drug to the myocardium is influenced by the method of preparation.^{21 22} Different tablets of digoxin may have varying effects, though they contain the same amount of digoxin. At present the simplest solution to this problem is to digitalize and maintain each individual on the same brand of digoxin.

Conclusion

The symptomatology and course of cardiovascular disease is modified by age and there are several forms of heart disease specific to old age. Congestive failure is a common and often complex problem. With accurate diagnosis and careful treatment the prognosis is relatively good. The paradox of cardiovascular disease in the old is that, though heart disease is common in patients who survive to advanced old age, they are a selected group, a biological élite, whose general health and hearts might be expected to be unusually good.

I would like to thank Dr. G. Farrer-Brown, Senior Lecturer, Department of Pathology, The Middlesex Hospital Medical School for permission to publish Fig. 5, and Mr. G. Bryan, Chief Pharmacist, The Middlesex Hospital for his help and advice.

References

- ¹ Bedford, P. D., and Caird, F. I., *Quarterly Journal of Medicine*, 1956, **25**, 407.
- ² Lown, B., and Levine, S. A., *Current Concepts in Digitalis Therapy*. London, Churchill, 1955.
- ³ Pathy, M. S., *British Heart Journal*, 1967, **29**, 190.
- ⁴ Evans, W. E., *British Heart Journal*, 1943, **5**, 205.
- ⁵ Lerner, P. I., and Weinstein, L., *New England Journal of Medicine*, 1966, **274**, 199, 259, 388.
- ⁶ Wedgwood, J., *Lancet*, 1955, **2**, 1058.
- ⁷ Wedgwood, J., *Gerontologia Clinica*, 1961, **3**, Suppl., p. 11.
- ⁸ McIntyre, N., and Stanley, N. N., *British Medical Journal*, 1971, **2**, 567.
- ⁹ Pollitt, N. T., *Journal of the American Medical Association*, 1968, **203**, 153.
- ¹⁰ Gould, J., *Proceedings of the Royal Society of Medicine*, 1954, **47**, 215.
- ¹¹ Wedgwood, J., in *Medicine in Old Age*, ed. J. Agate. London, Pitman Medical, 1966.
- ¹² McKeown, F., *Journal of Clinical Pathology*, 1963, **16**, 532.
- ¹³ Pomerance, A., *British Heart Journal*, 1965, **27**, 711.
- ¹⁴ Bedford, P. D., and Caird, F. I., *Valvular Disease of the Heart in Old Age*. London, Churchill, 1960.
- ¹⁵ Pomerance, A., *British Heart Journal*, 1966, **28**, 815.
- ¹⁶ Shirley-Smith, K., *British Heart Journal*, 1960, **22**, 110.
- ¹⁷ Sleight, P., *British Heart Journal*, 1962, **24**, 726.
- ¹⁸ Wood, P., *Diseases of the Heart and Circulation*, 2nd edn. London, Eyre and Spottiswoode, 1956.
- ¹⁹ Wedgwood, J., *Modern Geriatrics*, 1970, **1**, 40.
- ²⁰ Durozier, P., *Gazette Hebdomadaire de Médecine et de Chirurgie*, 1874, **2**, 780.
- ²¹ Hamer, J., and Chamberlain, D. A., *British Medical Journal*, 1973, **2**, 177.
- ²² Falch, D., Teien, A., and Bjerkelund, C. J., *British Medical Journal*, 1973, **1**, 695.

New Inventions

Marsupial Principle in Maintenance of Personal Hygiene in Urinary Incontinence

F. L. WILLINGTON

British Medical Journal, 1973, **3**, 626-628

Summary

A garment has been designed for the management of urinary incontinence, with the objective of maintaining dryness of the skin and clothing, while reducing odour. Trials of this garment in various hospitals and age groups have shown them to be effective and practical.

Introduction

The importance of incontinence lies in the crippling social complications in child and adult age groups, though there may be vital medical considerations. This can be seen by the existence of local authority enuresis clinics, the dominating importance of continence in the geriatric age groups, and the existence of a European continence society.

Whereas the numbers of primary or secondary enuretics have been assessed¹ and the numbers of spastic children or spina bifida cases with incontinence are likely to be known, the total numbers in the middle and older age groups in the

community have never been satisfactorily estimated. From a social and nursing standpoint, the over-riding need of these patients for whom effective treatment is not possible, is for an aesthetically satisfactory and effective means of prevention of wetting so that the patient can lead a relatively normal life.

Method

A review of existing garments was undertaken in 1967 and their common factors were assessed. All tended to rely on the containment of fluid within an impermeable barrier, so that the urine was kept in contact with the skin. Skin lesions were prominent and odour was troublesome for this reason. The efficacy of the garments in preventing leakage of urine varied with design. All had shortcomings but none overcame the basic mechanics of the situation; when the patient was erect, or sitting, fluid, however contained, would gravitate to the lowest part of the garment, usually the crotch. All shared the objective of treating the clothes rather than the patient. Because of the difficulties in changing the garments all tended to produce dependence and not independence.

The fundamental objective must be to treat the patient rather than the clothes or the bed; and his treatment must keep him warm and dry, even though he is incontinent of urine. The secondary objective is independence. This can be achieved by designing a garment which can be used by a single-handed patient such as a hemiplegic. It must reduce

or abolish odour and incidence of skin rash by allowing a free circulation of air around the genital area; it should be undetectable to the observer; and, finally, the garment should be aesthetically satisfactory for either sex to wear and thus prevent the elderly feeling (with resentment) a return to childhood thrust on them.

Marsupial Pants

The garment I have designed keeps the urine away from the skin by the use of tight-fitting pants made from hydrophobic material (100% knitted polyester). As urine is voided it passes through the pants to a pad of highly absorbent material (bleached wood pulp) fitted over the genital area. This absorptive pad is retained in a waterproof pouch, which keeps the clothing dry (figs. 1, 2).

FIG 1—Marsupial principle applied to Incontinence Pads

FIG 2—Incontinence pants in use by child aged 10. Note the lack of bulk.

So long as the pad of absorptive material remains unsaturated the fluid will flow through the pants, which it does with remarkable speed, the hydrophobic material ensuring that the patient remains and feels dry. The pads are quickly and easily changed, even in the sitting position, without removing the pants. The capacity of a pad is about 400 ml, and in practice two to four pads are needed daily.

The pouch is made from knitted polyester fibre and coated plastic on the inside to achieve waterproofing. This effectively disguises its true nature. The stitching is with polyester fibre to protect the skin from sensitization.

Failure can occur if the pants do not fit closely, and a precise fit round the thighs may be a problem since the thighs of the elderly are disproportionately small. Adjustment of the leg elastic is provided to take account of this.

When the patient lies down the urine tends to gravitate to the sacrum, and this problem has been overcome by the backward extension of the pouch.

The pants in use by a hemiplegic patient are shown in fig. 3.

FIG 3—Incontinence pants in use by hemiplegic man.

A recent successful trial² conducted by the Welsh Hospital Board with this garment, which was originally designed for geriatric patients, has shown that the development of new materials has made obsolete many traditional techniques of achieving the stated objectives.

Discussion

The marsupial principle is capable of use in any age group. This has been borne out by our experience with geriatric, psychogeriatric, and young subnormal patients and with spina bifida. Handicapped children have been able to attend normal schools without trouble from incontinence or odour.

Calculations by the Welsh Hospital Board have shown that the yearly saving on laundering and replacement of clothing can be about £120 for each patient, while the cost of the protective garments compares favourably with other, similar garments. Only one design is necessary for male and female patients (four sizes for adults and two for children), but a special design is available for spina bifida cases.

This garment is not intended to be used in cases of faecal incontinence, but dauntless patients with double incontinence, or persistent faecal staining or discharge, have found that a thin interliner wrapped round the anal/gluteal area within the pants enables them to lead a satisfactory social existence. The newfound confidence and comfort provided

by these garments has made it possible to discharge from hospital several elderly patients with "established" incontinence. Those who regularly have automatic emptying of the bladder producing a large quantity of urine at a time—say, 600 ml—do not find the garment very satisfactory because the capacity of the pad is at present too small for their needs.

Many elderly patients are on diuretics, and often they have little warning before micturition occurs; in such cases this device may be helpful, though it is clear that there is a need for a superior pad of greater capacity but with no increase in bulk.

Fear of wetting and open criticism by other patients, residents, or nursing staff may result in the perpetuation of incontinence in this age group.^{3,4} In children, Woodmansey,⁵ discussing the enuretic, pointed out the consequences of the well known reaction by parents and school authorities to incontinence. Emphasis has also been laid on the unfortunate effects of anxiety on learning.^{1,6,7}

Conclusion

This, then, is a simple, aesthetically satisfactory, and relatively cheap garment designed to produce greater independence in those afflicted with transitory or permanent urinary

incontinence. It appears to have greater efficiency than many conductive devices and has the additional advantage of excellent patient acceptability and comfort.

I should like to pay tribute to the foresight and singlemindedness of the clothing division of the Welsh Hospital Board which resulted in the successful development of the garment; in particular, Mr. A. W. C. Campbell, chief supplies officer, Welsh Hospital Board, Mr. A. M. Thomas, assistant area supplies officer, and Mr. A. Sellars, area supplies officer, West Glamorgan area.

I should also like to thank Messrs. Courtaulds for their help on the technical side and in providing the materials and adequate supplies of Kanga pants to enable the project to be finally realized, and Mrs. J. Brown, department of photography and medical illustration at the University Hospital of Wales, Llandough, Cardiff, for her help with the illustrations.

References

- ¹ Meadow, R., *British Medical Journal*, 1970, 4, 787.
- ² Willington, F. L., Lade, C. M., and Thomas, A. M., *Nursing Mirror*, 1972, 135, 40.
- ³ Willington, F. L., *Gerontologia Clinica*, 1979, 342, 11.
- ⁴ Lipman, A., *Gerontologia Clinica*, 1968, 88, 10.
- ⁵ Woodmansey, A. C., *British Medical Journal*, 1972, 3, 161.
- ⁶ *British Medical Journal*, 1969, 2, 63.
- ⁷ MacKeith, R., *Developmental Medicine and Child Neurology*, 1968, 10, 465.

Child Psychiatry: A Nursing Aid

K. S. WALSH BRENNAN

British Medical Journal, 1973, 3, 628–629

Incontinence in patients aware of their condition is a soul-destroying experience. It is a psychological and humanly distasteful problem to the patient and to the nurse, for whom extra work is created and who can expect to change bedclothes and clean the patient up to six times in 24 hours. Laundry costs alone in a ward of mentally or physically handicapped children, paraplegics, or geriatric patients can be astoundingly high.

Comfort matters greatly, even to those in extremis. "Besides the security of knowing that he will not be broken down by intolerable suffering," says Hutton,¹ "the dying person needs assurance that he can be adequately tended if he becomes quite weak or helpless. . . . A nurse can restore order, calm and comfort where there was incipient panic and discomfort. If attention to personal cleanliness has become impossible, the nurse's restoration of habitual cleanliness and neatness allows self-esteem to return."

Design of Apparatus

Present methods of nursing incontinent patients aim at keeping them as clean and comfortable as possible, but even with the best nursing care in fully staffed hospitals the handicapped will spend some time lying miserably in their own excreta. In an effort to find some way of alleviating this discomfort and embarrassment, as well as helping to take the load off nursing

colleagues, a device which can be wheeled under a bed and left in constant operation was designed (see illustration).

Two prototypes (British Patents 7043-68 and 41433-68) have been used for 18 months in a ward for the severely mentally handicapped at St. Joseph's Hospital, Sheffield.