534

Hutton M[1], Drinnan M[2], Pickard R[2], Robson W[2], Caffarel J[2], Clarkson B[2], Griffiths C[2]
1. Newcastle Upon Tyne Hospitals NHS Trust, 2. Newcastle Upon Tyne Hospitals NHS Trust

PRESSURE MEASUREMENT DURING FILLING CYSTOMETRY USING A SINGLE LUMEN CATHETER

Hypothesis / aims of study

Pressure-flow studies using intravesical catheters are used routinely in clinical practice for the diagnosis of patients with lower urinary tract symptoms (LUTS) and have been recognised as the ideal method to determine the presence of bladder outlet obstruction (BOO)[1]. Most centres use transurethral catheters in pressure-flow studies consisting of either a double lumen catheter or a narrow-lumen bladder-pressure catheter (4F) mounted “piggy back” on a larger bladder filling catheter (10F). Neither of these options are however ideal. The double lumen catheter is expensive leading many centres to adopt the “piggy back” method, but using this method it is not uncommon for the narrower bladder-pressure catheter to be pulled from the bladder when disengaging it from the filling catheter. Also, using the “piggy back” approach the large catheter assembly results in an increase in detrusor pressure at maximum flow rate while voiding for men with symptoms of BOO[2]. A method that permits the measurement of pressure while filling the bladder with a single catheter is therefore desirable.

During the voiding phase it is straight forward to measure bladder pressure using the filling catheter. However, to do so during the filling phase of pressure-flow studies one must correct for the peristaltic artefact from the infusion pump. This is manifest as both a rhythmic variation in pressure and a pressure offset dependant on the infusion rate. The peristaltic artefact also depends on the size of the lumen. For a method of pressure measurement in the filling catheter to be viable the artefact from the peristaltic pump must be adequately filtered and the pressure offset induced by the pump must be predictable.

The aim of this study was to investigate the feasibility of measuring pressure in the filling line during the filling phase of pressure-flow studies.

Study design, materials and methods

Three subjects undergoing pressure-flow studies were selected. The standard pressure-flow study set-up (using the “piggy back” method) was modified with the inclusion of an additional pressure transducer in the filling catheter. Pressures were recorded in both the filling catheter (10F) and the measuring catheter (4F) and subsequently processed using a two stage procedure. The digitiser sampling rate was 10Hz.

Stage one: filtering the recorded pressures using the Butterworth filter (1Hz, low pass) to remove the rhythmic pressure variations. *Stage two:* estimating and removing the pump-induced offset. To allow this the infusion pump was switched off for five seconds during filling in each pressure-flow study. The pump offset was then calculated using this by computing a mean pressure over the middle 3 second period with the pump switched off and subtracting this from a similar mean computed from the pressure prior to switching off the infusion pump.

The pressures recorded in the filling catheter were compared with the pressures recorded in the measuring catheter using the method of Bland and Altman.

Results

	Infusion rate (ml/min)	Pump-induced offset (cmH_2O)	Mean ± SD of difference (cmH_2O)
Subject 1	100	54	-0.9 ± 1.1
Subject 2	100	52.6	4.8 ± 2.2
Subject 3	50	39	-0.4 ± 0.9

Table 1. Summary of results. The mean difference was calculated by subtracting the pressure recorded in the measuring catheter from the pressure recorded in the filling catheter with filtering and the pump offset-removal algorithms applied.

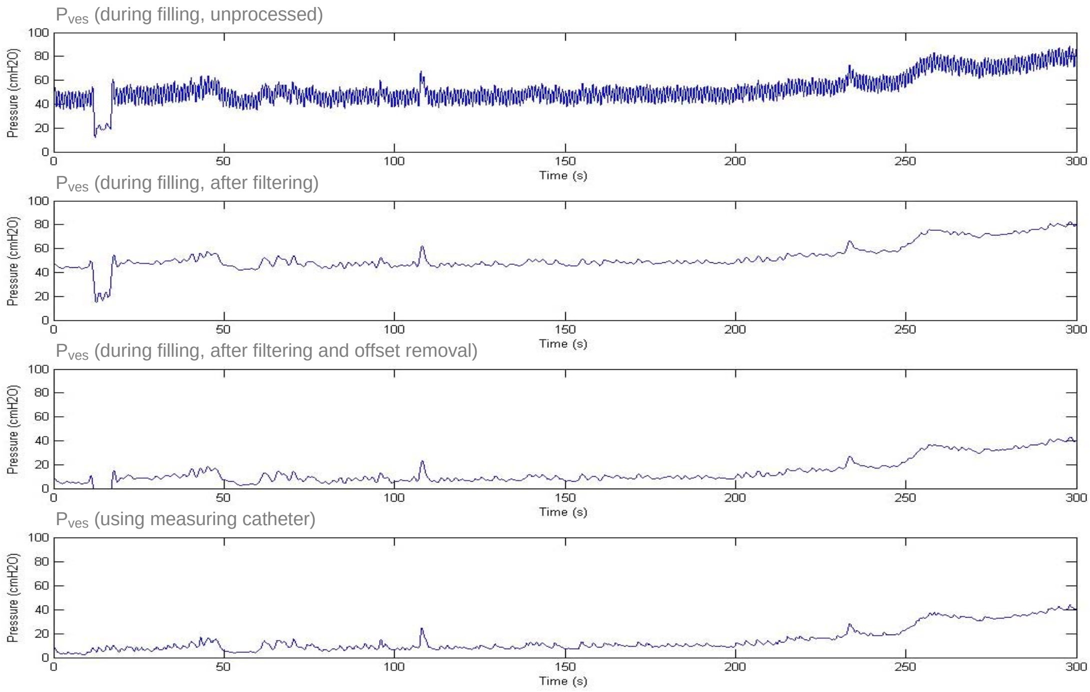

Fig. 1. Recorded pressures during the filling phase of pressure-flow study for Subject 3 showing (from top) the measured pressure prior to application of the artefact removal algorithms; with the filtering algorithm only applied to the filling catheter; the filtering and offset removal algorithms applied to the filling catheter; and the pressure measured with the measuring catheter. Filling rate was 50ml/min. Note that the pump was switched off at t=12s (for offset estimation) and note also the start of a bladder contraction at t=240s.

<u>Interpretation of results</u>

We have shown that measuring pressure in pressure-flow studies using the filling catheter is possible. The pump-induced pressure offset was successfully determined in the subjects studied. The pressure profile obtained following digital filtering of the filling catheter data is in good agreement with the pressure profile obtained in the measuring catheter with an SD in the difference of less than 2.2cmH_2O (see Table 1). The pressure measured in the filling catheter was found to respond identically to the pressure obtained from the measuring catheter during destrusor contractions, as was the case in Fig. 1 from t=240s onwards. More rapid changes in pressure are also faithfully reproduced even after filtering of the filling catheter data (e.g. cough at t=110s in Fig. 1).

<u>Concluding message</u>

Using a single intravesical catheter to fill the bladder and to measure pressure during pressure-flow studies is a viable alternative to the two methods currently in use. Future work will involve the development of an automatic detection of the pump on/off status.

<u>References</u>

[1] *British Journal of Urology* 1997, 79:693-697
[2] *British Journal of Urology* 1987, 60:64-68

FUNDING: None

HUMAN SUBJECTS: This study did not need ethical approval because This was an alternative analysis of data being collected as part of the standard clinical urodynamic assessment but followed the Declaration of Helsinki Informed consent was not obtained from the patients.