## **TECHNICAL NOTE**

## A TILTING BED FOR THE URODYNAMIC ASSESSMENT OF SPINAL CORD INJURED PATIENTS

By B. P. GARDNER, M.A., M.R.C.P., F.R.C.S.,<sup>1</sup> J. F. HAYCOCK, C.G.L.I., H.N.C.,<sup>2</sup> K. F. PARSONS, F.R.C.S. (Ed.), F.R.C.S.,<sup>3</sup> D. MACHIN, F.R.C.S.,<sup>4</sup> and K. R. KRISHNAN, F.R.C.S. (Ed.)<sup>5</sup>

<sup>1</sup> Senior Registrar, <sup>5</sup> Consultant in Charge, Merseyside Regional Spinal Injuries Centre. <sup>2</sup>Consultant Mechanical Engineer, Chestnut Cottage, 5, Pinfold Lane, Scarisbrick, Nr Ormskirk, Lancashire L40 8HR. <sup>3</sup>Consultant Urologist, <sup>4</sup>Research Registrar, Royal Liverpool Hospital.

Key words: Spinal Cord Injury; Tilting Bed; Urodynamics.

#### Introduction

IT HAS been demonstrated (Gibbon *et al.*, 1980) that posture can significantly influence urostatic and urodynamic results in spinal cord damaged patients. Therefore, full urodynamic assessment of these cases should include measurement of urethral pressure profiles in the horizontal and vertical position. These parameters are difficult to record in such patients, in particular the voiding flow rate and pattern. A tilting bed is described which enables all of these measurements to be made.

#### **Description of Bed**

The bed is illustrated in Figs I and 2. The base is 6'  $6'' \times 2' 3''$ . It is constructed from square hollow section steel tubing. Strap attachment rails are fixed to the base superiorly and laterally. The base contains a wooden block board and a mattress. The blockboard and mattress have a 'keyhole' slot through which the patient can micturate in the horizontal position. The mattress is manufactured from 2'' thick high density polyurethane foam covered with heavy duty fire-retardant ICI vinyl. The bed base is mounted on the output shaft of a 60:I reduction 90° industrial gear box. A handle is attached to the gear box.

The bed base pivots from the horizontal to the vertical at approximately the level of the symphysis pubis thereby minimising any need to move the pressure transducers.

There are six patient restraining straps. One supports both shoulders, one restrains the chest, two support the body at the level of the groin and two restrain the legs above the knees. These straps are manufactured from 2'' wide 2000-lb breaking strain nylon webbing and have tensioning buckles and stainless steel quick-release hooks. These enable the straps to be removed from the patient without unthreading the buckles. The nylon straps are covered with foam at the various pressure points on the patient's skin.

The foot plate is manufactured from 10 mm PVC sheet with tubular



FIG. I Diagram of the tilting bed.

KEY: I = Fixed Eye Bolts; 2 = Restraining Straps; 3 = Body Support Straps; 4 = 'Keyhole' Slot; 5 = Foot Plate; 6 = Mounting Plinth; 7 = Base; 8 = Output Shaft; 9 = Gearbox; IO = Handle; II = Bolt Holes.

steel mountings. The foot plate can be moved to five different positions by releasing two wing nuts and bolts. In this way patients of different leg lengths can be accommodated.

The mounting plinth is manufactured from quarter inch mild steel plate. The dimensions prevent the bed from tipping over both in the horizontal and vertical positions. The plinth has six bolt holes to secure it to the floor.

The bed has been tested with a 500 kilogramme load to give a safety factor of approximately five times body weight.

The main body support straps are each fastened to 250 kilo fixed eye bolts to give a similar safety factor.

Synchronous radiological assessment is readily achieved by using a 'C' arm winger intensifier.

## Discussion

The use of this tilting bed has extended the range of urodynamic investigations in this Unit.

The position of the restraining straps is such that the effect of posture on respiratory, cardio-vascular and other physiological parameters can also be assessed.



FIG. 2 A C 6 Tetraplegic patient in the upright position on the tilting bed.

# REFERENCE

GIBBON, N.O.K., PARSONS, K. F. & WOOLFENDEN, K. A. (1980). The Neuropathic Urethra. Paraplegia, 18, 221–225.