W36: What is a vaginal pressure profile and how might this be useful?

Workshop Chair: Jennifer Kruger, New Zealand
06 September 2019 09:00 - 10:30

Start	End	Topic	Speakers
09:00	09:20	Biomechanics of pressures and how we measure them	David Budgett
09:20	09:40	Review of instrumentation developed to measure vaginal pressures: how do they work, assumption, advantage and disadvantages and recent updates	Jennifer Kruger
09:40	10:00	Repeatability and validity of intravaginal pressure measurements. Conservative management of urinary incontinence and POP: is it important to control abdominal pressure in addition to train the pelvic floor muscle? Update on therapies aiming to reduce intra-abdominal pressures	Chantale Dumoulin
10:00	10:20	Pressure during exercise. Its relevance and current research. How is this information helpful?	Margaret Sherburn
10:20	10:30	General wrap up and questions	Jennifer Kruger David Budgett Chantale Dumoulin Margaret Sherburn

Aims of Workshop

The aim of the workshop is to provide a basic understanding of the biomechanics associated with the development of a vaginal pressure profile. It will explore how changes in the pelvic anatomy (usually due to pelvic organ prolapse or urinary incontinence) are likely to impact on vaginal pressures and how this may influence the pressure differential along the length of the vagina. Participants will have an up to date review of instrumentation development used to measure pressure to assess pelvic floor muscle function/dysfunction. Recent advances in instrumentation development, data interpretation and the potential application of the profile (intra-abdominal pressure vs pelvic floor muscle pressure) will also be discussed.

Learning Objectives

1. Understanding the basic biomechanics that are involved the development of pressure and how these changes can be measured in the vagina.
2. Awareness of the instrumentation that has been developed to measure pressure/force in this area: the pro's and con's
3. Application of the profile to a clinical condition

Target Audience

Urology, Urogynaecology, Basic Science, Conservative Management

Advanced/Basic

Basic

<u>Biomechanics of pressure and how we measure it</u>

Associate Professor David Budgett
Technical Lead Development Engineer, Pelvic floor research group Auckland Bioengineering institute. The University of Auckland New Zealand

Pressure is a measure of force over a defined surface area. The SI unit for pressure is Pascal, representing 1 Newton over 1 square metre. Pressure has historically been measured by its ability to displace a column of liquid in a manometer, hence the units of millimeters of mercury (mmHg) or centimetres of water (cmH2O) have become commonly adopted. Today solid-state sensors, electronic circuits and microprocessors support reporting pressure in any familiar unit of pressure. Unlike force, pressure is a scalar such that any point in the body will have a pressure that is independent of direction. The pressure in a static fluid (e.g. in the bladder) is a single value and the pressure value is the same everywhere in the bolus of fluid. So what does it mean when we talk about a pressure profile along the vagina?

To start this workshop, we will clarify what can realistically be measured by typical pressure sensing devices, used to assess pelvic floor muscle function. We will discuss these measurements in relation to other types of physiological pressures that are routinely measured in the body i.e. intra-cranial pressure, or blood pressure. Finally, the potential value of measuring pressures along the length of the vagina, which requires an understanding of absolute pressure values which are generated at rest, and differences in pressure generated from intentional muscle exercising.

<u>Review of instrumentation developed to measure vaginal pressures: how do they work, assumption, advantage and disadvantages and recent updates</u>

Dr Jennifer Kruger
Principal Investigator Pelvic Floor Research Group. Auckland Bioengineering Institute. The University of Auckland New Zealand.

A review of the literature will provide a historical perspective of the use of instruments to measure pressure/force in a clinical context, and a critique on the current, more commonly used instruments used for research and clinically. Discussion will focus on instrumentation that includes either force transducer(s) or pressure sensor(s) The advantages and disadvantages of the various systems will be presented. This will include myometers, elastometers, and pressure sensing devices. Commercially available devices, in which the measurement system is public knowledge will be included as part of the discussion and a brief look at the use of mobile technology linked to devices, as a means for encouraging pelvic floor muscle training. We will discuss any evidence of reliability or validity for these products.

The development of a vaginal pressure profile and the association between the features of the anatomy that are thought to contribute to this profile in relation to pelvic floor function/dysfunction will be presented.

Measurement of any physiological parameter (muscle force/pressure/) is dependent on how the data is collected and analysed. Each instrument will collect data differently dependent on the characteristics of that instrument. How this data is analysed, presented, interpreted, and any potential clinical implications will be part of the discussion.

<u>Repeatability and validity of intravaginal pressure measurements.</u>
<u>Conservative management of urinary incontinence and POP: is it important to control abdominal pressure in addition to train the pelvic floor muscle?</u>
<u>Update on therapies aiming to reduce intra-abdominal pressures</u>

Professor Chantale Dumoulin
Chercheure et directrice de laboratoire. Titulaire de la Chaire de Recherche du Canada Santé Urogynécologique et vieillissement
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Intra-vaginal pressure measurements have been used since Kegel's first perineometer to evaluate and document PFM function in women. Originally intra-vaginal pressure was measured with one large intra-vaginal pressure sensor. Recent intra-vaginal pressure measurement units use multiple pressure sensors to document pressure profile throughout the vaginal cavity. In this section of the workshop, we will present the psychometric properties (repeatability, validity and sensitivity) of both types of intravaginal pressure measurements. Further, we will discuss advantages and disadvantages of these measuring instruments in clinical practice.

Conservative management of urinary incontinence and POP aims to increase pelvic floor muscle strength and tone (making it resistant to stretching) in order to limit downward movement during effort and exertion, thereby preventing urine leakage and symptoms of POP. Up until now the conservative management has mainly focussed on the PFM. Recent studies have documented the impact of certain sports, exercise and activities on intra-vaginal pressure and indirectly on the PFMs. The impact of these new data and their impact on choice of exercises will be discussed. We will further discuss the importance of controlling or reducing intra-abdominal pressure in addition to train the PFM as a conservative management for urinary incontinence and POP.

Finally, therapies aiming to reduce intra-abdominal pressures and thereby improve PFM tone (hypopressive technics) have become more popular in the last decade. We will present and discuss the evidence on the impact of these approaches on PFM function and on urinary incontinence and POP.

Pressure during exercise. Its relevance and current research. How is this information helpful?

Dr Margaret Sherburn: Coordinator, Women's Health Programs; Physiotherapy, School of Health Sciences. The University of Melbourne

Clinicians have long understood that raised intra-abdominal pressures during exercise may have deleterious effects on the pelvic, floor heightening the risk of pelvic floor dysfunctions. Measuring the pressures developed during different exercises has now become possible with wireless technologies. Initially intra-abdominal and pelvic floor pressures were able only to be measured separately, giving clinicians some information on which to base their rehabilitation of women at risk of PFD, but many questions remain unanswered.

The Pelvic Floor First program of the Continence Foundation of Australia (http://www.pelvicfloorfirst.org.au/) was set up to assist clinicians make decisions on the use of pelvic floor 'safe' exercises for women at risk of pelvic floor dysfunction. Decisions at to what constituted a pelvic floor 'safe' exercise was based on best knowledge at the time. The development of a vaginal pressure profile device now means that both intra-abdominal and pelvic floor pressures can be measured simultaneously during an exercise, giving us more information about safe exercise for the pelvic floor.

A recent study undertaken by this group investigated nine exercises, using a vaginal pressure profile device, and compared the pelvic floor 'safe' version versus the conventional form of the same exercise. We will present the results from this study and open it up for discussion.

References:

1.Hsu Y, Coleman TJ, Hitchcock RW, Heintz K, Shaw JM, Nygaard IE. Clinical evaluation of a wireless intra-vaginal pressure transducer. Int Urogynecol J. 2012;23(12):1741-1747.
2.Tian T, Budgett S, Smalldridge J, Hayward L, Stinear J, Kruger J. Assessing exercises recommended for women at risk of pelvic floor disorders using multivariate statistical techniques. International Urogynecology Journal. 2017.
3.Schell A, Budgett D, Nielsen P, et al. Design and development of a novel intra-vaginal sensor array. Neurourol Urodyn. 2016;35(4):S355-356.
4.Cacciari, L., Kruger, J., Goodman, J., Budgett, D., Dumoulin, C. (2018) Reliability of intra-vaginal pressure measurments during maximal voluntary pelvic floor muscle contraction and Valsalva in lying and standing positions. (2018) 48th Annual meeting of the International Continence Society, Philadelphia Aug 2018.
5.Kruger, J., Budgett, D., Goodman, J., Sherburn, M. (2018). Measuring the vaginal pressure profile during exercise. 27th National Conference on Incontinence, Hobart Australia Nov 2018.