4
100 ml. - 1	350 ml. - 7
150 ml. - 1	400 ml. - 25
200 ml. - 2	

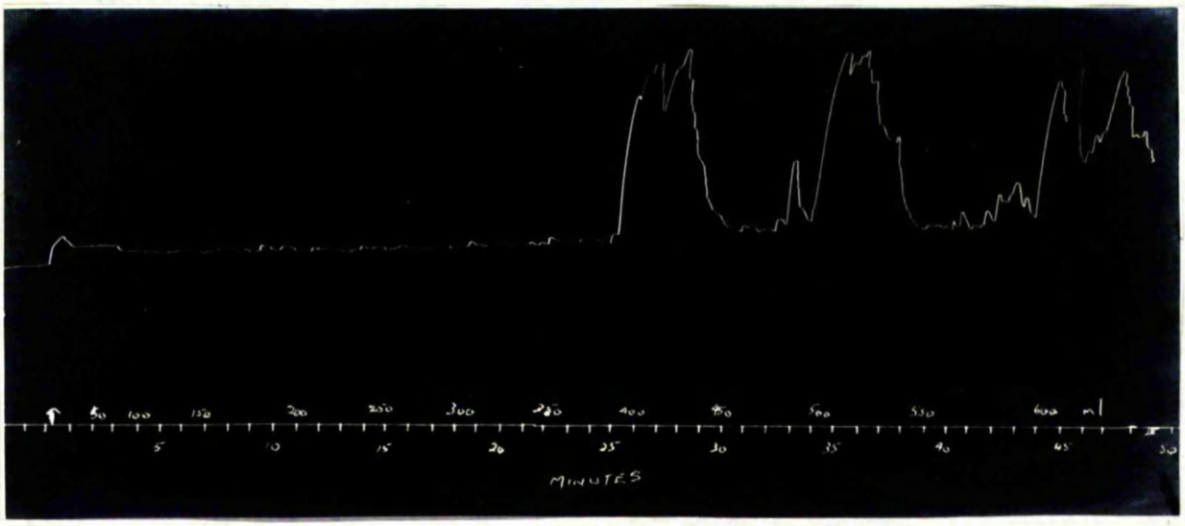


Figure 2.

R.B., a male aged 83 years, had an obstruction of the small bowel due to volvulus, and a colostomy was performed. There was some post-operative difficulty in micturition and a cystometry was performed which showed a bladder capacity of 600 ml. with an initial contraction at 375 ml. associated with a desire to micturate. Other contractions occurred at 475 and 600 ml. with severe discomfort, and the filling was discontinued although micturition did not occur. There was no residual urine present. (Figure 2).

CHAPTER V

AETIOLOGICAL FACTORS IN INCONTINENCE OF THE ELDERLY

Incontinence of urine in the elderly is due to a number of causes which may be present either singly or in combination. The general condition of the patient is of importance, as incontinence is commonly present in terminal illness and often accompanies acute illness during its early stages. Other factors which have been found to be of importance are the mental condition of the patient, local disease of the urinary tract, and bowel malfunction. These factors will now be considered in detail.

The Influence of the Mental State

The majority of elderly patients who are incontinent exhibit varying degrees of mental impairment due to cerebral disease, usually vascular in origin. The severity of the incontinence has been found to be proportional to the degree of confusion, and the bladder capacity has been noted to be smaller in the more confused cases. The response to treatment is also adversely affected by the confusion. The cases were divided into three categories,

1. Sensible.
2. Impaired - these cases were emotional, apathetic or forgetful.
3. Confused - they were disorientated, could not converse rationally, and were restless or aggressive.

The impaired cases comprised 29.2% of the total and 45.3% were confused, a total of 74.5% (Table I); the causes of the mental disturbance in these patients are given in Table II. The response to treatment is seen in Table I; of the sensible patients 63% were cured, while the corresponding figures for impaired and confused patients were 16.1% and 14.6% respectively.

TABLE I

RESULTS OF TREATMENT

	Cases		Cured		Improved		Unimproved	
	No.	%	No.	%	No.	%	No.	%
Sensible	27	25.5	17	63	1	3.7	9	33.3
Impaired	31	29.2	5	16.1	3	9.7	23	74.2
Confused	48	45.3	7	14.6	3	6.2	38	79.2
Totals	106	100	29	27.4	7	6.6	70	66

TABLE II

DISEASES CAUSING MENTAL CONFUSION AND IMPAIRMENT

Disease	Impaired	Confused	Total
Senile dementia	8	25	33
Cerebral thrombosis	14	11	25
Cerebro arterio-sclerosis	5	6	11
Chronic meningitis	1	-	1
Mental defective	1	-	1
Arteriosclerotic Parkinsonism	1	-	1
Osteitis deformans	1	-	1
Diabetes mellitus	-	1	1
Subarachnoid haemorrhage	-	1	1
Myxoedema	-	1	1
Bronchial carcinoma with cerebral metastases	-	2	2
Carotid insufficiency	-	1	1
Totals	31	48	79

TABLE III

DISCHARGE OF PATIENTS RELATED TO MENTAL STATE

	Total		Home		Local Author.		Longstay Hospital		Mental Hospital		Died	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Sensible	27	25.5	15	55.5	2	7.4	6	22.3	0	0	4	14.8
Impaired	31	29.2	6	19.3	1	3.2	20	64.5	1	3.2	3	9.8
Confused	48	45.3	6	12.5	1	2.1	19	39.6	8	16.6	14	29.2
TOTALS	106	100	27	25.5	4	3.8	45	42.4	9	8.5	21	19.8

The demand for long-term accommodation is also much greater in mental confusion, 56.2% requiring long-stay hospital care and of the impaired 67.7% were in need of this care. Only 22.3% of the sensible cases took up beds in long-stay wards, and 55.5% were able to be discharged to their own homes (Table III).

The mortality rate was highest in the confused patients (29.2%) and not inconsiderable in the sensible patients (14.8%). The overall mortality of the series was 19.8% which indicates the large part that terminal illness plays in this symptom.

It is thus evident that the mental condition of the patient

is of great importance in the prognosis; in this series 85.4% of the confused cases required prolonged hospital care or died, and for the impaired cases the percentage was 77.5. Many of the confused patients are in a terminal illness of which urinary incontinence is only one symptom.

Cystometric examination of the confused and impaired cases showed the presence of an Uninhibited or Reflex Neurogenic Bladder as described in the chapter on physiology of the bladder, with a diminished capacity, lessened cerebral control, early onset of contractions with a short warning period for micturition. This was ascribed to the waning of cerebral cortical influence over the reflex centre in the spinal cord, due to damage from arteriosclerosis, vascular disaster, tumours or toxaemia.

It was noted that the degree of mental impairment was related to the severity of the incontinence as the bladder was of greater capacity and under greater control of the cerebral cortex in the less impaired patients. Thus, the cystometric tracing could be utilised in assessing the degree of mental impairment, and also the probable response to treatment.

A series of illustrative cases will now be described.

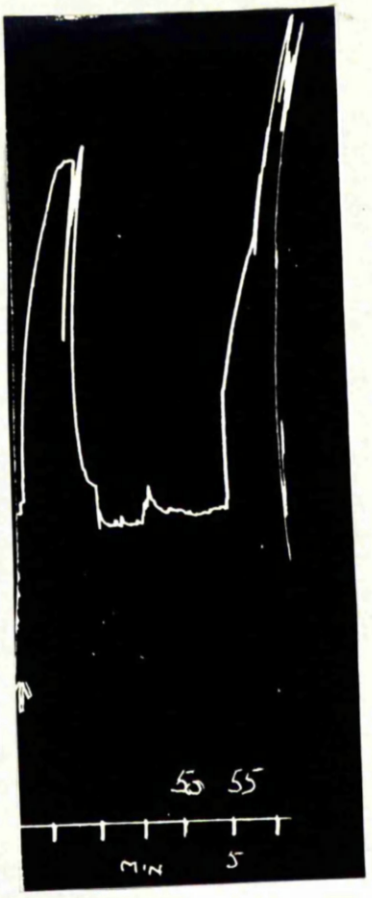


Figure 3.

1. Case 6. 82 years

Summary ; Mental confusion, urinary infection, died.

This man had a left hemiplegia 5 years before his admission to hospital, and at that time he became confused and developed incontinence of urine and faeces.

Examination on admission showed him to be confused and to have no localising signs of cerebral disease. A heavy infection of the urine was present, the organism being Proteus vulgaris. He was incontinent of urine up to five times daily. Treatment consisted of antibiotics without improvement of the infection or the incontinence; his condition deteriorated and he died in uraemic coma.

Cystometrogram ; Residual urine was 56 ml.

The capacity was 55 ml. and at this volume spontaneous contractions occurred with micturition; there was no attempt to control the escape of fluid and no warning period. The initial pressure rise is due to the resistance of the bladder muscle to the inflow of fluid (Figure 3).

Pressures (in Cm.)

0 - 0

50 - 28

55 - 60

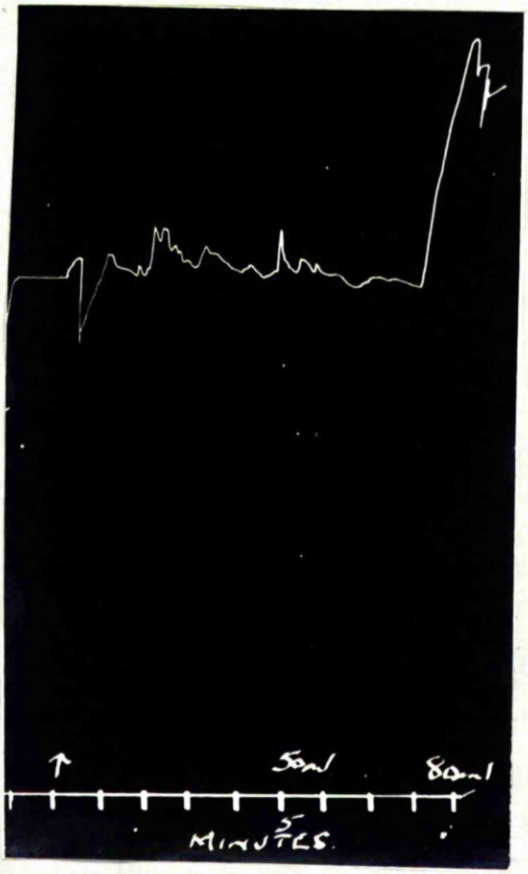


Figure 4.

2. Case 26. 70 years.

Summary : Cerebral infarcts, fracture of right femoral neck, died.

This man had small strokes two years and again 8 months before admission resulting in mental impairment and aphasia. Four months before admission he fell and fractured the neck of his right femur, which was pinned and plated.

On examination he was aphasic and apathetic and it was difficult to communicate with him, he slowly deteriorated and died.

Cystometrogram : No residual urine was present.

The bladder held 80 ml. when a spontaneous contraction occurred with micturition. There was no attempt to control the escape of fluid (Figure 4)

Pressures (in Cm.)

0 - 0

50 - 10

80 - 60

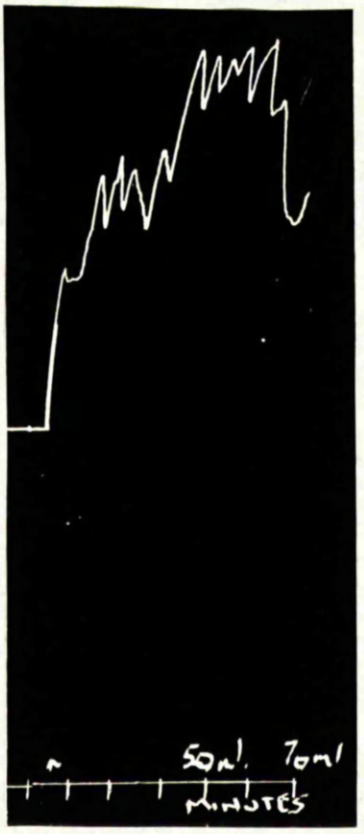


Figure 5.

3. Case 52. 67 years

Summary : Cerebral infarcts, Parkinson's disease, mental impairment, long-stay hospital.

This patient had two strokes, four years and again three years before admission. There had been a gradual development of mental impairment associated with hypertonicity of skeletal muscle. The urine was sterile on culture. Treatment consisted of tincture of belladonna, 0.9 ml. three times daily, but no effect was noted. He remained incontinent and was transferred to long-stay hospital accommodation.

Cystometrogram : Residual urine was 50 ml.

The vesical pressure rose sharply on introducing fluid,

micturition occurring at 50 ml. and filling was discontinued at 70 ml. (Figure 5).

Pressures (in Cm.)

0 - 0

50 - 50

70 - 60

These cases demonstrate the features of this type of severe incontinence. There is cerebral disease of a serious nature, associated with a degree of mental confusion which is usually severe. The bladder capacity is reduced markedly and the detrusor muscle is hypertonic. Treatment is usually unavailing, incontinence is frequent - the patient being wet almost continually - and the prognosis is poor.

This is the Reflex Neurogenic Bladder where there is loss of bladder sensation, no desire to micturate, and no knowledge of when the bladder is acting. It is the result of destruction of the cerebral centre in the cerebral cortex with consequent loss of voluntary control of the bladder, which then becomes a reflex organ.

Where the cerebral centre has been impaired and not destroyed, the capacity of the bladder is not reduced so greatly, and bladder sensation is present. The warning period between the desire to micturate and contraction of the detrusor muscle is shortened, and the patient suffers from urgency and also from frequency because of the reduced bladder volume. This is called the Uninhibited Neurogenic Bladder, and the prognosis is good especially if the patient is sensible. The following three cases illustrate this condition.

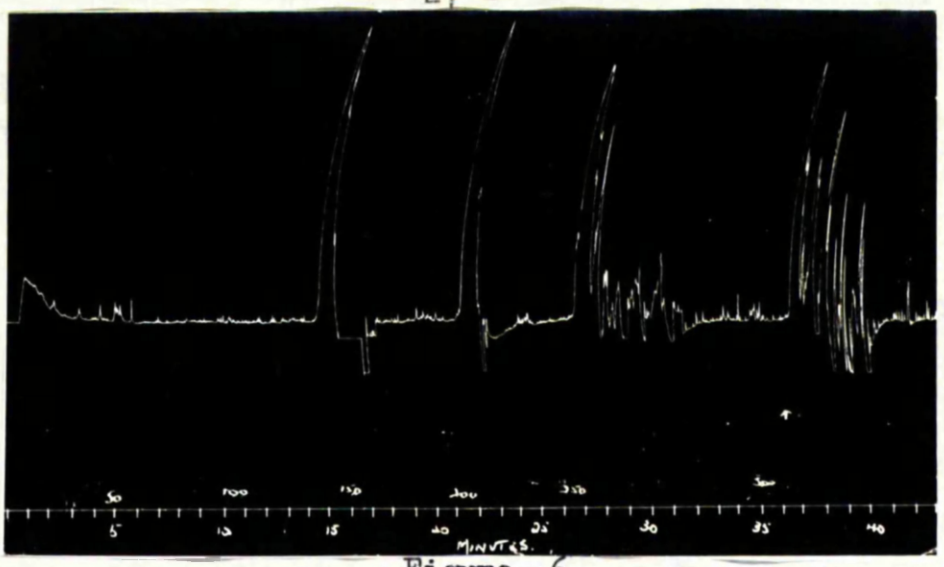


Figure 6.

1. Case 5. 86 years

Summary : Prostatectomy, cerebral arteriosclerosis, discharged home.

This patient had his prostate gland removed 4 years before admission. There was a mild cerebral incident 3 years before admission which caused unsteadiness in walking, and incontinence of urine gradually developed in the year before admission.

The patient was alert and sensible and aware of his disability; a urinary infection with Proteus vulgaris was found. Treatment consisted of antibiotics to control the infection and propantheline bromide, an anticholinergic drug, was given with good effect on the bladder hypertonicity. He became continent and was discharged home.

Cystometrogram : Residual urine was nil.

A spontaneous contraction occurred at 130 ml. together with a desire to micturate. Contractions occurred every 50 ml. thereafter with a strong desire to micturate, but there was no voiding of fluid until 300 ml. This indicates that although there was impairment of cerebral cortical control, enough remained to control the flow when the patient was alert (Figure 6).

Pressures (in Cm.)

0 - 1	100 - 10	200 - 88
50 - 10	130 - 85	250 - 75
		300 - 80

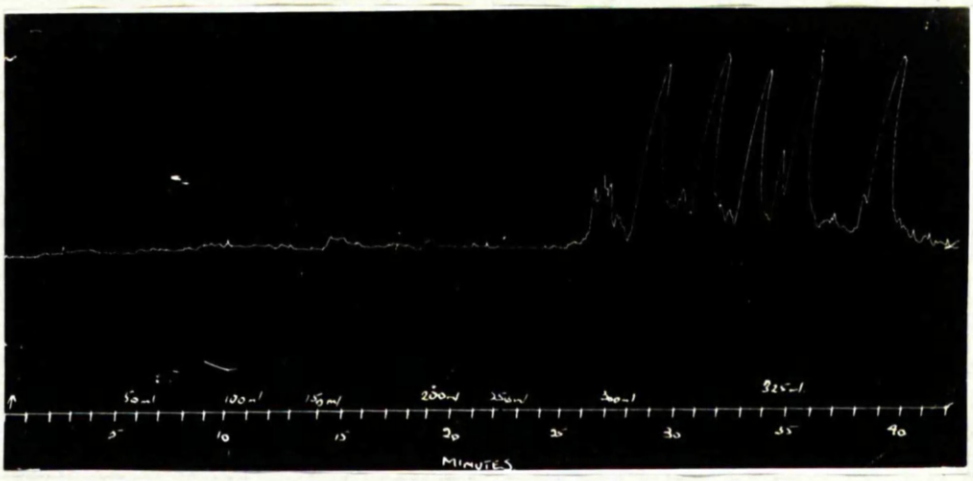


Figure 7.

2. Case 48. 77 years

Summary : Cerebral infarct, right hemiplegia, aphasia, long-stay hospital.

This man had a cerebro-vascular catastrophe six months before admission, which resulted in aphasia and a right hemiplegia. He was emotional and the mental state was difficult to assess because of the aphasia. He remained incontinent and required long-stay hospital care.

Cystometrogram : The residual urine was 180 ml., and was sterile. The bladder capacity was 325 ml., and spontaneous contractions did not appear until 270 ml., when good control was exercised and he did not micturate. The filling of the bladder was discontinued because of the patient's discomfort (Figure 7).

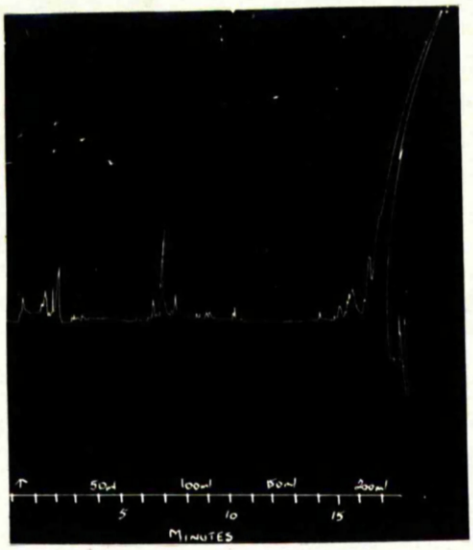


Figure 8.

3. Case 66. 74 years

Summary : Mental defective, chest infection, urinary infection, discharged home.

This patient was a high-grade mental defective who was admitted because of an acute upper respiratory illness associated with congestive cardiac failure. He had a urinary infection due to Paracolon bacillus which cleared on treatment with antibiotics. He became continent and went home.

Cystometrogram : Residual urine was 80 ml.

The bladder held only 200 ml. when a spontaneous contraction occurred with micturition (Figure 8).

In these cases limitation in the bladder capacity, associated with mental impairment and early spontaneous contractions, are present, but the degree is less severe, and the response to treatment is better. The cystometrogram is of value in estimating the degree of cerebral control of the bladder and the prospects of improvement with therapy, as the more nearly the bladder capacity and control approach normal, the better is the prognosis.

This is an important practical point as it enables an assessment to be made of the probable response to therapy in the individual case. In confused patients with a small bladder and poor or absent control, palliative methods should be used and a long-stay hospital bed sought; but when the patient is sensible with a good capacity bladder and an attempt at control is made, treatment should be pushed energetically with a good hope of success.

Obstruction to the Urinary Outflow

In this group the presenting feature is incontinence of urine caused by obstruction to the flow of urine, giving rise to a subacute retention of urine with a consequent large volume of residual urine. This reduces the functional capacity of the bladder, giving rise to frequency, and in severe cases to constant dribbling of urine. The most common cause in elderly men is prostatic hypertrophy.

In these cases the neuromuscular mechanism of the bladder may be normal, but if the obstruction has been of long standing, an enlarged atonic or hypotonic bladder may result. In this type of case, urinary infection is commonly present, as the residual urine forms an excellent medium for the multiplication of organisms.

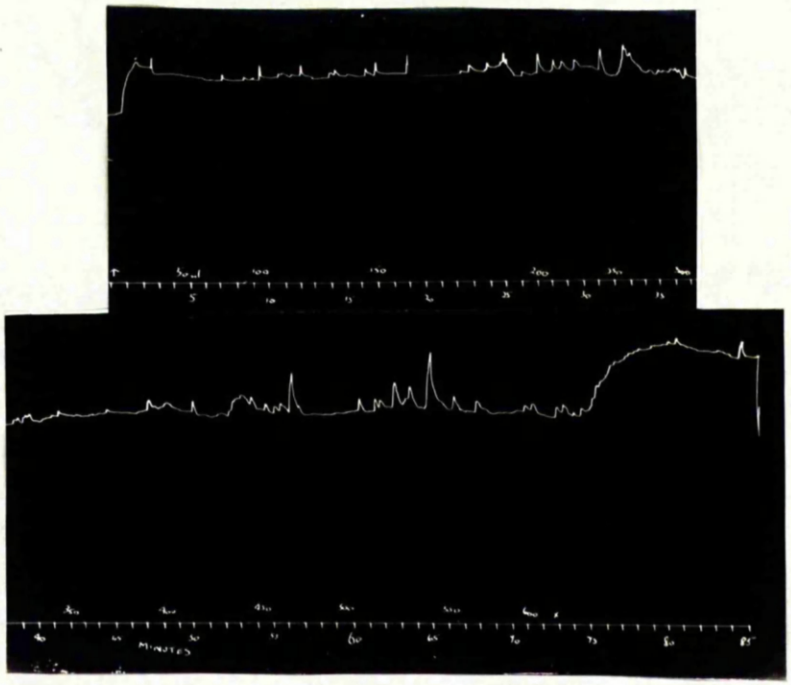


Figure 9.

1. Case 27, 61 years

Summary : Cerebral infarct, left hemiplegia, benign prostatic hypertrophy, died.

This man had a stroke with a left hemiplegia 10 months before admission, and when seen the hemiplegia was still present and he also had a retention of urine due to prostatic enlargement. He was alert and sensible. Treatment consisted of carbamylcholine 2 mg. orally three times daily which caused evacuation of the bladder, leaving a small amount of residual urine. The patient remained incontinent and died of a lobar pneumonia.

Cystometrogram : The bladder was able to hold 600 ml. with only small contractions from 180 ml. onwards, but there were no large contractions and no discomfort, showing hypotonicity of the detrusor. An intramuscular injection of carbamylcholine, 0.25 mg., produced a good bladder contraction two minutes after injection (Figure 9).

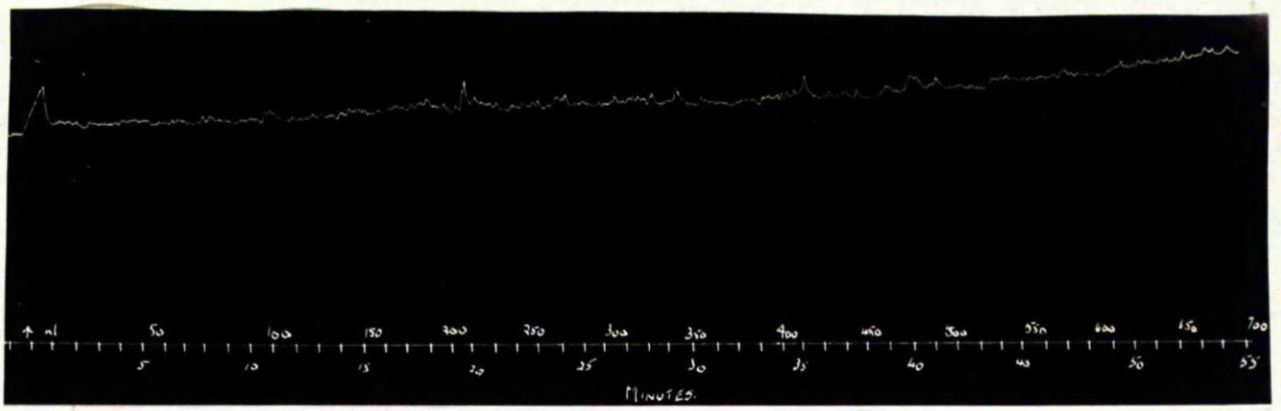


Figure 10.

2. Case 51. 64 years

Summary: Bronchial carcinoma, cerebral metastases, right hemiplegia, died.

This man was admitted with a left bronchial carcinoma and pleural effusion. He was confused and restless at times because of cerebral metastases, and had had two strokes, one five months previously and the second just before admission, causing a right hemiplegia and aphasia. Rectal examination showed an enlarged firm prostate. Treatment consisted of carbamylcholine orally without effect, and he required an in-dwelling catheter until his death.

Cystometrogram : The residual urine was 952 ml. and was sterile.

The bladder held 700 ml. with a gradually rising pressure and with small contractions; the filling was stopped at this point although there was no apparent discomfort (Figure 10).

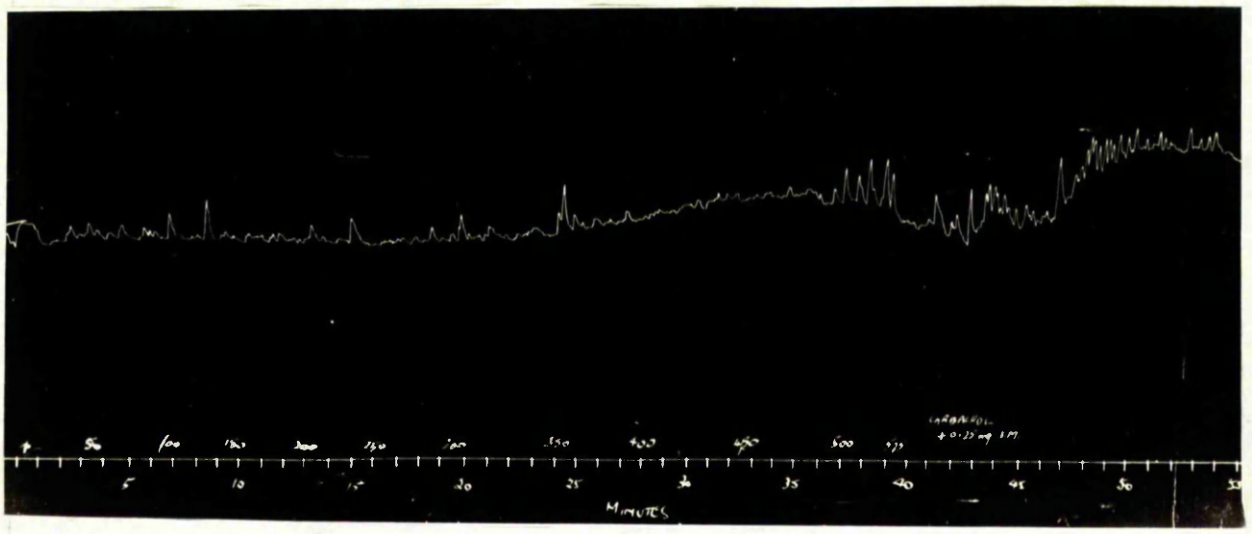


Table 11.

3. Case 59. 77 years

Summary : Benign prostatic hypertrophy, discharged to an Eventide Home.

This patient gave a history of difficulty in micturition of three years duration, with recent onset of incontinence. Cystoscopy showed residual urine of 540 ml. infected urine, the bladder was congested and showed trabeculation and sacculation. Treatment consisted of carbamyl--choline orally and antibiotic and sulphonamide therapy for the infection, following which he made a good recovery and became continent, and was able to go to an Eventide Home.

Cystometrogram : The residual urine was 550 ml. and was infected with Proteus vulgaris.

The bladder held 525 ml. before small bladder contractions occurred with discomfort. Following 0.25 mg. carbamylcholine intramuscularly there was a good rise in pressure to 48 cm. after five minutes (Figure 11).

Pressures (in Cm.)

0 - 0	300 - 11	525 - 19
100 - 8	400 - 12	
200 - 10	500 - 17	

These cases show some of the salient points of this type of incontinence; the bladder is distended with a large volume of residual urine which is often infected, and there is usually a degree of hypotonicity of the detrusor present.

If these patients are sensible, the prognosis is good as they often respond well to decompression of the bladder associated with carbamylcholine therapy to improve the tone of the detrusor muscle. When the physical condition of the patient warrants it, prostatectomy may be done with good hope of success. The associated urinary infection should be treated vigorously with an appropriate sulphonamide or antibiotic.

In this series this type of incontinence occurred in about 20% of the cases, if a residual urine of 200 ml. or more is accepted as an indication of a significant degree of obstruction (Table IV).

Resu Results of Cystometric Examinations

A total of 61 cystometric examinations were done and the results are shown in Table IV.

A large proportion of the cases had a small bladder capacity; 73.8% had a capacity of less than 300 ml., and if the functional capacity is considered then this figure rises to 87.3%. Cases with a capacity of less than 100 ml. comprised 42.6%, and these figures suggest that reduction in the bladder size is commonly present in urinary incontinence of the elderly.

TABLE IV

RESULTS OF CYSTOMETRIC EXAMINATIONS

Volume in ml.	Nil		1 - 100		101 -200		201-300		301-400		401+	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
' Residual urine	11	18.6	29	49.2	7	11.8	6	10.2	2	3.4	4	6.8
" Onset of contractions	-	-	32	55.2	11	18.9	8	13.8	2	3.5	5	8.6
Capacity	-	-	26	42.6	9	14.8	10	16.4	6	9.8	10	16.4
' Functional capacity (Capacity - residual urine)	17	28.6	18	30.3	11	18.4	6	10	5	9.3	2	3.4

' In 2 cases the residual urine could not be measured due to an in-dwelling catheter.

" In 3 cases no contractions occurred.

' In 2 cases the functional capacity could not be estimated as there was no record of the residual urine.

Associated with the decreased size of the bladder is the early onset of spontaneous contractions which usually cause micturition. These contractions normally are controlled by the higher cerebral centre, and their appearance early in filling indicates that the bladder has escaped from their control, and is under the increased influence of the lower centres. The results show that 55.2% of the cases had contractions before 100 ml. and 87.9% before 300 ml.

A small amount of residual urine is commonly present, only 18.6% had none, and 32.2% had more than 100 ml. This indicates the prevalence of a degree of prostatism among the elderly male patients, predisposing to infection of urine which is difficult to eliminate owing to the obstruction, and tends to perpetuate and intensify the incontinence.

The bladder capacities were compared in the sensible, impaired and confused groups of patients (Graphs I-III). In the sensible group there is a higher proportion of normal bladder capacities, and in both the other groups, the percentage of bladder capacity of less than 200 ml. was high.

The prognosis, measured by the destination of the patient, can be estimated in relation to the bladder capacity. If it was less than 100 ml. only 23.1% went home, and 65.4% required long-stay hospital beds (Table V). In patients with bladder capacities approaching normal the home discharge rate improves and the demand for long-term accommodation diminishes. The high mortality rate in cases with normal bladder capacity suggests that the incontinence here is often due to terminal illness.

BLADDER CAPACITY RELATED TO MENTAL STATE.

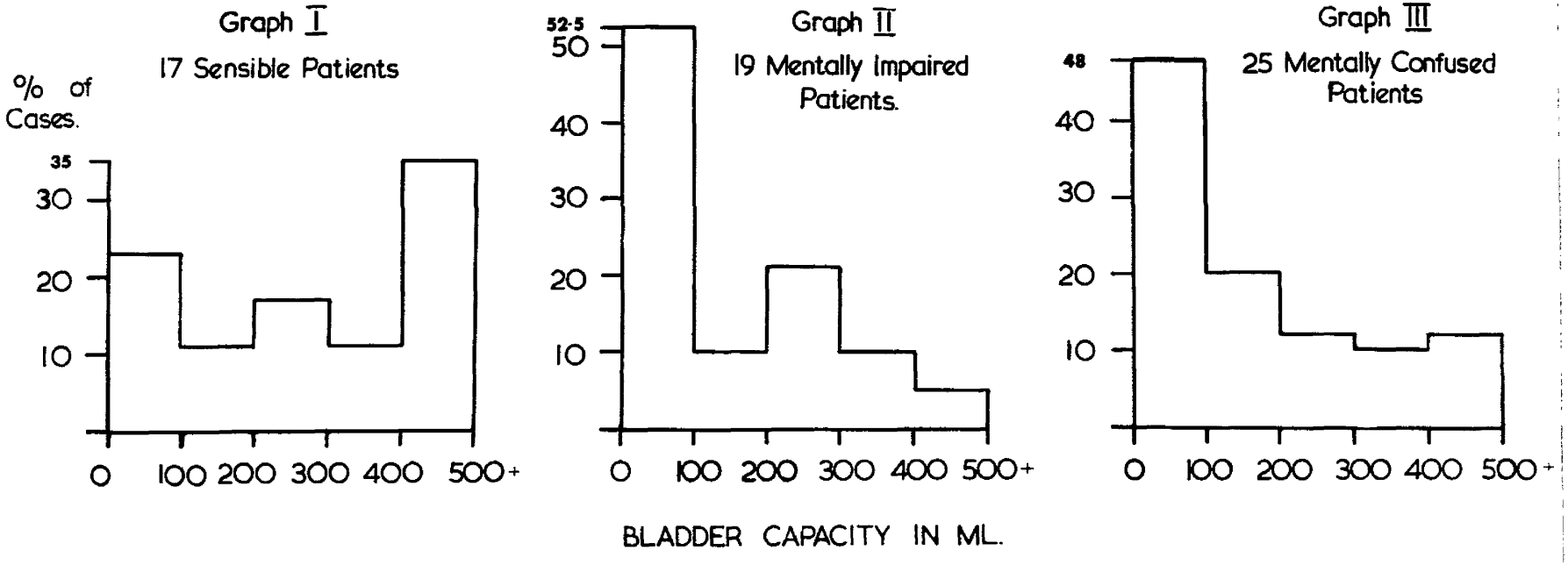


TABLE V

DISCHARGE OF PATIENTS RELATED TO BLADDER CAPACITY

Bladder capacity in ml.	Total	Home		Local Authority		Long-stay Hospital		Mental Hospital		Died	
		No.	%	No.	%	No.	%	No.	%	No.	%
Nil - 100	26	6	23.1	-	-	15	57.7	2	7.7	3	11.5
101 - 200	9	4	44.5	1	11.1	3	33.3	-	-	1	11.1
201 - 300	10	2	20	1	10	4	40	1	10	2	20
301 - 400	6	4	66.6	-	-	1	16.7	-	-	1	16.7
401 +	10	3	30	1	10	2	20	-	-	4	40

The Incidence of Urinary Infection

The incidence of urinary infection in this series was found to be high, 51 cases (48.1%) showed a growth of micro-organisms on culture. Esch. coli was present in 15 cases, Proteus vulgaris in 14 cases, and they were present together in 7 cases, a total of 36 cases or 70.6% of all the infections. Other micro-organisms found were streptococcus faecalis, staphylococcus albus and aureus, B. lactis aerogenes and paracolon bacillus.

There is a marked preponderance of Esch. coli and Proteus, and this was also the finding of Whitby and Muir (1961) who tested 330 specimens of infected urines and isolated Esch. coli in 45% and Proteus in 13.5%.

Wilson (1948) in a series of 36 cases found that 55% had a urinary infection. He thought that an acute infection increased the reflex excitability of the bladder, but found that incontinence could improve in spite of the persistence of a chronic urinary infection. In this series it has been found that if the urinary infection is cured, the patient's chances of becoming continent are increased fourfold.

The urinary infection was cured in 15 cases (29.4%) and of this number 6 became continent and 2 were improved. In 4 cases continence was re-established although the infection persisted.

The Incidence of Constipation.

The number of patients in this series who were constipated as shown by the presence of faeces in the rectum was 68 (64.2%). Of this number, 25 cases (36.7%) had a rectum which was loaded with faeces, and only 5 cases were noted to have a small amount of faeces.

This often gives rise to a spurious diarrhoea, and will aggravate any existing block to the outflow of urine. The cause of the constipation may be due to ignoring the call to stool over a long period, and the faeces are allowed to accumulate more and more without giving rise to discomfort, and the bowels will not move without the use of purgatives. Brocklehurst (1951) found that the rectum in senile incontinence was more excitable than normal, that there were soft faeces usually present in the rectum and that evacuation was often incomplete.

The important practical point is to perform a rectal examination on cases of urinary incontinence, and if dyschezia is found, it should be treated.

CHAPTER VI

THE TREATMENT OF INCONTINENCE.

As has been shown in the previous chapters the main causes of urinary incontinence in the elderly are mental confusion, diminution in bladder size, blockage to the urinary outflow and infection of the urinary tract. Treatment was designed to overcome these various aspects and followed the pattern which is set down below.

1. In order to improve the patient's alertness and to minimise mental confusion, Vitamins B. and C were used parenterally in high dosage in the form of Parentrovite. Also used for this purpose was procaine hydrochloride given intramuscularly, as this had been commented on favourably; and lastly chlorpromazine was used for its tranquillising effect, where agitation was a feature.

2. In many cases the bladder was small and under the increased control of the sacral centre and, as the efferent nerves of this centre are the para-sympathetic Pelvic nerves formed by the second and third sacral nerves, it was thought to be rational to attempt to block these impulses locally by the use of anticholinergic drugs, belladonna and propantheline bromide being used.

3. Another method of increasing the size of a small bladder was to perform frequent cystometric examinations and to attempt to introduce increasing amounts of fluid at each treatment if possible; this was thought to be analagous to attempting to overcome the contracture of a spastic limb muscle. In some cases a local anaesthetic was introduced into the bladder in an attempt to interrupt the reflex arc so that distension could be done.

4. If the bladder was large and hypotonic due to long-continued subacute obstruction, carbamylcholine was used to increase the muscle tone after a preliminary catheter drainage.
5. To eliminate infection of the urinary tract antibiotics and sulphonamides were used.
6. Posterior pituitary extract, in the form of Di-sipidin as snuff, was given to the patient in the evening, in an attempt to reduce the nocturnal secretion of urine.

These methods of treatment will now be considered in detail, and an assessment of the results obtained by them will be made.

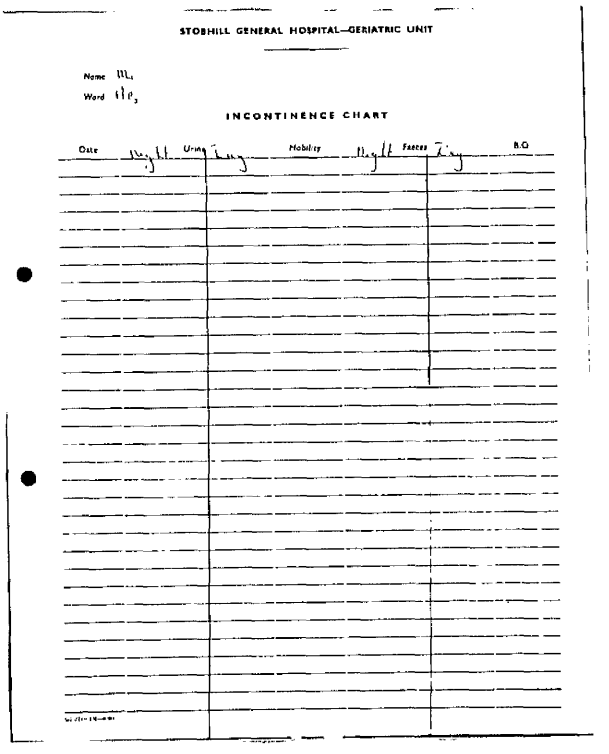
CHAPTER VII

THERAPY TO IMPROVE THE MENTAL STATE.

In view of the fact that 75% of the patients in this series had some degree of mental impairment, it was necessary to determine the effect on incontinence of drugs whose function was to improve the mental condition of the patient. The drugs used were the vitamin B group and vitamin C, given together parenterally in high dosage, 2% procaine hydrochloride intramuscularly, and chlorpromazine hydrochloride by mouth.

Associated with the use of these drugs was nursing care consisting of encouragement and informing the patient of where he was and what was being done for him, and also frequent attention to his sanitary needs. Cards with the patient's name were placed at the head of the bed so that he might be addressed properly by name, which was found to be helpful in his re-orientation.

Incontinence charts were placed at the bed, and, if the bed was wet or the patient was wet when out of bed, a mark was made on the chart. Incontinence of faeces was also recorded, together with continent bowel movements, as dyschezia was common and worsened the urinary symptoms. The time allowed out of bed was marked to guide the nursing staff and to ensure that the patient was up for as long as possible as this is important in encouraging continence and relieving pressure areas.


STOBHILL GENERAL HOSPITAL—GERIATRIC UNIT

Name
Ward

INCONTINENCE CHART

Date | Urine: Night, Day | Mobility | Faeces: Night, Day | B.O.

INCONTINENCE CHART.

This chart was found to be helpful in obtaining an accurate assessment of the incontinence in regard to three important points:

1. The degree of incontinence - whether the patient was wet frequently or occasionally.
2. The timing of the incontinence - if the patient was wet day and night, the prognosis was worse than if he was incontinent at night only.
3. The response to therapy.

High Potency Vitamins

High potency vitamin therapy is designed for the treatment of certain disorders characterised by disturbance of cerebral function, shown by mental confusion, apathy, loss of memory, disorientation, coma and delirium, in many of which there is a common biochemical lesion consisting of damage to the enzyme systems concerned in cerebral glucose metabolism.

This occurs in the pyrexial delirium of severe infections, especially those due to viruses, and in confusional states following severe illness, especially in old people.

Kreb's citric acid cycle is the final common path in which energy is set free and from which water and carbon dioxide are formed. The break-down products of all energy-producing nutrients are directed into this cycle and the role of the B group of vitamins as co-enzymes is established. Vitamin C is also concerned in all reactions to physiological stress.

The preparation used was Parentrovite which consisted of two ampoules as follows:-

Ampoule No. 1

Aneurine hydrochloride	B.P.	250 mg.
Riboflavine	B.P.	4 mg.
Pyridoxine	B.P.C.	50 mg.
Nicotinamide	B.P.	160 mg.
Dextrose		1 g.
Benzyl alcohol		2.8 %

Ampoule No. 2

Ascorbic acid	B.P.	500 mg.

These are the high potency ampoules and another strength, known as maintenance strength, is available in which the dose of aneurine is 100 mg. These ampoules are mixed together and are supplied in forms suitable for intramuscular or intravenous injection.

The results of treatment in 10 patients can be seen in Table VI. Only in one case, No. 105, was any change noted in the mental state and in none of the cases was the incontinence affected.

TABLE VI

HIGH POTENCY VITAMINS SERIES

Case	Age in years	Diagnosis	Dose X time in days	Mental State	Incontinence
36	62	Subarachnoid haemorrhage	1 pair H.P. I.M. X 7	Remained confused	Remained incontinent
42	74	Cerebral thrombosis	1 pair H.P., I.M. X 7	Remained confused	Remained incontinent
70	72	Senile dementia	1 pair M., I.M. X 7	Remained confused	Remained incontinent
71	71	Senile dementia	2 pairs H.P. I.M. X 7	Remained confused	Remained incontinent
73	69	Senile dementia	1 pair M., I.V. X 7	Remained confused	Remained incontinent
74	61	Cerebral thrombosis	1 pair M., I.V. X 10	Remained confused	Remained incontinent
78	78	Senile dementia	1 pair M., I.V. X 10	Remained confused	Remained incontinent
92	79	Senile dementia	3 pairs H.P. I.V. X 7	Remained confused	Remained incontinent
104	69	Hypertension	3 pairs H.P., I.V. X 7	Remained confused	Remained incontinent
105	85	Senile dementia	3 pairs H.P., I.V. X 7	Became more alert	Remained incontinent

H.P. = High potency ampoules

M. = Maintenance ampoules

Procaine Hydrochloride

Para-aminobenzoyldiethylaminoethanol hydrochloride was discovered by Eindorn in 1905 and is recorded in the pharmacopeia as procaine hydrochloride.

It has many actions and has been shown to have beneficial effects in arteriosclerotic and degenerative nervous disorders and in the sequellae of cerebrovascular accidents. (Aslan 1960).

A strength of 2% with a Ph of between 3.3 and 4 was used, and after test doses of 0.5 ml. subcutaneously and 2 ml. intramuscularly, a course of 12 injections of 5 ml. intramuscularly is given over a period of 4 weeks followed by a rest period of 10 days and then the course can be repeated.

The procaine is split in 30 minutes under the influence of procaine-esterase into para-aminobenzoic acid and diethylaminoethanol and these substances are excreted in the urine. Its actions are anaesthetic, antihistaminic and anti-acetylcholinic and it causes generalised vasodilatation. It blocks nervous conduction, diminishes the spasm of smooth muscle and reduces the contraction of striated muscle.

Procaine was given to 10 cases, a course of 60 ml. being given except in 2 cases - Case 85 was given only 30 ml. as he developed a generalised erythematous rash; Case 79 had 120 ml. The results obtained are shown in Table VII, there were 2 cures and 2 cases were definitely improved, while 1 case showed slight improvement.

TABLE VII

PROCAINE HYDROCHLORIDE SERIES

Case	Age in Years	Diagnosis	Mental State	Incontinence
79	77	Cerebral thrombosis	Became alert, euphoric, facile.	Cured, became continent.
80	77	Cerebral arteriosclerosis	Remained confused, but alert and co-operative.	Improved, continued to be wet at night.
83	81	Cerebral arteriosclerosis	Remained confused, more co-operative.	Marked improvement from doubly incontinent to occasional nocturnal incontinence.
97	81	Senile dementia	Remained confused, quieter.	Became continent.
85	67	Cerebral thrombosis	Remained confused.	Remained incontinent.
94	84	Cerebral arteriosclerosis	Remained confused.	Remained incontinent.
95	70	Cerebral thrombosis	Remained confused.	Remained incontinent.
96	68	Senile dementia	Remained confused.	Remained incontinent, slight improvement during day, some dry days.
99	70	Cerebral arterio-sclerosis	Remained confused.	Remained incontinent, with dirty habits.
100	82	Cerebral arterio-sclerosis.	Remained confused.	Remained incontinent.

Chlorpromazine Hydrochloride

Chlorpromazine hydrochloride (Largactil) is a phenothiazine derivative which can be given orally or intramuscularly in the treatment of confusion, restlessness and agitation. Its chemical formula is 2-chloro-10 (3' - dimethylamino-n-propyl)-phenothiazine. It has a powerful peripheral

anti-adrenaline action and also central effects which include depression of the vomiting and thermo-regulating mechanisms, but it has a comparatively low antihistaminic activity.

It was used in incontinent patients who were confused and in whom restlessness or agitation was a feature. Nine cases were treated, the dose used being 25 mg. or 50 mg. three times daily for 3 to 6 weeks; the results are shown in Table VIII. A good result was obtained in 1 case (case 88) both mentally and with regard to the incontinence, and another case (case 91) showed a marked improvement in incontinence.

TABLE VIII

CHLORPROMAZINE HYDROCHLORIDE SERIES

Case	Age in Years	Diagnosis	Daily Dosage in mg. X time in weeks	Mental State	Incontinence
44	74	Cerebral thrombosis	75 x 6	Remained confused	Remained incontinent.
69	63	Cerebral thrombosis	75 x 1 150 x 2	Remained confused	Remained incontinent
71	71	Cerebral thrombosis	75 x 2 150 x 3	Remained confused	Remained incontinent
73	69	Cerebral arterio-sclerosis	150 x 3	Remained confused	Remained incontinent.
82	76	Senile dementia	75 x 3	Remained confused	Remained incontinent.
88	76	Paget's disease	75 x 4	Became sensible	Became continent.
89	77	Senile dementia	75 x 4	Remained confused	Remained incontinent.
90	90	Senile dementia	150 x 3	Became quietly confused.	Remained incontinent.
91	83	Cerebral thrombosis	75 x 1 150 x 3	Became quietly confused	Marked improvement

CHAPTER VIII

THERAPY TO INCREASE BLADDER CAPACITY.

Anticholinergic Drugs

In view of the fact that many incontinent elderly patients had a bladder of small capacity with early spontaneous contractions, and as the motor supply to the bladder was by the parasympathetic system, it was thought that the influence of this system could be reduced by the use of anticholinergic drugs. The drugs chosen were belladonna in the form of the tincture, and propantheline bromide (Pro-Banthine).

Belladonna.

Tincture of belladonna is made from the dried leaf of the plant Atropa Belladonna and standardised to contain 0.03% of alkaloids, which are hyoscamine and atropine. These alkaloids have a central action on the central nervous system of stimulation followed by paralysis, and a highly selective action of blockage of the effector organs innervated by post-ganglionic cholinergic nerves. The site of action is at the effector cells concerned and there is an increase in the threshold of these cells to acetylcholine.

The dosage of the tincture employed was 0.3 ml. three times daily increasing gradually to a maximum of 1.2 ml. three times daily. This treatment was given to 15 patients and the results are shown in Table IX. 4 cases became continent (26.7%), 3 cases were improved but remained incontinent, and the remainder were unchanged. Of these 8 unimproved cases, 5 were confused and 3 were mentally impaired, showing again the important role played by the mental state in this condition. Treatment was given from 1 to 40 weeks,

the average being 9 weeks. It would seem that 4 weeks would be a reasonable time to try the effect of the treatment, as of the 7 cases who were cured or improved, the effect was apparent in 3 weeks or less and if no improvement has occurred by this time it is unlikely to appear subsequently. If cure is effected, the dosage can be reduced gradually and discontinued, depending on the response.

TABLE IX

BELLADONNA SERIES

Case	Age in Years	Mental State	Daily Dosage in ml. X time in weeks	Result
25	70	Impaired	3.6 x 41	Remained incontinent
36	62	Confused	2.7 x 15	Improved
37	72	Sensible	1.8 x 7	Cured
46	87	Impaired	2.7 x 19	Improved
50	69	Sensible	1.8 x 8	Cured
52	67	Impaired	2.7 x 7	Remained incontinent
53	87	Confused	2.7 x 8	Remained incontinent
55	74	Confused	2.7 x 12	Remained incontinent
60	76	Confused	3.6 x 1	Remained incontinent
61	77	Sensible	0.9 x 4	Cured
62	65	Impaired	3.6 x 3	Cured
63	75	Impaired	3.6 x 5	Remained incontinent
64	85	Confused	1.8 x 1	Remained incontinent
65	69	Confused	3.6 x 5	Remained incontinent
67	69	Sensible	2.7 x 11	Improved

In two of these cases a second cystometric examination was done in

order to measure the effect on the bladder capacity.

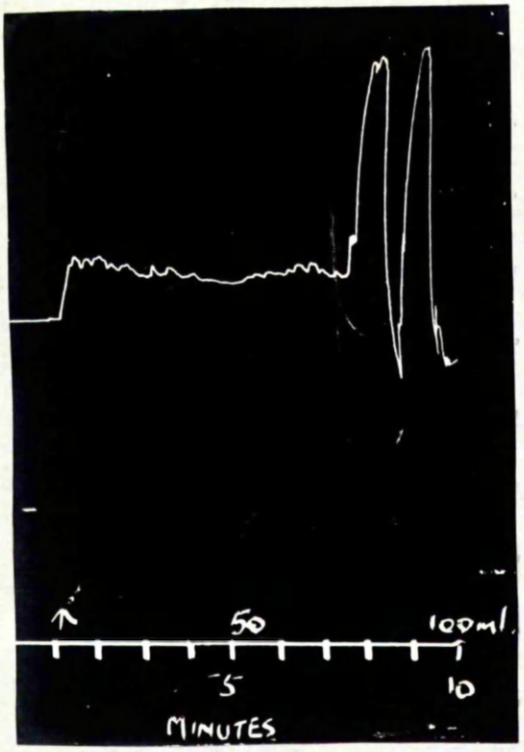


Figure 12.

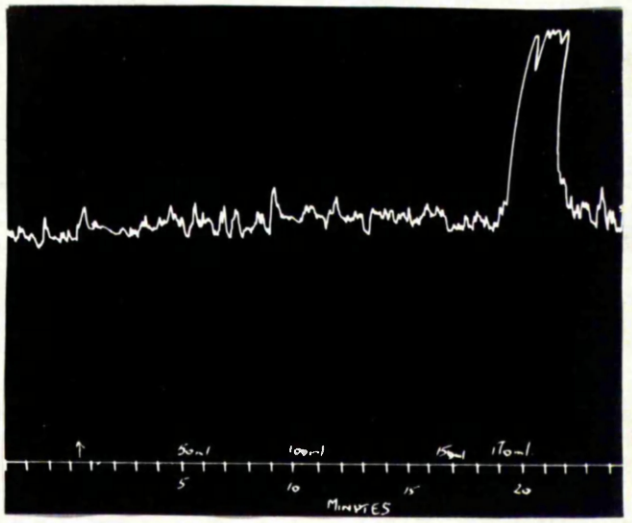


Figure 13.

1. Case 25.

Summary: Cerebral thrombosis, left hemiplegia, hypertension, long-stay hospital.

The first examination showed no residual urine and a bladder capacity of 100 ml. (Figure 12).

After 6 months therapy, 3.6 ml. daily, the residual urine was 130 ml. and the capacity was 170 ml. (Figure 13).

Comment: Increase in capacity of 70%, improved co-operation, but the incontinence was unchanged.

2. Case 65.

Summary: Cerebral thrombosis, right hemiparesis, rheumatoid arthritis, long-stay hospital.

The first examination showed a residual urine of 100 ml. The bladder capacity was 70 ml. with spontaneous contractions and micturition at this volume

After 6 weeks therapy, 1.3 ml. daily, the residual urine was unchanged at 100 ml., and the capacity increased to 200 ml.

Comment: The bladder size increased but there was a deterioration in the general condition and the patient became more confused and remained incontinent.

Propantheline bromide.

This is an anti-cholinergic drug which is manufactured under the trade-name of Pro-Banthine; it is the methobromide salt of a quaternary amine. It has marked anticholinergic activity at the autonomic ganglia and at the parasympathetic effectors, and at the dosage employed its activity is confined to the nerves innervating the gastro-intestinal and urinary tracts, the salivary system and the sweating mechanism.

Draper and Sierp found that previously administered propantheline bromide prevented the increase in tone of the detrusor muscle following a 5 mg. furmethide injection, and tests on hypotonic, normal and hypertonic bladders showed an increasing scale of response.

Five cases were treated in this series and the results are shown in Table X. The dosage employed was 30 mg. three times daily except in Case 25 where 15 mg. three times daily was used and Case 47 where 30 mg. twice daily was given. Of these cases, two were cured and three were unchanged. Repeated cystometric examinations were performed on two of the cases; Case 63 had an initial capacity of 70 ml. and following treatment he had a residual urine of 200 ml. and the bladder held 300 ml. with good control of contractions, which began at 100 ml. Case 47 had a residual urine of 20 ml. and a capacity of 120 ml. Following treatment, the residual urine was 40 ml. with a capacity of 270 ml.

TABLE X

PROPANTHELINE BROMIDE SERIES

Case	Age in Years	Mental State	Daily Dosage in mg. X time in days	Result
2	75	Confused	90 x 13	Remained incontinent.
25	70	Sensible	45 x 14	Remained incontinent.
47	74	Confused	60 x 90	Became continent.
54	78	Confused	90 x 90	Became continent.
63	75	Impaired	90 x 17	Remained incontinent.

In two other cases dexamphetamine, in a dosage of 5 mg. morning and afternoon, was given in addition. It is a stimulant to the central nervous system and imparts a feeling of well-being and a wakening effect useful in preventing a sleepy state in old people. Braithwaite (1956) found that this combination gave the best results in enuresis in children. In his series, 10 patients out of 13 were cured.

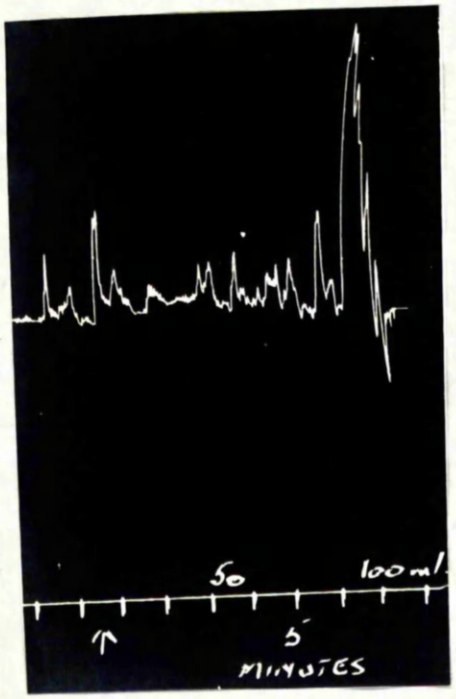


Figure 14.

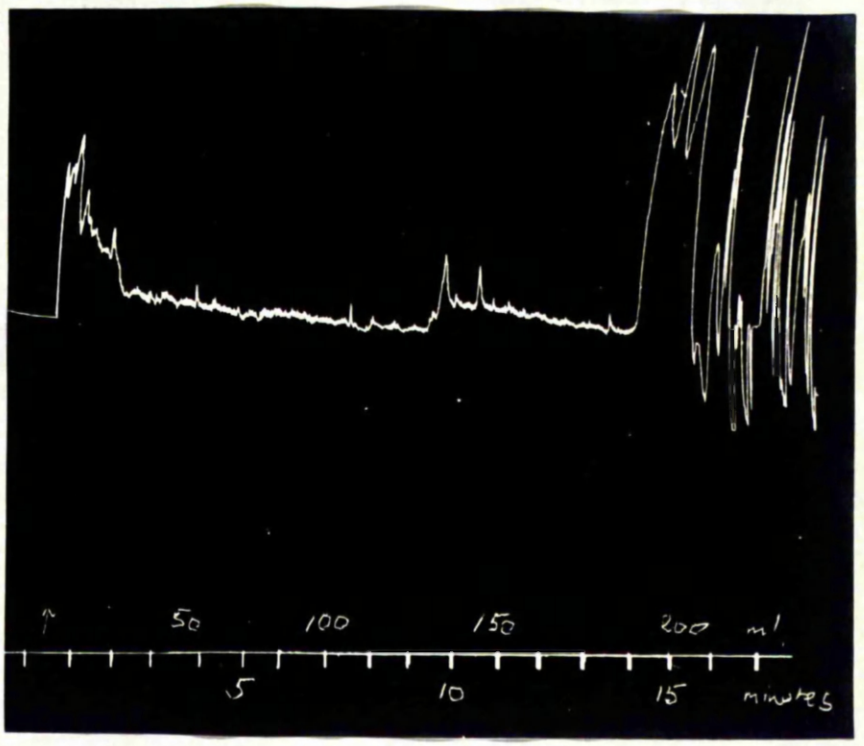


Figure 15.

1. Case 102. 70 years

Summary: Arteriosclerotic Parkinsonism, carcinoma of rectum, long-stay accommodation.

He suffered from incontinence of urine and difficulty in walking of 9 months duration; he was facile and mildly disorientated. Treatment consisted of 30 mg. of propantheline bromide three times daily and dexamphetamine 5 mg. twice daily for 11 weeks. The incontinence improved initially but relapsed towards the end of the course.

Cystometrograms: The residual urine was 15 ml.

The bladder held 100 ml. before micturition occurred (Figure 14).

Pressures (in Cm.)

0 - 0
50 - 14
100 - 120

After treatment, the residual urine was nil, and the bladder capacity increased to 200 ml. (Figure 15).

Pressures (in Cm.)

0 - 0
50 - 5
100 - 5
150 - 20
200 - 100

2. Case 84. 76 years

Summary: Senile dementia, died.

This man had shown mental and physical deterioration for the three years before admission, and he was doubly incontinent.

He was given 30 mg. of propantheline bromide three times daily and dexamphetamine 5 mg. twice daily for two months. There was an improvement in

the incontinence of urine which decreased from 5 times daily to once daily with occasional dry days; the faecal incontinence also improved.

He slowly deteriorated, developed pressure sores and died.

Sympathicomimetic Drugs

Ephedrine

Ephedrine has an adrenaline-like action, but its action is less potent and more prolonged than that of adrenaline. Ephedrine can be given by mouth and is a time-honoured remedy in the treatment of enuresis. Learmonth (1931) thought that the sympathetic caused a definite relaxation of the detrusor, of a temporary nature, associated with vasoconstriction in the bladder, and contraction of the ureteric orifices and the internal sphincter. Brocklehurst did not consider ephedrine to be of value in incontinence. Three cases were treated with ephedrine.

1. Case 17: aged 70 years, sustained a left hemiplegia 9 years before admission and he had a residual paralysis; he was sensible but apathetic. He was given ephedrine 30 mg. three times daily for 9 months with resulting cure of his incontinence. He became cheerful and active but required long-term hospital care because of his paralysis.
2. Case 25: aged 70 years, had a cerebral thrombosis on the day of admission which caused a left hemiplegia; he was sensible but emotional. Ephedrine was given, 30 mg. three times daily for 3 months, with improvement in the incontinence from two or three times daily to only occasional nocturnal incontinence. He was discharged to his home.

3. Case 38: aged 73 years, had a cerebral infarction 3 weeks before admission with a left hemiplegia; he also had a strongly positive Wassermann reaction in blood, negative in the cerebro-spinal fluid. He was mentally impaired and unco-operative. He was given a three weeks course of penicillin and ephedrine 30 mg. three times daily for 1 month. There was no improvement in his incontinence and he required long-stay hospital accommodation.

Repeated cystometric examinations

As many of the cases of incontinence in the elderly had a small bladder capacity, and the detrusor muscle was hypertonic, an attempt was made to increase the capacity by introducing increasing amounts of fluid at repeated cystometric examinations. Wilson (1948) noted improvement in bladder function following this procedure; on the other hand, Rose (1940) found that when the bladder had been distended and the nerve supply was intact, the bladder capacity was subsequently decreased.

Five cases were treated with this method, and in three of them, 0.5% lignocaine hydrochloride (Xylocaine) was introduced into the bladder in an attempt to anaesthetise the nerve endings and thus to interrupt the reflex arc and allow the bladder to distend.

Three of these cases showed an increase in the bladder capacity, but it was not of significant amount, and the patients remained incontinent. The other two cases showed a reduction in the bladder capacity. The instillation of the local anaesthetic produced no apparent effect on the bladder contractions or capacity.

The cases will be described on the following pages.

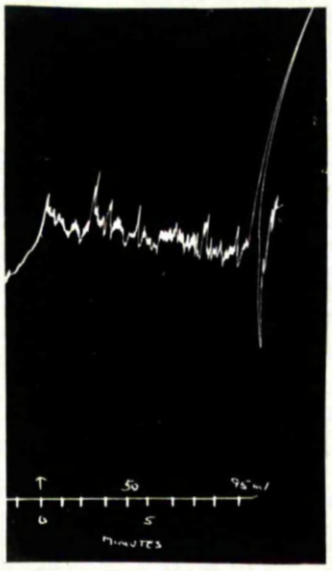


Figure 16.

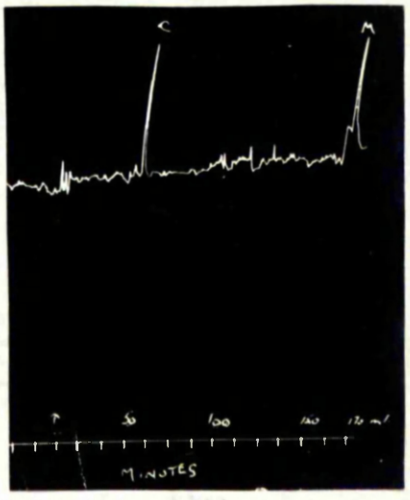


Figure 17.

1. Case 2. 75 years

Summary: Senile dementia, mental hospital.

This patient was mentally confused and had been incontinent of urine for 3 months before admission. Three cystometries were done with intervals of 5 days, and the capacity increased from 95 to 170 ml. The patient remained incontinent, which was not surprising in view of the persisting small capacity. He had eventually to be admitted to a mental hospital because of confusion and restlessness.

Cystometrograms: The residual urine was nil.

The bladder capacity was 95 ml. (Figure 16).

The third examination showed a residual urine of 50 ml. and a bladder capacity of 170 ml. (Figure 17). The contraction at 50 ml., marked C, is due to the patient coughing.

2. Case 29, aged 76 years

Summary: Cerebral infarct, left hemiplegia, long-stay hospital.

This patient sustained a cerebral infarction two months before admission which resulted in a left hemiplegia. He was also found to be doubly incontinent.

Three cystometries were carried out at intervals of 20 and 10 days. The initial capacity was 280 ml., and on the second occasion 400 ml. were introduced although pain was present from 150 ml. onwards.

On the third examination, there was an immediate onset of pain with desire to micturate, and some fluid was passed at 15 ml. and 75 ml., but the pain passed off and 175 ml. were introduced before he emptied his bladder. There was therefore a reduction of the bladder capacity. He remained incontinent of urine.

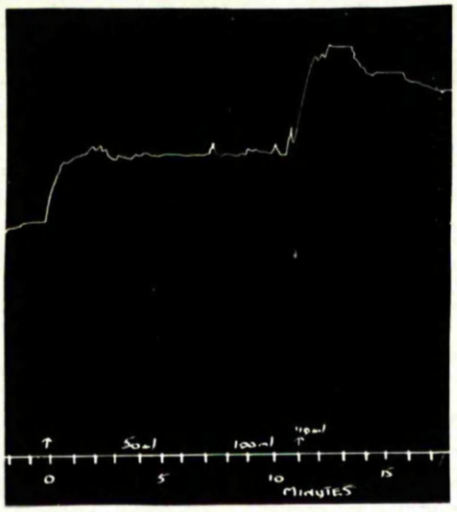


Figure 18

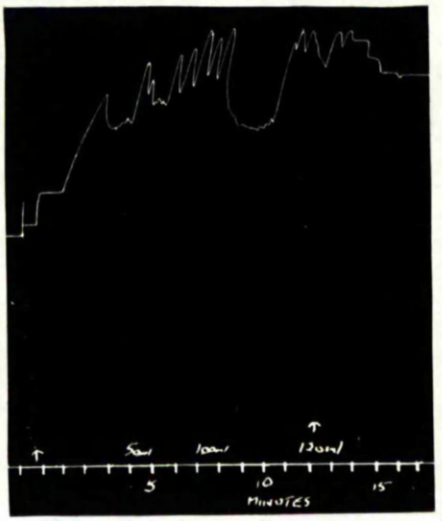


Figure 19

3. Case 46. 87 years

Summary: Arteriosclerotic mental impairment, hypertension, long-stay hospital.

This patient suffered from cerebral arteriosclerosis with mental impairment. Cystometric examination showed the bladder to be small, 110 ml., and it was thought that distension of the bladder would be achieved more readily if the reflex arc was interrupted at the periphery by anaesthetising the nerve endings in the bladder mucosa. The anaesthetic used was 0.5% lignocaine hydrochloride, 20 ml. of which was introduced, and 10 minutes later the bladder was filled again, and on this occasion held 120 ml.

Cystometrograms: The bladder capacity was 110 ml. (Figure 18). Following the instillation of lignocaine hydrochloride, spontaneous contractions occurred earlier; the capacity increased slightly to 120 ml. (Figure 19).

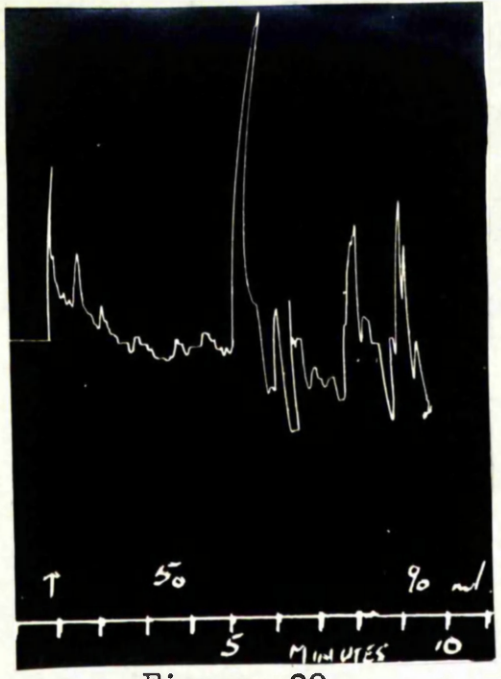


Figure 20

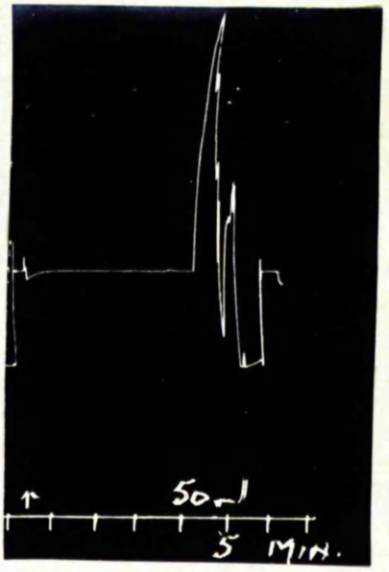


Figure 21

4. Case 102. 70 years

Summary: Arteriosclerotic Parkinsonism, rectal carcinoma, long-stay hospital accommodation.

This patient had incontinence of urine and increasing difficulty in walking of 9 months duration. Four cystometric examinations were done at intervals of 7, 2, and 3 days, and the capacity of the bladder, originally 90 ml., was reduced to 50 ml. On the third examination, 40 ml. of 0.5% lignocaine were instilled but no improvement in volume was noted. He remained incontinent of urine.

Cystometrograms: The residual urine was nil.

The capacity was 90 ml. with a spontaneous contraction at 60 ml. (Figure 20).

Pressures (in Cm.)

0 - 0
50 - 16
90 - 70

On the fourth filling, the bladder capacity was 50 ml, with a spontaneous contraction at this volume (Figure 21).

Pressures (in Cm.)

0 -0
50 - 75

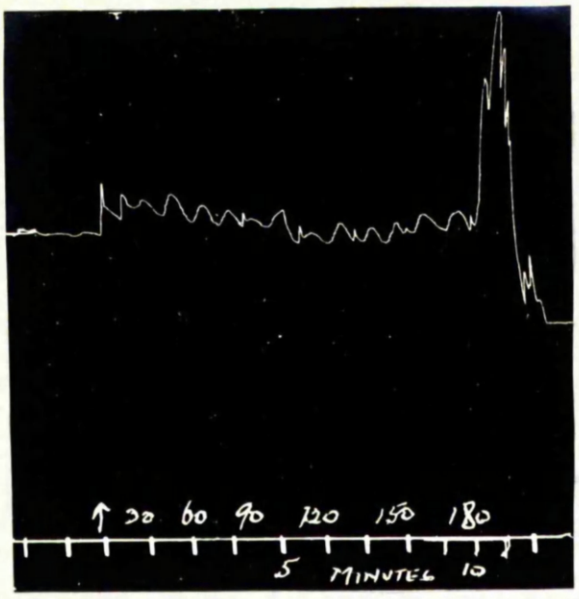


Figure 22

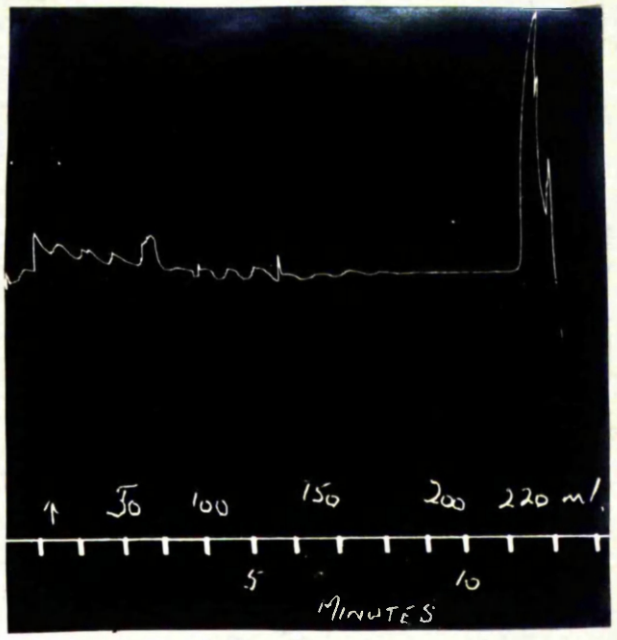


Figure 23

5. Case 96. 68 years.

Summary: Senile dementia, mental hospital.

This man was confused, disorientated and had dirty habits of 6 months duration. Seven cystometric examinations were performed, the first four at intervals of two days, and the last three at intervals of one week. There was no change in the residual urine, which remained at 20 ml., and the capacity improved from 180 to 220 ml. On the last two examinations, 0.5% lignocaine was used in volumes of 20 ml., and 40 ml. respectively, with no appreciable effect. He remained incontinent of urine.

Cystometrograms: On the first filling the residual urine was 20 ml.; a spontaneous contraction appeared at 180 ml. (Figure 22).

Pressures (in Cm.)

0 - 4
50 - 9
100 - 8
150 - 8
180 - 70

On the fourth filling residual urine was 20 ml.; the contraction appeared at 220 ml. (Figure 23).

Pressures (in Cm.)

0 - 6
50 - 10
100 - 11
150 - 10
200 - 11
220 - 60

CHAPTER IX

CARBACHOL THERAPY

In a minority of cases of incontinence in the elderly the bladder is distended due to a blockage of the outflow of urine, and the detrusor muscle may be hypotonic or normal in tone. A large volume of residual urine is commonly found, which provides a convenient locus for the development of infection, and the incontinence is of the overflow variety.

Many of these patients are unfit for major surgery, and the operation of supra-pubic cystostomy is not considered to be a suitable method of treatment as it predisposes to infection and the patient has a miserable life thereafter. The method of treatment employed here is to pass a catheter and gradually decompress the bladder. The catheter is left in situ and with the bladder empty and the catheter open, carbamylcholine (Carbacholum B.P.) is given orally in a dosage of 2 mg. three times daily; the catheter being removed on the next day. The method is not without risk and the effects of therapy must be carefully assessed. If oral treatment is ineffective, intramuscular injections can be given in a dosage of 0.25 mg., also three times daily. Carbamylcholine causes a fall in blood pressure, stimulates the muscle of the digestive tract, bladder and bronchioles; its action simulates the action of acetylcholine, but it is more stable. Some illustrative cases are now described.

1. Case 18.

Summary : Benign prostatic hypertrophy, retention of urine, bladder atony, congestive cardiac failure, discharged home.

This patient, aged 81 years, had a history of breathlessness and ankle oedema of 7 weeks duration, the bladder was found to be distended and cystometry showed an atonic bladder with a capacity

of 650 ml. Carbamylcholine 1 mg. was given orally three times daily for 10 days, and repeat cystometry showed an active bladder which held only 65 ml. before spontaneous contractions caused evacuation. He was able to pass urine normally, was continent and was discharged home.

2. Case 59.

Summary: Benign prostatic hypertrophy, subacute retention of urine, Local Authority Home.

This man of 77 years had difficulty in micturition of 3 years duration and had recently become incontinent. Cystometry showed a residual urine of 550 ml., and the bladder held 525 ml. before contractions started. An intramuscular injection of carbamylcholine caused a rise in bladder pressure from 19 cm. of water to 48 cm. of water. Cystoscopy showed a congested bladder with trabeculation and sacculation of the bladder wall.

Treatment consisted of carbamylcholine 2 mg. three times daily for 6 weeks, and this was associated with an indwelling catheter for the first week. Micturition became satisfactory, continence was restored and he was transferred to an Eventide Home. Cystometry 9 days after the commencement of treatment showed a capacity of 500 ml.

There was therefore little change in the size of the bladder, but the pressures were higher on the second examination, for example at 500 ml. on the first occasion the pressure was 17 cm. of water, and on the second occasion it was 26 cm. of water. This would indicate that there was an increase in the tone of the detrusor muscle.

3. Case 1.

Summary : Cerebral thrombosis, left hemiparesis, benign prostatic hypertrophy, subacute retention of urine, discharged home.

This patient of 73 years had a left hemiparesis and aphasia of 5 months duration. Cystometry showed a residual urine of 350 ml. and the bladder capacity was 700 ml. Carbamylcholine was given intramuscularly in a dosage of 0.5 mg. 3 times daily, but following a reaction after 17 days therapy, this was changed to 2 mg. orally three times daily, which was given for 5 weeks. The patient became continent and was sent home. Catheterisation was repeatedly done during therapy when he developed retention of urine, but the treatment was persisted in and was eventually successful.

4. Case 27

Summary : Bronchial carcinoma, left hemiplegia, benign prostatic enlargement, subacute urinary retention, died.

This man of 63 years had a left hemiplegia of 11 months duration, and chest X-ray showed collapse of the right upper lobe due to neoplastic disease.

Cystometry showed a bladder capacity of 600 ml. Carbamylcholine 0.25 mg. was given intramuscularly three times daily for two days, and then twice daily for 10 days. Oral therapy was substituted because of reactions, and 2 mg. was given three times daily for a month. The reactions consisted in flushing, perspiring and trembling. He passed urine freely with carbamylcholine although a subacute retention persisted, but catheterisation was not required. The patient remained incontinent and eventually died.

5. Case 33.

Summary : Senile dementia, benign prostatic hypertrophy, subacute retention of urine, died.

This patient, aged 81 years, had a residual urine of 700 ml., and his bladder held 310 ml. before spontaneous contractions occurred. Carbamylcholine, 2 mg. orally, was given three times daily for 5 days, and subsequently 1 mg. was given for two periods of 6 and 9 days. Repeated catheterisation was necessary, the patient did not resume normal micturition and died in uraemic coma.

6. Case 51.

Summary : Bronchial carcinoma, cerebral metastases, died.

This man of 64 years had a left bronchial carcinoma treated by radiotherapy 5 years previously. Just before admission he developed a right hemiplegia and dysphasia. He had a residual urine of 952 ml. and 700 ml. was introduced into the bladder without contractions. Carbamyl-:choline was given, 1 mg. three times daily for 6 days, and 2 mg. three times daily for 8 days, without effect, and an indwelling catheter had to be used. The patient had terminal epileptiform seizures.

7. Case 101.

Summary : Cerebral thrombosis, left hemiplegia, benign prostatic hypertrophy, acute retention of urine, died.

This man of 80 years had a left hemiplegia of 2 years duration and progressive mental deterioration for 1 year. He developed an acute retention of urine shortly after admission. Cystometry showed a bladder

capacity of 625 ml. , the catheter was left in situ for 3 days and carbamylcholine was given orally 2 mg. three times daily. The catheter was then withdrawn and the dosage continued for one week and then reduced to 1 mg. three times daily for 2 weeks. There was success in establishing the urinary flow and he passed urine incontinently. One week after the withdrawal of the catheter catheterisation was again done and the residual urine was only 80 ml.

Comment

Of the seven cases who were treated, the urinary flow was re-established in five of them, and three of these also became continent. Carbamylcholine is of value in ill or terminal cases, and frequent catheterisation or the use of an indwelling catheter may be avoided. In patients who are in better health, but for whom an operation may carry a risk, carbamylcholine may re-establish normal micturition, and is worthy of a trial.

CHAPTER X

THE TREATMENT OF URINARY INFECTION

In this series of 106 cases, 51 (48.1%) were found to be suffering from infection of the urinary tract. The predominating micro-organisms were Esch. coli and Proteus vulgaris, and they were found either alone or in combination in 36 cases (70.6%). Of the 51 cases, who were found to have a urinary infection, 41 were treated with one of three drugs - chloramphenicol, sulphonamides, or nitrofurantoin. The results obtained are presented in Tables XI - XIV, and the results obtained with the individual preparations are discussed below.

Chloramphenicol

The antibiotic action of chloramphenicol on micro-organisms that invade the urinary tract, and its high concentration in the urine following moderate dosage, render it valuable in treating urinary tract infections. Leadbetter and Woodruff (1952) found it to be the most consistently effective antibiotic against Esch. coli and Proteus vulgaris. Chloramphenicol is known to be toxic to the bone marrow, and may cause aplastic anaemia, and it should not be used indiscriminately. However, with the small doses used here, this danger is minimal and no side-effects were encountered; repeated courses should be avoided.

In Table XI it is shown that 14 cases were treated with a cure rate of 42.9% and a reversion to continence in 28.6%. The dosage used was 1 gramme

daily, given in four doses and the usual period of treatment was one week. Of the 8 cases in which the infection was not eradicated, 5 were due to Proteus and this might be expected as this organism is often drug resistant and less sensitive to chloramphenicol than Esch. coli.

TABLE XI

CHLORAMPHENICOL SERIES

Case	Total dose	Organisms (All sensitive)	Result	Incontinence
1	14 G.	E. coli	Cured	Remained incontinent
2	7 G.	Paracolon bacillus	Cured	Remained incontinent
3	6 G.	E. coli	Proteus appeared	Remained incontinent
10	6 G.	E. coli	No change	Remained incontinent
18	4 G.	Strep. faecalis	Cured	Became continent
23	14 G.	E. coli	Cured	Became continent
30	7 G.	E. coli	Cured	Became continent
31	7 G.	Proteus	No change	Remained incontinent
32	7 G.	E. coli	Proteus appeared	Remained incontinent
33	7 G.	E. coli	No change	Remained incontinent
43	7 G.	E. coli	No change	Remained incontinent
44	7 G.	Staph. albus Proteus	Proteus persisted	Remained incontinent
45	7 G.	B. lactis aerogenes Proteus	Cured	Remained incontinent
77	7 G.	Proteus	No change	Became continent

The relationship of incontinence to infection is shown by the fact that 50% of the cases in which the infection was cured became continent, while where the infection persisted 12.5% became continent. Clearly other factors must be taken into account, but the curing of infection is important in the relief of incontinence.

Sulphonamides

The sulphonamides used were as follows, Sulfafurazole (Gantrisin) was employed in six cases, and it is chemically described as 3,4 - dimethyl - 5 sulphonamidoisoxazole. It is highly soluble in urine at physiological pH value and 8-hourly dosage is considered adequate for moderate infections. It has a wide spectrum which includes cocci, Esch. coli and Proteus, and it was given for periods of 9 to 36 days in a daily dosage of 1½ or 2 grammes, without complications.

Sulphatriad was used in three cases in varying doses from 1 gramme four-hourly to 0.5 gramme three times daily for periods ranging from 4 to 34 days. It is a combination of sulphathiazole, sulphamerazine, and sulphadiazine and, because of the small amount of each constituent, is reputed to be less liable to cause crystallisation in the kidney tubules.

Sulphamethoxypyridazine, a long-acting sulphonamide known chemically as 3- (sulphanilamido)-6-methoxypyridazine, was used in three cases. It is rapidly absorbed and slowly excreted and is active against cocci, Esch. coli and more rarely Proteus, and is exhibited in doses of 1 gramme on the first day followed by 0.5 gramme daily and was used for 7 to 14 days.

TABLE XII

SULPHONAMIDE SERIES

Case	Drug	Total Dose (grammes)	Time in days	Organism	Result	Incontinence
1	Sulfafurazole	54	36	E. coli(S) Strep. faecalis (I)	Failed	No change
2	Sulfafurazole	43.5	22	E. coli(U)	Cured	No change
39	Sulfafurazole	28	14	E. coli(S) Proteus(S)	Failed	No change
40	Sulfafurazole	18	9	Proteus(S)	Cured	Improved
43	Sulfafurazole	60	30	Proteus(I)	Failed	No change
44	Sulfafurazole	28	14	Proteus(S)	Cured	Became continent
18	Sulphatriad	20	4	Proteus(U)	Failed	No change
23	Sulphatriad	71	32	Proteus(U) E. coli(U)	Failed	Improved
38	Sulphatriad	51	34	Proteus(S)	Failed	No change
47	Sulphamethoxy-pyridazine	3.5	7	E. coli(I) Proteus(S)	Cured	Became continent
49	Sulphamethoxy-pyridazine	6.5	13	E. coli(S)	Cured	Improved
59	Sulphamethoxy-pyridazine	7	14	Staph. aureus (S)	Failed	No change

(S) - sensitive to drug
(I) - insensitive to drug
(U) - sensitivity unknown

The results obtained are shown in Table XII; 5 cases were cured of the infection, a cure rate of 41.7%, and of these cases 2 became continent

(40%)and 2 were improved, while of the remaining 7 cases none became continent and only 1 case showed improvement (14.3%). Again the importance of detecting and eliminating urinary infection in elderly incontinent patients is underlined. The most successful drug was sulfafurazole with 3 cures out of 5 cases, and it is noteworthy that two of these cases were due to Proteus vulgaris. Sulpham-:ethoxypyridiazine was also successful and it has the additional merit of being given only once a day.

The duration of treatment in these successful cases was fairly short, 7 - 22 days, and it would appear that if the treatment is to be successful, a course of therapy of up to three weeks should suffice.

Nitrofurantoin

This drug was developed from nitrofurazone which had been used in the topical treatment of chronically infected wounds and in the irrigation of the bladder. Its formula is N-(5-nitro-2-furfurylidine)-1-aminohydantoin, briefly nitrofurantoin, and it is marketed under the name Furadantin. Following oral administration it appears in the urine in half an hour and therapeutic levels are maintained for 6 hours; 40% is excreted in the urine and 4% in the faeces. Treatment should be continued for three days after the urine becomes sterile; the side-effects are few and consist of nausea and skin rashes, and if treatment is prolonged beyond three weeks blood counts should be done.

Nitrofurantoin has a broad spectrum and is effective against cocci, E. coli, Proteus, Pseudomonas pyocyanea and diphtheroids. Schatten and Persky (1953) treated 36 patients with acute and chronic urinary infections, symptomatic

improvement was obtained in all acute cases and in 16 of the 26 cases with chronic infections. Sterilisation of the urine was effected in 8 of the 10 patients with acute disease but in only 3 cases with chronic disease. The results in this series are shown in Table XIII.

TABLE XIII

NITROFURANTOIN SERIES

Case	Total dose (grammes)	Organism	Result	Incontinence
1	4	E. coli	Cured	No change
3	4.8	E. coli	Proteus appeared	No change
7	3.9	Proteus	Cured	No change
10	4.8	E. coli	Failed	No change
14	4.2	Proteus	Failed	No change
15	5.4	E. coli Proteus	E. coli persisted	No change
18	1.8	Proteus	Failed	No change
21	9.6	E. Coli	Failed	No change
23	4.2	Proteus	Failed	No change
28	4.2	Proteus	Failed	No change
33	4.2	Proteus	Failed	No change
58	3.6	E. Coli	Proteus appeared	No change
59	5.7	Proteus	Failed	Became continent
67	2.4	Proteus	Failed	Became continent
74	3.6	Proteus	Failed	No change

All organisms were sensitive except Nos. 28, 67.

Of 15 cases treated, the infection was cured in 2 cases, a cure rate of 13.3%; and also 2 cases became continent. The dosage used was 100 mg. or 150 mg. given three or four times daily for 6 to 19 days given by mouth, no toxic effects were noted. These results were disappointing and seem to indicate that nitrofurantoin is ineffective in treating urinary infection in the elderly, which agrees with the findings of Schattan and Persky quoted above.

Comment

TABLE XIV

COMBINED RESULTS OF TREATMENT

Drug	Cases	Cured		Incontinence improved		Incontinence cured	
	No.	No.	%	No.	%	No.	%
Chloramphenicol	14	6	42.9	0	0	4	28.6
Sulphonamides	12	5	41.7	3	25	2	16.7
Nitrofurantoin	15	2	13.3	0	0	2	13.3
Totals	41	13	31.7	3	7.3	8	19.5

In Table XIV the combined results for the treated cases are given and it can be seen that the overall cure rate was 31.7%, and 19.5% of the patient became continent and 7.3% were improved. Chloramphenicol gave the best results especially in Esch. coli infections, but the toxic effects of this drug on the bone marrow must be kept in mind. However in this age group and with total doses of the order of 7 grammes the risk would seem to be minimal; repeated courses should be avoided. The sulphonamides, especially sulfafurazole, gave good results and should certainly be the first line of defence, other drugs

being used if they fail. Guidance in drug therapy should always be sought from the results of drug sensitivity of the organism, as shown by culture.

The more recently developed sulphonamides appear to be free from the danger of crystallisation in the kidney, and the less frequent dosage is helpful to the patient and the nursing staff.

There would seem to be no place for the use of nitrofurantoin in the treatment of chronic urinary infection in the elderly.

Of the 13 cases who were cured of their infection 5 became continent (38.5%), and of the remaining 28 cases only 3 became continent (10.7%). Therefore an incontinent elderly patient who has a urinary infection cured has his chances of becoming continent increased fourfold.

With regard to the collection of mid-stream specimens of urine from incontinent patients and the reliability of the results obtained from them, a number were compared with a catheter specimen obtained on the same day or shortly thereafter, with the results shown in Table XV.

TABLE XV

COMPARISON OF MID-STREAM URINE AND CATHETER URINE

Case	Mid-stream urine		Catheter urine	
	Pus cells	Growth	Pus cells	Growth
2	Few	Light Proteus	Nil	Nil
9	Nil	Moderate E.coli & Proteus	Few	Nil
5	Few	Moderate Proteus	Numerous	Moderate Proteus
22	Nil	Moderate E.coli	Nil	Nil
24	Few	Heavy Proteus	Few	Nil
25	Nil	Nil	Nil	Nil
50	Nil	Heavy Proteus	Nil	Nil
54	Nil	Few E.coli	Nil	Nil
71	Nil	Heavy Proteus	Nil	Nil
98	Nil	Heavy Proteus	Few	Nil

Only 2 of the 10 results agreed, the discrepancy always being a growth in the mid-stream specimen which was not corroborated by the catheter specimen. An interesting point is that in only 2 of the false positives were pus cells found, and the inference would be to treat all mid-stream specimens from incontinent elderly patients with suspicion which show a growth of micro-organisms without

accompanying pus cells. In these cases repeat mid-stream specimens should be taken, and if the growth is a contaminant, the type of organism grown will be found to alter. The reason for the unreliability of these specimens in the incontinent patient is the difficulty of collection. Whitby and Muir (1961) found that in a series of 330 urines, which were infected with micro-organisms, one third did not represent a true infection, but were due to contaminants.

CHAPTER XI

POSTERIOR PITUITARY THERAPY

In many cases of urinary incontinence of the elderly, the incontinence is nocturnal and during the day the patient is continent. This is ascribed to the fact that the impaired cerebral control is sufficient to control the bladder during the waking hours, but during sleep the control is weakened further and incontinence occurs.

In an attempt to diminish the amount of urine formed during the night, posterior pituitary extract containing the anti-diuretic hormone was administered The preparation used was Di-sipidin, in which the extract is in powder form and is given by means of a special insufflator into the nostrils. It is standardis and the strength expressed as units (anti-diuretic), the usual dose being one capsule of 10 units, about 33 mg., being given on retiring to bed. It has oxytocic, vasopressor, and hyperglycaemic actions in addition to the anti-diuretic one. Five cases were treated and will now be described.

1. Case 4

Summary: Arteriosclerotic mental impairment, benign prostatic hypertrophy, subacute retention of urine, discharged home.

This man of 75 years was given one capsule of Di-sipidin at night for 14 days. There was an improvement in the incontinence and he had periods of continence of 5 days, and it was possible to discharge him home.

2. Case 12

Summary: Post-prostatectomy incontinence, discharged home.

This patient aged 75 years had a transurethral prostatic resection done

four months before admission. His bladder held 400 ml. with a residual urine of 36 ml., but he was occasionally incontinent at night. One capsule of Di-sipidin was given for 8 days with improvement and he went home.

3. Case 21

Summary: Cerebral softening, right hemiplegia, mental impairment, urinary infection, long-stay hospital.

This patient, 76 years of age, had a right hemiplegia of 3 years duration. Cystometric examination showed a residual urine of 71 ml. with early spontaneous contractions and a capacity of 150 ml. One capsule of Di-sipidin was given at night for 37 days with improvement although he remained incontinent and required long-term hospital care.

4. Case 67

Summary: Arteriosclerotic Parkinsonism, benign prostatic hypertrophy, urinary infection, discharged home.

He was 69 years of age and had suffered from Parkinsonism for 7 years. Di-sipidin, one capsule nightly, was given for 3 weeks and he became completely continent apart from accidents in handling the urinal due to his Parkinsonism. He was discharged home.

5. Case 87

Summary: Thrombo-phlebitis of leg, Addisonian pernicious anaemia, long-stay hospital.

He was 76 years old and was a known case of Addisonian pernicious anaemia for 3 years, and had a recent thrombo-phlebitis of his left leg. Cystometry showe a capacity of 280 ml. and he made a good attempt to control the flow during the

examination. No improvement was obtained by Di-sipidin therapy, and he required long-stay hospital care.

Of these 5 cases, 1 was cured and 3 were considerably improved and it would seem to merit a trial when the incontinence is mainly or exclusively nocturnal. The chart for recording the incontinence which was previously mentioned is of particular value here.

CHAPTER XII

DISCUSSION

Incontinence of urine is a frequent symptom among sick elderly people and it poses a great problem to physicians and nurses who are concerned with its treatment.

The most common cause is impairment of cerebral control of the bladder resulting from brain damage, due to degenerative vascular conditions associated with atherosclerosis or cerebral thrombosis with an associated hemiplegia. Linked with the cerebral disease there is often intellectual impairment which varies in degree, the greater the impairment the more severe is the incontinence.

When the cerebral centre has been damaged, the bladder comes under the increased influence of the lower centres in the hypothalamus and the sacral cord, and as these are reflex in nature, the bladder tends to become a reflex organ. The patient has diminished control of bladder function, depending on the amount of damage to the cortical centre, and certain abnormalities of function appear.

Early in filling, spontaneous contractions appear with sharp rises in intra-vesical pressure and they cause micturition unless control is exerted by the external sphincter, which many of these patients are unable to do. Normally these contractions occur late in filling and are preceded by the desire to micturate by a considerable interval. In the incontinent elderly patient, the desire to micturate occurs coincidentally with the contraction, and so they suffer from urgency and are often unable to get to the toilet in time. The early contractions also cause emptying of the bladder at small volumes and thus give rise to frequency and the comment by the nursing staff that the patient is always wet.

The symptoms tend to be worse at night when the cerebral control is further weakened by sleep, and it is a common finding in less severe cases that they manage to be continent during the day but are incontinent at night. In these cases, the incontinence chart at the bed is particularly useful as they can be readily distinguished, and they usually have a good prognosis. This matter of prognosis is of special importance in this condition owing to the large numbers involved, as if those who are likely to benefit from intensive investigation and treatment can be identified, the results of treatment will be improved. Those who are unlikely to benefit from treatment can be quickly moved to long-term accommodation which is kinder to them and frees beds in assessment units for patients suitable for further investigation.

The three cardinal points of prognosis are mental alertness, the degree of incontinence and its timing, and the cystometric tracing. The cystometer is of value here, as if the tracing approaches the normal and if a good attempt is made to co-operate and control the flow during contractions, then it can be predicted with confidence that the patient will become continent. This apparatus can also be used to ascertain the effect of treatment on the bladder size and control and also the effect of drugs on the bladder. It can now be obtained in a convenient and portable unit and should be available in all geriatric units, as this investigation is an essential part of the treatment and management of incontinence in the elderly.

In selected cases with a good prognosis, where a surgical condition such as prostatic hypertrophy is thought to exist, further investigations such as cystoscopy, pyelography, and kidney function tests may be done and a surgical opinion obtained.

Any form of medical treatment must be supported by intensive nursing measures. The patient must be kept out of bed for as long as his general condition will permit, discretion being exercised in ill or terminal cases. He should be taken to the toilet regularly, and this may be combined with walking exercises, which also help in the rehabilitation of the patient. If necessary, he can be awakened from sleep and asked to empty his bladder during the night. Restriction of fluids in the evening is helpful, especially after 8 p.m., and in nocturnal incontinence this may be combined with the administration of posterior pituitary extract as snuff or by injection. Encouragement should be given to the patient and an interest taken in his progress, and he should be made to feel that it is of importance that he remains dry. Reprimand should also be given when it is thought that the incontinence is due to the patient's negligence or carelessness.

Much of the incontinence in the elderly is due to impairment of cerebral function and it is necessary to direct treatment to this cause. The cerebral damage is usually caused by degenerative vascular processes resulting in dementia, or to destruction of brain tissue from brain softening, due to cerebral thrombosis or haemorrhage. These processes are obviously not amenable to therapy as we know it at present, but efforts should be made to improve the patient's vitality by nursing care, good diet, and encouragement. Where there is thought to be an associated depression or where there is doubt about the aetiology of the mental condition, psychiatric opinion should be obtained and, ideally, all these patients should be seen by a psychiatrist. It has been shown by Kidd (1962) that confused patients do better in a mental hospital, and it may

be that incontinent confused patients would show more progress if given the benefit of skilled psychiatric medical and nursing care. I believe this to be a field in which closer co-operation between the geriatric and psychiatric services would be of great benefit to the patients.

In this series no drug has been shown to exert a decided improvement on the mental state or the incontinence. The most promising of those tried was 2% procaine hydrochloride in the method advocated by Aslan but in much shorter courses than she used. It is possible that better results would be obtained in courses of 18 months to 2 years, and would be feasible in long-stay units, and I believe that it would be worthy of trial under double-blind conditions. Chlorpromazine was not successful in treating incontinence, although of value in restlessness, and high-potency vitamin therapy is ineffective in the treatment of senile confusion unless where there is evidence of vitamin lack, e.g. in alcoholism. We are still awaiting the drug of proved effect, and drug trials should be carried on in geriatric units where these patients are so prevalent. It is among the new drugs - tranquillisers, anti-depressants and drugs to improve cerebral blood-flow - that the answer may be found, and in view of the poor prognosis in untreated cases, it would be in the patients' interest that these drug trials be made.

Often associated with the confused mental state is the small, hyperactive, Reflex or Uninhibited Neurogenic Bladder; the parasympathetic nervous supply is here providing excess stimulation to the detrusor muscle, and in this situation anticholinergic drugs are of value. In this series, both belladonna and propantheline bromide have been used successfully to

block the parasympathetic and allow the bladder to increase in volume. This treatment can be combined with a stimulant, such as dexamphetamine, in order to increase the mental alertness. Treatment can be prolonged, and dosage should be pushed to the limit of the patient's tolerance; in successful cases it can be gradually discontinued and the patient will remain continent. New anticholinergic drugs are continually being developed, and this would seem to be a fruitful field for further research. Ephedrine, a sympathicomimetic drug, has a good effect on hyperactive bladders, either by its antagonistic action to the parasympathetic, or by increasing the tone of the sphincters, and it might be combined with an anticholinergic drug with benefit.

Attempts to increase the bladder capacity and improve incontinence by repeated cystometric examinations, with and without local anaesthesia, were unsuccessful, and this practice is not recommended.

The urine should always be cultured for micro-organisms and an examination made for pus cells. The infection will usually be due to E. coli or Proteus, and a determined effort made to eliminate it should be made, as the patient's chances of cure of the incontinence will be greatly improved thereby.

Where subacute retention of urine and overflow incontinence are present, carbamylcholine may be used either orally or by injection, to increase the strength of the bladder contractions and to avoid the necessity of catheterisation or a supra-pubic cystostomy.

In spite of all efforts the patient may remain incontinent and palliative remedies may have to be employed. Rubber and plastic urinal

appliances, of both day and night type, have proved ineffective in the treatment of incontinence in the elderly when associated with mental impairment, as the patient does not co-operate in their use, and also sores of the penis and scrotum are readily produced. For the patient who is sensible and could use them other methods of treatment, such as those previously discussed, are to be preferred.

A urinal in the bed is the most successful way of keeping the bed dry in male patients, especially if it is supported by an absorbent incontinence pad to soak up any slight spillage. If an unspillable urinal could be developed it would obviate much bed-wetting due to accidental upsetting of the urinal. Attempts have been made in this unit to develop such a urinal but so far these have not been successful.

Penile clamps have been used, but these are again only of use in sensible men, and they tend to be painful and have to be removed frequently. Indwelling catheters are not favoured owing to their tendency to become dirty, and to predispose to ascending infection of the urinary tract. They may have to be used where the skin becomes broken or inflamed due to excessive wetting. The skin of incontinent patients requires careful supervision to prevent bed sores developing; scrupulous cleanliness is necessary, and barrier creams or cod liver and zinc ointment should be applied frequently and massaged well into the skin. Quaternary ammonium compounds may also be used to eliminate the urea-splitting organisms in the skin which cause urine rashes.

Most of these patients will require hospital care and attention for the remainder of their lives, and it must be realised that incontinence in the elderly is often an expression of general physical and mental deterioration, with

only a short prognosis, and thus is unlikely to yield to any form of treatment. However there does remain a large number of elderly people who suffer from incontinence, who could be relieved from this distressing malady if increased knowledge of the disease was available, together with improved methods of treatment.

It is to be hoped that increasing time and money will be spent on research into this widespread and disabling disease, preferably by trained teams of research workers working from well-equipped centres. The benefits which would accrue to a very large number of senior citizens would be great and progress now is vital when one considers the increase in the elderly population which is expected in the future. Unless efficient prophylaxis and treatment is forthcoming in the reasonably near future, one can envisage hospitals becoming flooded, in both senses of the term, with cases of incontinence, as relatives will become more and more reluctant to deal with them at home, and indeed they are cases worthy of hospital care. Money spent now will be recouped many times over in saving in hospital beds in the future, and the benefits in relief of suffering and discomfort would be incalculable.

SUMMARY

1. The majority of cases of urinary incontinence in elderly patients are due to cerebral disease, resulting in diminished control of the bladder.
2. The bladder is commonly smaller than normal and shows early spontaneous contractions.
3. Many of the cases with brain disease are confused and the degree of confusion is related to the bladder size and the prognosis.
4. Infection of the urinary tract increases the patient's chances of becoming incontinent; cure of the infection improves the prognosis of the incontinence.
5. Cystometric examination is valuable in assessing the bladder capacity, the cerebral control, the prognosis and the probable response to therapy.
6. Rubber or plastic appliances have only a small part to play in treatment, as they require the co-operation of the patient.
7. Accurate recording of the incontinence is important in assessing the prognosis and response to treatment.
8. Treatment should be directed to improving mental performance, to blocking parasympathetic stimuli, to eliminating infection, and to overcoming any blockage to the outflow.
9. Further intensive investigation is needed.

LIST OF REFERENCES

Aslan, A., (1960), Geront. Clin., 2, No. 3, 148.

Barrington, F.J.F., (1921), Brain, 44, 23.

Bors, E., Parker, R.B., (1956), J. Urol., 76, 566.

Braithwaite, J.V., (1956), Proc.roy.Soc.Med., 49, 33.

Brocklehurst, J.C. (1951), Incontinence in Old People, (Livingston, Edinburgh.

Denny-Brown, D., Robertson, E.G., (1933a), Brain, 56, 397.

Denny-Brown, D., Robertson, E.G., (1933b), Brain, 56, 149.

Draper, J.W., Sierp, M., (1956), J.Urol., 75, 665.

Gray's Anatomy, 32nd . Edition, (Longmans, Green and Co., London.).

Kidd, C.B., (1962), Brit.med.J., 2, 1491.

Leadbetter, W.F., Woodruff, L.M., (1952), Med.Clin. N. Amer., 36, 1421.

Learmonth, J.R., (1931), Brain, 54, 147.

Ranson, S.W., Kebat, H., Magoun, H.W., (1935), Arch.Neurol.Psychiat., 33, 467

Rose, D.K., (1940), J.Urol., 43, 190.

Schatten, W.E., Persky, L., (1953), Amer.J.Surg., 86, 720.

Whitby, J.L. Muir, G.G., (1961), Brit.J.Urol., 33, No. 2, 130.

Wilson, T.S., (1948), Lancet, 2, 374.