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Kruger J[1], Hayward L[2], Nielsen P[1], Lim Q[1], Kirton R[1]
***1.** Auckland Bioengineering Institute, **2.** Counties Manukau District Health*

INTRA-ABDOMINAL PRESSURE INCREASE IN WOMEN DURING EXERCISE: A PRELIMINARY STUDY.

Hypothesis / aims of study

The influence of increased intra-abdominal pressure (IAP) on the development of pelvic organ prolapse is poorly understood. Nonetheless, clinical evidence suggests that women with chronic cough, constipation, high BMI and a history of heavy lifting have an increased risk of the development of prolapse due to increased IAP (1). Current advice given to women following surgery for prolapse, regarding returning to exercise or normal activity is inconsistent at best. However, it is recognised that moderate exercise is an important component for general health and recovery. Previous studies which have used intra-vaginal pressure devices to measure increases in IAP have been limited by their shape, or their inability to transmit data wirelessly (1,2). There is little quantitative evidence to provide guidelines for clinicians and the exercise industry about exercise related IAP increases.

The aim of this study was to use a novel, wireless intra-vaginal pressure device to provide preliminary quantitative evidence of increased IAP during a variety of exercises and physiological manoeuvres.

Study design, materials and methods

This observational study used a new intra-vaginal pressure device in fourteen female volunteers across eight different activities. The wireless intra-vaginal pressure device was proven to be reliable and consistent in a test re-test series, across a range of activities, (Cronbach's alpha 'r' >0.9 across all activities) with no significant differences between initial and repeated tests. The device is novel, in that its shape conforms to the vaginal anatomy, is flat, soft and compliant and does not mechanically distort the surrounding tissues. The pressure transducer is made from medical grade silicone, and filled with 5 ml of sterile water. Pressure data is transmitted wirelessly, within a 10 metre range and received by a wireless receiver (TR151, Telemetry Research®) which converts the pressure data into a calibrated analogue pressure output. The analogue data is then digitised and saved using the ADI Powerlab data acquisition system and Labchart software.

Participants inserted the device into the proximal vagina, above the levator ani muscles, with the transmission antenna and battery pack positioned outside the body. Exclusion criteria included symptomatic prolapse, menstruation, vaginal infections, previous vaginal surgery, pregnancy or any contra-indications for moderate exercise. Once the device was comfortably in place, a series of exercises and activities were performed including: coughing; valsalva manoeuvres; walking at 2 km/hr, 4 km/hr, 6 km/hr and running at 7 km/hr on a treadmill; star-jumps; lifting 2 kg and 5 kg weights above the head; sit-ups and squatting. Some activities were performed twice, giving a total of eighteen measurements. Each device was calibrated prior to testing. Baseline measurements were taken when the subjects were lying down at the start and end of each cycle of activities.

Descriptive statistics were used to describe both the 'mean' and 'amplitude' pressures during exercise. Amplitude is defined as the difference between the minimum and maximum measured pressures within that activity, as was quantified using the LabChart Bloodpressure software. An example of this output is shown Figure 1. A case-by-case analysis was performed to determine which exercises generated the greatest increase in 'mean' and 'amplitude pressures'.

Results

The average age of the participants was 35.9 years (range 20-51 years), BMI 22.6 kg/m^2 (range 18.6-26.7 kg/m^2). Four were nulliparous, ten multiparous with the median number of vaginal deliveries being two. Twelve sets of data were available for analysis; two participants could not complete the experimental protocol.

The intra-vaginal pressure (mean) and (amplitude) across the activities is shown in Figure 2. In a case-by case analysis, coughing and star jumps demonstrated the highest amplitude in 83% (10/12) of participants; sit-ups were highly variable and technique dependant. There was a >40% increase in the measured amplitude pressure in all but one participant when changing from walking at 6 km/hr to running at 7 km/hr. This increase was much less marked in the mean pressure with only a 6% increase from walking to running. 58% (7/12) produced the highest sustained mean pressure during Valsalva manoeuvres.

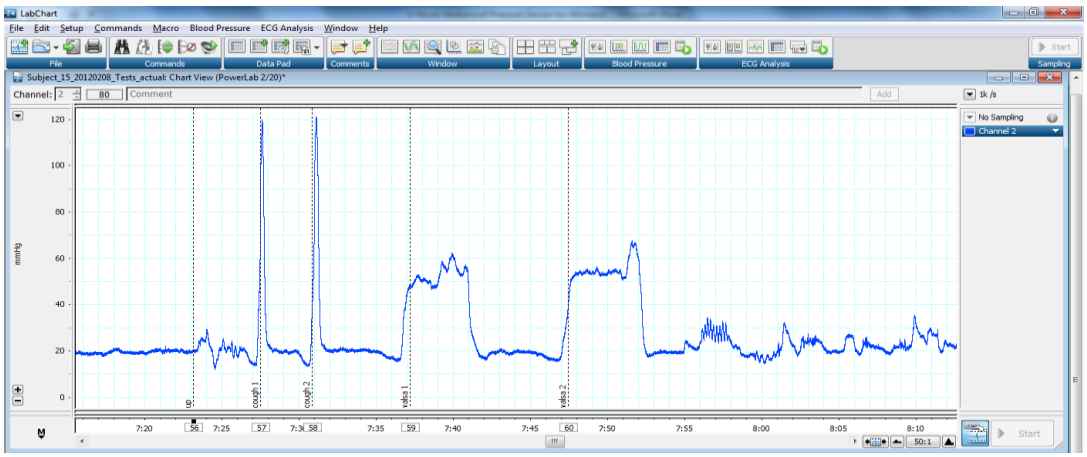

Figure 1. LabChart trace of a subject performing two coughs and two valsalva manoeuvres.

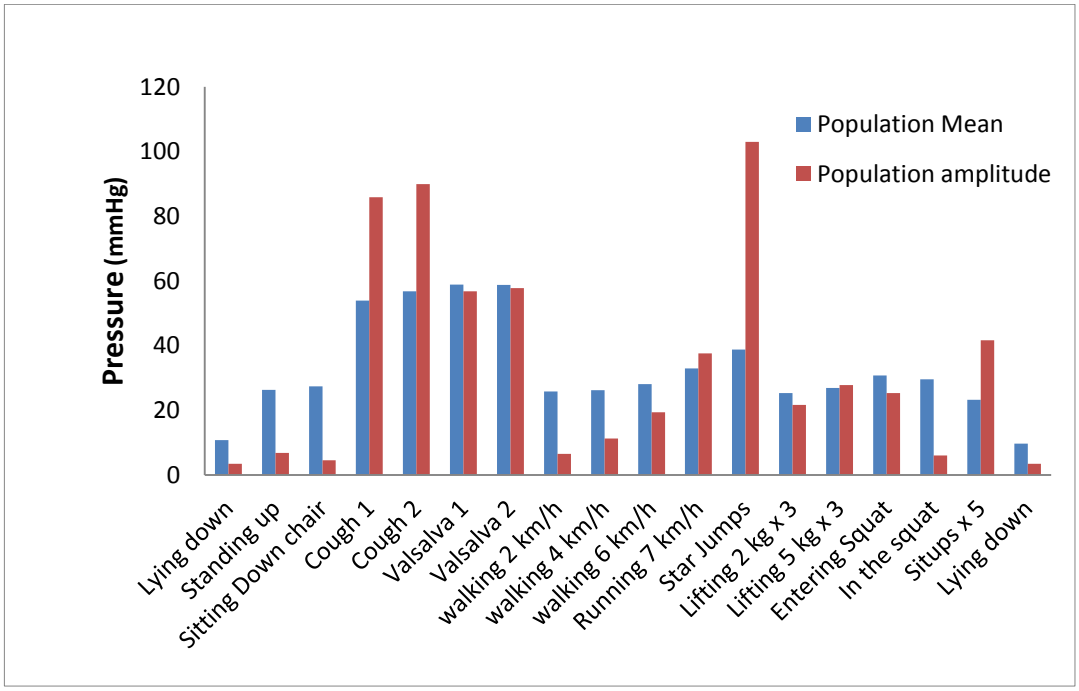

Figure 2: Mean and Amplitude pressures measured across the activities in all subjects (n=12)

Interpretation of results

This preliminary study has shown a marked increase in IAP amplitude between walking and running, even if the running speed was only marginally faster than walking. For some, lifting of light weights above the head generated no more intra-vaginal pressure than sitting. Star jumps and coughs invoked the highest peak pressures, whereas an effective valsalva produced higher mean sustained pressures than a cough. Squatting and 'sit-ups' did not demonstrate the increases in intra-abdominal pressure that were anticipated.

Concluding message

This intra-vaginal pressure device has shown to be easy and comfortable to use, is retained in place and able to reliably determine increases in IAP measurements during a wide range of moderate activities. A planned extension of this study is to use the device in a gym where IAP can be quantitatively determined during more intense exercise.

References

1. DeLancey, 2008
2. Rosenbluth, 2011
3. Dell, 2007

Disclosures

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