**Can bladder outlet obstruction be diagnosed from the urethral cross-sectional area estimated by ultrasound imaging?**

**Introduction**

In theory, the resistance of a collapsible tube depends on the cross-sectional area and the pressure necessary to keep the tube open, therefore it should not be possible to diagnose obstruction from the cross-sectional area alone. As this is somewhat counterintuitive and because non-invasive imaging techniques do not measure the pressure, we sought for experimental verification.

**Aim**

To study to which extent the urethral cross-sectional area can be used to diagnose bladder outlet obstruction.

**Materials and Method**

- A custom made phantom of Polyvinyl Alcohol (PVA) cryogel was used to represent the lower urinary tract of a male.
- For a large number of combinations of $p_{\text{head}}$ and $p_{\text{prostate}}$ the cross-sectional area of the model urethra was measured on B-Mode ultrasound images.*
- The bladder outlet obstruction index (BOOI) was calculated as:

  $BOOI = (p1 - p2) - 2Q$

**Results**

According to the pressure-flow data, both obstructed and unobstructed situations existed for a single lumen area.

- **Obstructed**
  - $p1 = 96$ cm H2O
  - $p2 = 30$ cm H2O
  - $Q = 9.7$ ml/s
  - BOOI = 46.6
  - $p_{\text{prostate}} = 150$ cm H2O

- **Unobstructed**
  - $p1 = 70$ cm H2O
  - $p2 = 36$ cm H2O
  - $Q = 12$ ml/s
  - BOOI = 10
  - $p_{\text{prostate}} = 117$ cm H2O

**Conclusion**

Bladder outlet obstruction cannot be diagnosed from the urethral cross-sectional area alone.