chronic arthropathy. Periarticular calcification, which is a feature of both these conditions, is not, however, a feature of dialysis arthropathy. Similarly, there was no evidence of chondrocalcinosis or, hence, pseudogout in these patients. As bone biopsies were not performed in these patients the possibility that accumulation of aluminium in bone contributed to this arthropathy cannot be excluded.

The results of this study of patients receiving long term treatment with haemodialysis show that many patients develop a progressive and often severe arthropathy that is commonly complicated by recurrent carpal tunnel syndrome. Some of the patients became severely disabled from this arthropathy, which therefore must be regarded as a major complication of long term treatment with haemodialysis. As this arthropathy does not develop in patients with longstanding chronic renal failure who are not receiving dialysis it is probably due to the haemodialysis process itself rather than uraemia. Further studies are needed urgently to determine the cause of this dialysis arthropathy and establish whether inflammatory responses induced by dialysis could lead to this widespread deposition of amyloid.

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Internal urinary sphincter in maintenance of female continence

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Abstract

The integrity of the bladder neck was assessed in 98 continent women. Radiological and physiological evidence showed that half of these women had an incompetent bladder neck, but they were still continent. These data devalue the urodynamic finding of an incompetent bladder neck as an indication for surgery for incontinence and question the physiological importance of the internal sphincter.

Introduction

Traditionally, it has been taught that urinary continence is maintained by the internal and external sphincters. Ellis claims that in women the internal sphincter (the bladder neck) is the more important,¹ and in *Cunningham's Textbook of Anatomy* it is stated

that "urine is held at the level of the bladder neck."² Opening of the bladder neck in response to stress—for example, increase in intra-abdominal pressure during a cough—has been considered to be abnormal³ and has been used as an indication for surgery in patients complaining of stress incontinence (S Rees, T P Stephenson, C J Richards. The results of colposuspension. Proceedings of the International Continence Society's fourteenth meeting, Innsbruck, 1984). The aim of this paper is to show that incompetence of the bladder neck may be a common variant of normal and should not therefore be regarded as a urodynamic abnormality. This was achieved by radiological screening and interpretation of urethral pressure profilometry under stress.

Patients and methods

Ninety eight women presenting with symptoms of the climacteric, not incontinence, were recruited for this study from the Dulwich Hospital Menopause Clinic. They were all found to be continent on pad testing (E Versi, L D Cardozo. One hour single pad test as a simple screening procedure. Proceedings of the International Continence Society's fourteenth meeting, Innsbruck, 1984) and normal uroynamically (uroflowmetry and videocystourethrography⁴).

Each patient had her bladder filled to capacity (400-600 ml) with Urografin 150 at room temperature, which was then screened radiologically using an image intensifier. The bladder neck was viewed in the erect oblique position. At the same time intravesical and intra-abdominal (rectal) pressures were recorded with the use of 1 mm manometer tubing, filled with saline, attached to Statham Gould transducers. This system enabled changes in detrusor pressure to be measured even during a cough (by subtracting the intra-abdominal pressure from the intravesical pressure). The integrity of the bladder neck was assessed radiologically and the image recorded on videotape while the patient was asked to cough six times as hard as possible. Incompetence of the internal sphincter was diagnosed when the bladder

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neck was seen to open in response to a cough in the absence of a detrusor contraction and when contrast medium was seen not to pass beyond the mid-urethral point—that is, incontinence did not occur.

Urethral pressure profilometry was carried out as described by Hilton and Stanton.⁵ Patients were in the supine, semilithotomy position and each had 250 ml saline at room temperature instilled into her bladder. Simultaneous pressures of the urethra and bladder were recorded using a 7 French Gaeltec catheter mounted with two solid state depressed transducers with a 6 cm separation. Initially, the catheter was placed so that both sensors were in the bladder; the catheter was then withdrawn mechanically at a steady speed of 2.5 mm/second. This resulted in the proximal sensor passing through the urethra, thus obtaining a profile of resting pressure, which was repeated to ensure reproducibility. The catheter was then reinserted and once again withdrawn while the patient was coughing to obtain a pressure profile on coughing (figure).

Generation of urethral pressure profile under stress. (a) Urethral pressure profile recorded as catheter is pulled through urethra. Single cough is recorded with pulse registering in urethral (U) and bladder (B) traces, resulting in notch in electronic subtraction trace as cough pulse to urethra is not as great as that to bladder. (b) Subtraction trace of stress pressure profile. Profile is generated by asking patient to cough repeatedly while catheter is withdrawn. Dotted line represents stress profile and proximal shortening results from opening of bladder neck during cough.

The subtraction trace—that is, urethral minus bladder pressure (fig (a))—was used to plot the stress pressure profile (fig (b), dotted line). The proximal deficit in the stress pressure profile is called “proximal shortening.” This occurs in patients who have an incompetent bladder neck on coughing. In such cases, when the proximal sensor is in the proximal urethra a cough resulting in opening of the bladder neck causes the two sensors mounted on the catheter to be rendered instantaneously in fluid continuity. Thus the difference in pressure is equalised and recorded as zero in the subtraction trace. In women with a competent bladder neck this should not occur. (All terms used are in accordance with the standardisation committee of the International Continence Society.)

Results

The table depicts the comparison of data obtained from the imaging and profilometry studies. Radiologically, 50 of the 98 women had an incompetent bladder neck on coughing, and on the basis of the profilometry data 48 had

TABLE 1—Comparison of incompetence of bladder neck as seen radiologically with data obtained from urethral pressure profilometry studies. Values are numbers of women in each category

Radiological findings	Profilometric findings		
	No proximal shortening	Proximal shortening	Total
Competent bladder neck	44	4	48
Incompetent bladder neck	6	44	50
Total	50	48	98

an incompetent bladder neck as shown by the presence of proximal shortening of the stress profile. To compare the agreement of results from the two techniques the kappa index was computed^{6,7}: $k = (P_o - P_e) / (1 - P_e)$, where P_o = observed proportion of agreement and P_e = expected proportion of agreement. From our data $k = 0.8$, which represents substantial agreement between morphological and physiological data. Our results suggest that about half of climacteric women have an incompetent internal sphincter but despite this are still continent.

Discussion

Function can be surmised from anatomical studies, but physiological data are required for verification. The strong correlation between morphological and physiological data in this study adds weight to our argument that the bladder neck is not essential for maintaining continence in climacteric women. Results of studies carried out by Gosling *et al* suggested that the orientation of smooth muscle fibre at the bladder neck would, on contraction, probably act to open rather than close the bladder neck.⁸ Competence of the bladder neck is probably achieved by the innumerable elastin fibres found in this area.⁹ As half of our patients had a competent bladder neck this clearly has sphincteric function for them, but for the other patients it does not: they use their external sphincteric mechanisms to maintain continence.

It is not clear whether incompetence of the bladder neck is peculiar to climacteric women or if it is a normal finding in women of all ages. Hilton and Stanton, in their small series of 20 asymptomatic women aged between 25 and 74, found proximal shortening of the urethral pressure profile under stress in five women.⁵ The weakness of the bladder neck may be initiated or exacerbated by a deficiency in oestrogen in these climacteric women, but as yet no data are available on this.

As incompetence of the bladder neck was seen in half of our sample of continent climacteric women we conclude that this is not a reliable urodynamic finding on which to base the diagnosis of genuine stress incontinence. Incompetence of the bladder neck should not therefore be used as the sole indication for surgery for incontinence.

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