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Gammie A[1], Abrams P[1]
1. *Bristol Urological Institute, UK*

BLADDER COMPLIANCE – A REVIEW OF PRACTICE

Hypothesis / aims of study

There has been a history of papers seeking to define normal values for bladder compliance (e.g. 1, 2, 3). There is a wide range of importance attached to compliance from "useful terminology" (3) to "the most important information obtained from a urodynamic test" (2). There is a variety of approaches to using the figure, not all of which comply with ICS guidelines. A review of published papers has therefore been carried out with a view to suggest improvements in practice and standards.

Study design, materials and methods

A Pubmed search of English language papers using phrases 'bladder(s) compliance', 'detrusor compliance' and 'vesical compliance' in the title yielded 76 papers. Papers concerning animal studies, other senses of the word 'compliance' and treatment studies were excluded, leaving 34 papers for review of which 26 were analyzed. These papers reported a range of measurement technique, filling speed, normal reference values and volume measurement techniques, though many gave no details of compliance calculations. In addition, we surveyed all urodynamic software currently available on the national market to investigate what automatic analysis of compliance is offered.

Results

The figures below display the range of filling rates (Fig.1) and low compliance threshold values (Fig.2) used, where these values were reported, against the number of papers.

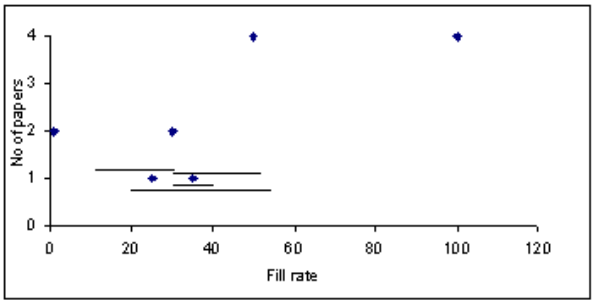

Fig.1 Filling rates reported (lines indicate range of rates)

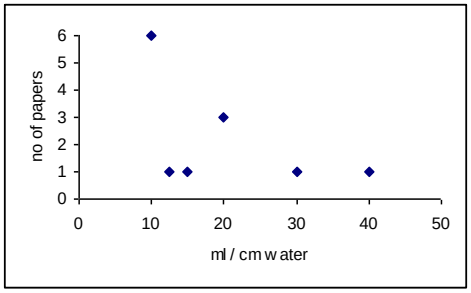

Fig.2 Thresholds for low compliance

The types of patients included in the reported studies (Fig.3) and the associations reported (Fig.4) are displayed showing the number of papers reporting.

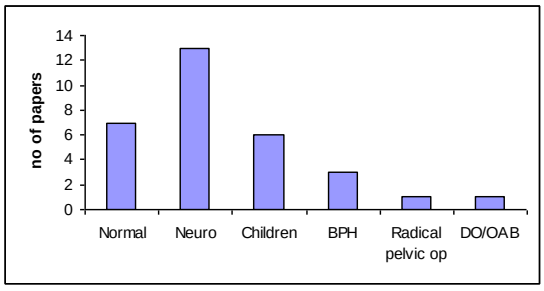

Fig.3 Groups of patients investigated

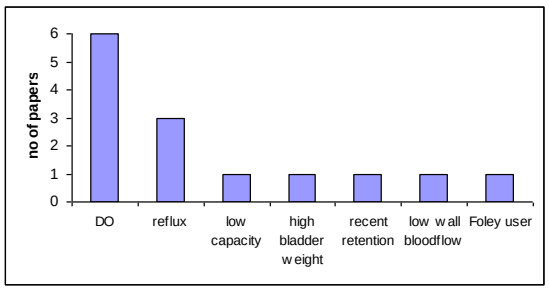

Fig.4 Associations reported from data

The standard recommends that bladder volumes be stated when reporting compliance. Since final voided volume will be different from filled volume due to diuresis and residual urine, it would be expected that a common protocol exists. However, only two papers mention final voided volume, one of which includes estimated natural fill in the compliance calculation. Further, two papers consider post void residual urine volume and one specifically excludes it. No others mention whether these were considered in calculation. Four papers report using CO_2 as the filling medium and we assume the rest have used water.

In compliance calculation, the unit ml/cmH_2O (as per ICS standard) was normally used, though also reported as more useful was 'compliance cost' – the cmH_2O rise for 100ml fluid infused. This is equivalent to the term 'dynamic compliance' referred to in two other papers, being the gradient of the pressure/volume curve at different points during the urodynamic test. Other new methods of measurement were also reported, but not subsequently referred to, namely a dimensionless unit (2) and sinusoidal pumping.

The analysis of software currently on the market reveals a variety of approaches. Some packages use vesical volume (i.e. accounting for leakage and residual urine) but most do not. All include the facility for the user to mark points between which compliance is calculated, with clear cautions about the placement of these points. One refers to a 'Compliance Nomogram' but the reference cited does not use the term or the classifications displayed on screen.

Interpretation of results

There is agreement on the lack of normal data and on situations that see reduced compliance (e.g. neuropathy, higher filling rates, children). Association with detrusor overactivity (DO) is widely reported, though in one paper in women is not linked. The association with reflux is frequently referred to as a given. The considerations that should be made when calculating compliance are generally recognized, although two papers do not stop filling when a pressure rise is seen and three different methods exist for calculation when pressure change is zero. Dissatisfaction with the measurement and use of compliance is shown by the fact that new methods have been proposed (e.g. 2).

The wide variety of filling rates used render comparison impossible. Of the two papers to use ambulatory monitoring (i.e. natural filling rate), one reported that low compliance was replaced by phasic detrusor contractions, although this was only studied for patients with neurogenic bladder dysfunction. Until standard recommendations are made and followed, there cannot be agreement on what constitutes a threshold value for low compliance. Alternatively, an interim working value could be proposed to enable comparisons to be made across studies.

Concluding message

Despite the existence of standard guidelines on the calculation of bladder compliance, there is a wide variety of methods used in published papers and marketed software. Consideration should be given to the evidence base of new methods that have been proposed. We therefore suggest that when revised, the ICS standard includes guidelines on reporting of compliance, volume measurements, filling rates and protocols to use, reference to an agreed normal value and a standard method for calculation when the pressure rise is zero.

References

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3. Harris et al. Bladder compliance in neurologically intact women. Neurourol Urodyn 1996;15;483-488

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Is this a clinical trial?	**No**
What were the subjects in the study?	**HUMAN**
Was this study approved by an ethics committee?	**No**
This study did not require eithics committee approval because	**it is a review of published papers and marketed equipment, not involving patient records or presence.**
Was the Declaration of Helsinki followed?	**Yes**
Was informed consent obtained from the patients?	**No**