The electrocardiographic changes are not those usually associated with hypercalcaemia. The pattern does, however, closely resemble that found in some patients suffering from vitamin-D poisoning. Such electrocardiographic changes may possibly result from lesions of the myocardium or coronary arteries.

The possibility exists that residual coronary artery damage from idiopathic hypercalcaemia in early childhood may persist into later life.

I am indebted to Professor Stanley Graham for permission to study patients who were under his care and for his encouragement and advice during the preparation of this paper. I thank Dr. R. A. Shanks for his advice, Dr. M. S. McBean for the data used in the Table, and the departments of biochemistry, pathology, and medical photography at the Royal Hospital for Sick Children, Glasgow, for their assistance.

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CONTROL OF SURGICAL INCONTINENCE BY MEANS OF THE PORTSMOUTH VALVED CATHETER

BY

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Surgical treatment of primary or secondary cancer of the bladder and/or urethra has become common practice in contemporary gynaecology. This usually results in incontinence from either the bladder or its substitute. Total extirpation of the urethra is followed by such a distressing degree of incontinence that the patient gladly accepts further surgery. Uretero-colic anastomosis so often results in an increasing degree of kidney damage that other operations have been devised in order to offer greater kidney protection. Most favoured among these operations has of recent years been the ileal graft draining through an abdominal opening. Whether it be an ileostomy or a suprapubic or perineal cystostomy, present systems of urine collection and disposal are, in my opinion, unsatisfactory. The most difficult problem

is presented by the perineal cystostomy. Five years ago I had to perform a total cystectomy in two such cases in order to relieve the patients' misery. What a drastic remedy, to have to remove an otherwise healthy organ.

For these reasons a new method of control, by means of a valved catheter, was conceived. In all these cases there is a soft-tissue track between the bladder or substitute and the body surface. If an effective seal can be obtained, continence is achieved. Methods of constricting the track or distending it were considered and discarded. The only remaining remedy seemed to be by compression from either end. This would quickly

FIG. 1.—Portsmouth valved catheter. Therapeutic series: 3, 2, 1, and 0.5 cm.

result in shortening of the track and recurrence of incontinence. A system was therefore then devised whereby the track was compressed by degrees over several days until an effective and lasting seal was obtained.

Description and Fitting.—The valve consists simply of two inflatable bulbs applied to a 24 French catheter. They are of 30-ml. capacity and are filled independently. In the fitting series (Fig. 1), the bulbs are 3, 2, 1, and 0.5 cm. apart. It is usually necessary to fit the 3-cm. valve in the first instance, but if an effective seal is not at once obtained it should be replaced by a 2-cm. valve. Within 24 hours the patient complains of pain or dampness of the surrounding skin. As soon as this occurs the catheter should be replaced by one in which the bulbs are closer together. On this occasion an effective seal is usually obtained for three or four days. Though the track has now been shortened to about 2 cm., seepage of urine again occurs, and a 1-cm. catheter should be fitted. It has never yet been necessary to use the final 0.5-cm. valve in the series. During this time the patient quickly learns how simple it is to manage the prosthesis.

Management.—(1) *Suprapubic or Perineal Cystostomies* (Fig. 2): When first fitted the catheter should be released two-hourly. Within a few days bladder capacity is greatly increased, and soon these patients behave as normal, but they are all instructed

to release the catheter before retiring, purely to ensure a good night's rest. (2) *Abdominal and Perineal Ileostomy Openings*: The management here is essentially the same, but the catheter must be released at frequent intervals, otherwise there is an increased danger of hyperchloraemic acidosis. Present experience suggests, however, that acidosis occurs far more frequently in association with infection, and it has occurred only once in eleven patients where urine and faeces were segregated from the outset.

Experience in Use

When I first tried out this remedy, it was at once apparent that, to be successful, the bulbs must be uniformly round and be durable. They are best distended with water, and should at first be partially distended and manipulated to achieve uniformity. Fig. 3 is a line drawing of an x-ray plate, which clearly demonstrates bulb uniformity. The outer bulb and bladder have been filled with sodium iodide, and the inner bulb with water. Fig. 3 also demonstrates the lowermost limits of urine in the bladder as shown by the contrast medium, thereby proving the seal to be effective.

The valve normally lasts about 14 days; sometimes as much as three weeks, but generally between 14 and 16 days' discomfort and dampness occur. On rare occasions a bulb has burst, and for this reason an attempt is being made to train one husband to fit the valve. This patient has been wearing the valve since January, 1958, and another for six months. Infection has never been a feature (fortnightly catheter specimens remain sterile), and, though these patients complain of a sense of pressure or even discomfort when first fitted, this soon passes off. The valve should never be fitted until the operation scar is well healed; this may take three to four months, although it has been possible to fit it earlier in two cases. A tight fit is essential not only to the seal but to the patient's comfort and freedom from infection.

The first experiments were conducted with volunteers, who were warned that infection of the urinary tract and/or necrosis of the track might well occur. It was also thought that some form of shield would be needed for the outer bulb. The valve has now been used in seven patients altogether, and the following case reports suggest that these fears were groundless.

Case 1

A 4-para aged 57 was first seen on June 12, 1956. Epithelioma of the vulva was diagnosed. Radical vulvectomy was performed on June 13 for a growth on the left labium minus measuring 3 by 1.75 cm. This tumour was 2 cm. from the urethra at its uppermost border.

Repair of urethrocele for stress incontinence was carried out on February 13, 1957. A local recurrence involving the urethra was treated on January 10, 1958, by local excision and removal of the entire urethra. In April, 1958, a Portsmouth valved catheter was fitted (as described) and the patient was discharged home continent and comfortable two weeks later. She has had the valve changed at 14-day intervals ever since.

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FIG. 2.—Line drawing of valve fitted to a suprapubic cystostomy before and after closure of the internal urethral meatus. Because of the difficulty usually experienced in closing the internal urethral meatus it has been found preferable to fit the valve to a perineal cystostomy; and, indeed, from the patient's point of view the result seems to be more satisfactory.

FIG. 3.—Line drawing of a radiograph, showing bulb uniformity.

Case 2

A 3-para aged 45 was first seen on November 7, 1956. Stage III cervical carcinoma was diagnosed. This was treated with radium followed by Wertheim's hysterectomy and block dissection of glands (seven metastatic glands were found on microscopy). She was admitted to hospital on July 6, 1957, for biopsy of a suspicious area at the external urethral meatus. This area was 1 cm. in its greatest diameter, and microscopy revealed a squamous carcinoma —? primary vulva/secondary cervix. On August 16 this lesion was treated by anterior radical vulvectomy, vaginectomy, and total urethrectomy.

The operation was followed by repeated attacks of infection of the urinary tract associated constantly with distressing incontinence. Eventually retention with overflow (due to stenosis) was treated by dilatation, which was followed again by infection and incontinence. At this stage the urological opinion given was, "I should advise uretero-sigmoidostomy . . ." The patient was then confronted with the full facts, and she opted for an experiment with the Portsmouth valved catheter prior to further surgery. The first valved catheter (bulbs 3 cm. apart) was inserted on January 20, 1958. Further fitting was carried out as described above, and the patient, who was discharged from hospital on February 19, has been continent, comfortable, and free of infection of the urinary tract ever since. Her valve is changed at 14-day intervals, but I feel confident that as time goes by the valve will last longer with increasing clinical and productive experience.

Case 3

A 4-para was first seen on December 19, 1955, complaining of frequency, stress, and haematuria. She was admitted for examination under anaesthesia and cystoscopy, which revealed a large carcinoma of the urethra extending into the bladder trigone and invading the pubic arch. An intravenous pyelogram showed bilateral grade III hydronephrosis and hydroureter.

On January 5, 1957, both ureters were transplanted into an ileal segment and a midline subumbilical ileostomy opening was fashioned. This ostium healed rapidly, and six weeks later the ileostomy bag was discarded and a Portsmouth valved catheter (3-cm. valve) fitted. The ileostomy opening when originally fashioned was made very narrow, the edges being sewn to the rectus sheath, with a view to fitting the Portsmouth valved catheter at a later date. Urine leaked within four hours of fitting the 3-cm. valve (this seems to be a constant finding when fitting an ileal graft with the Portsmouth valved catheter). A 1-cm. valve was inserted on the third day, and this proved satisfactory. This size was fitted at approximately 14-day intervals over the next four months, during which time there was no leakage of urine, and, as in other cases, the outer bulb was forming for itself a cavity or bed presumably due to pressure.

The patient died of spinal secondaries early in July, 1957, and necropsy revealed a healthy ileal mucosa, and a similar depression had been formed by the inner bulb.

Case 4

A 1-para aged 60 was first seen on March 16, 1953. She had an epithelioma 3 by 2 cm. in the region of the right Bartholin gland, and extending into the urethra for a distance of 1 cm. A classical radical vulvectomy was performed on April 30, and almost the whole of the urethra was additionally removed. Several different plastic (vaginal) operations were performed in the next 18 months in the hope of relieving to some extent the very distressing degree of incontinence which followed the original procedure. They were all unsuccessful.

In October, 1954, it was decided to perform a permanent suprapubic cystostomy and close the urethral orifice from below. The latter part of this procedure was successful

at the fifth attempt in March, 1955. The suprapubic cystostomy was drained through and around a de Pezzer catheter, and in May of the same year the de Pezzer tube was replaced by a 3-cm. Portsmouth valved catheter. On May 29 the fitting had been completed and the patient was discharged home completely continent for the first time. Whereas she was formerly a victim of recurrent infection of the urinary tract, from the time the Portsmouth valved catheter was fitted her urine remained sterile for the succeeding five months. She then complained of increasing hypogastric pain and developed some fever. *Proteus vulgaris* was cultured and intravenous pyelography showed a large vesical calculus. This was thought to be due perhaps to the Portsmouth valved catheter, though I had in mind the fact that monofilament nylon had been used in one of the attempts to close the urethral opening. By then this gallant woman had reached the end of her tether, and after due consideration it was decided to remove the bladder and fashion a substitute. In December, 1955, the ureters were transplanted into the pelvi-rectal junction, the colon was divided above this site, and the sigmoid brought out in the flank to furnish an end colostomy. The bladder and uterus were removed at the same time.

Examination of the stone confirmed the opinion that it surrounded some nylon suture material. It was a phosphatic calculus 35 by 30 by 15 mm. In addition areas of squamous metaplasia were found in the bladder neck, but there was no definite evidence of recurrent growth. For the past three years the patient has remained in good health.

As this is not the place to discuss the virtue of ileal grafts *vis-à-vis* isolation of the rectum, my reasons for doing the operation described above are not included here.

Indications

In my opinion this remedy is best suited to perineal cystostomies and ileostomies. The symphysis pubis provides a useful solid barrier or intermediate supporting structure. Abdominal openings are not so readily controlled unless the ostium is narrow and surrounded by firm scar tissue at the time of fitting. Though it has been used for several weeks apparently successfully in an abdominal ileostomy, it is so completely effective when fitted to perineal openings that it is my present opinion that ileal substitutes should in almost all cases surface on the perineal skin just beneath the pubic arch, thereby lending to the valve the bone support normally available to the undeformed urethra. There does not appear to be any reason why suprapubic cystostomies should not be converted into perineal/retropubic cystostomies (even in men), for this is also the natural and least embarrassing position from which to urinate. To fashion an adequate abdominal wall ostium for this or any other remedy is undoubtedly more difficult, but the pubic arch can so readily be used as a supporting structure, not only for the bladder substitute but for the valve, as to make this problem one of greater simplicity.

Summary

A new method of control of surgical incontinence by means of a valved catheter is described. Four examples of its use are given.

An outline of the technique of fitting and experience in use is given.

Ileostomy and cystostomy control is briefly discussed, and views on the position of these openings are included.

Five years ago my simple drawings were sent to Messrs. J. G. Franklin & Sons Ltd., 51, Manchester Street, Portman Square, London, W.1. Since that time the manufacture of this valve (provisional specification No. 5443/58) has been

undertaken solely by them. Throughout this period I have received the utmost consideration and help from this company, particularly from their Mr. F. Hodson. My thanks are due to Mrs. Shirley East for her line illustrations, to Dr. Donald Chisholm for his x-ray plates, and to my general surgical colleagues for their encouragement and for agreeing to the name chosen for this valve.

IRON THERAPY IN PRIMARY IRON-DEFICIENCY ANAEMIA

BY

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Recently much attention has been paid to the relative merits of various iron compounds in the treatment of iron-deficiency anaemia. Organic iron preparations such as chelates and salts of organic acids have been recommended on various grounds, including better utilization and lower toxicity (but never economy). On the basis of these trials it has been claimed that some of the new iron preparations give better results than the widely used ferrous sulphate tablets. However, as O'Sullivan *et al.* (1955) point out, the significance of such trials is doubtful for two reasons. Firstly, they have often been carried out on pregnant women with mild or moderate anaemia who tend to recover spontaneously after pregnancy. Secondly, the doses of the iron salts used have not been comparable in terms of their content of elemental iron.

In young men there is a form of anaemia in which exhaustive investigation fails to show evidence of organic origin. To this condition the name primary iron-deficiency anaemia has been given (Brumfitt, 1958). In these patients complicating factors which might interfere with or modify a normal response to iron therapy are absent. In the series described (Brumfitt, 1958) all the patients were young soldiers who were kept in hospital throughout the period of treatment. The risk of the patient forgetting to take the prescribed dose of iron was thereby avoided, and samples of blood could be obtained at frequent and regular intervals. In addition, it was possible to follow the patients for periods of up to one year after correction of the

anaemia. Such conditions provided a good opportunity to compare the response of two commonly used iron salts—ferrous sulphate and ferrous gluconate.

Patients and Methods

The patients were 30 soldiers between the ages of 18 and 20 years in whom organic disease had been excluded (Brumfitt, 1958). The extent of the anaemia varied from 6.4 to 11.1 g. of haemoglobin per 100 ml. The fasting serum iron level was always low and ranged from 23 to 45 μ g./100 ml. The patients were divided by random selection into two groups: 16 were treated with ferrous sulphate and the other 14 by ferrous gluconate. The comparability of the treatment groups is shown in Table I.

The dose of ferrous sulphate and ferrous gluconate was adjusted so that each patient received 149 mg. of bivalent iron daily. The tablets were given between meals and were taken at once in the presence of the ward sister. Therapy was continued for five weeks unless the haemoglobin rose to the arbitrary level of 13.5 g./100 ml., in which event iron was discontinued.

Haemoglobin and reticulocyte estimations were made daily for the first 14 days and thereafter twice weekly. In view of the diurnal variation in haemoglobin level (McCarthy and Van Slyke, 1939; Brown and Goodall, 1946) blood for haemoglobin estimations was taken between 10 and 11.30 a.m. The pipettes were calibrated gravimetrically (Stevenson *et al.*, 1951) and the

TABLE I

Average	Treatment Group	
	Ferrous Sulphate	Ferrous Gluconate
Age	18.3 years	18.4 years
Weight	10 st. 7 lb. (66.7 kg.)	10 st. 10 lb. (68 kg.)
Haemoglobin	8.8 g.	8.9 g.
P.C.V.	35.9%	35.9%
M.C.H.C.	24.5%	24.7%
Fasting serum iron	34 μ g./100 ml.	34 μ g./100 ml.
Histamine-fast achlorhydria	30%	42%

estimations made photoelectrically. Indices were calculated before starting treatment, after 1, 3, 5, and 12 weeks, and at follow-up.

Before beginning treatment, uptake of iron given by mouth was studied. The fasting serum iron level was

FIG. 1.—Comparison between response to ferrous sulphate (●—●) and ferrous gluconate (×—×).