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ICS Teaching Module: Artefacts in Urodynamic Pressure Traces (Basic Module)

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Aims: To present the ICS Teaching Module on artefacts in urodynamics pressure traces. **Methods:** Slides from three urodynamics centres were assembled. Descriptions and labels were agreed by the authors and the module presented at the ICS Annual Scientific Meeting in Brazil 2014. **Results:** Ten artefacts that should be recognized while using water-filled urodynamic systems are presented and remedial action described. **Conclusions:** This manuscript serves as scientific background for the slide set made available on the ICS website. By following the guidelines in this teaching module, good quality urodynamics can be more readily achieved. *Neurourol. Urodynam. 36:35–36, 2017.*

Key words: artefacts; pressure measurement; quality

INTRODUCTION

The International Continence Society (ICS) Urodynamics Committee presents the first teaching module of Artefacts in Urodynamic Pressure Traces as a resource to enhance good urodynamic practice.

An artefact is understood to be 'Something . . .that is not naturally present but occurs as a result of . . .the procedure.'[1] When artefacts arise during the test, they should be removed or can sometimes be compensated for, thus improving the quality of urodynamic results. If artefacts have not been corrected during the test they should be recognized during post-test evaluation. This module presents the artefacts that this working group has considered to be the most prevalent when water-filled urodynamic systems are used. They are described as patterns on the urodynamic traces, and all are recognizable and correctable during the test. Some artefacts may, however, necessitate repetition of the test.

We present ten artefact patterns with an explanation of their causes and a description of the remedies. Further understanding of the prevalence and nature of artefacts can be found in Hogan et al.,[2] and a full presentation of Good Urodynamic Practices is found in in Schaefer et al..[3] These underline that signal quality is only assured through using adequate equipment, with careful installation of the whole system and with skilled and alert staff performing the test. The teaching module referred to here consists of this manuscript and a slide presentation available at www.ics.org/eLearning. An advanced module will also be made available dealing with less common artefacts, along with those found in other types of pressure measurement systems.

CONTENTS

The ten artefacts described in this module are:

- Movement/tube knock
- Patient position change
- Expelled vesical catheter
- Expelled rectal catheter
- Flushed catheter
- Line open to syringe
- Empty bladder (poor response)
- Empty rectal catheter
- Poor cough response
- Poor response to live signal

The descriptions below are all with reference to water-filled pressure measurement systems, although some of these artefacts do occur in other types of system. Each artefact has the observed effect, underlying cause and recommended remedy described.

ARTEFACT DESCRIPTIONS, CAUSES AND REMEDIES

Movement/Tube Knock

Effect observed. High frequency, short duration pressure spikes visible in p_{ves}, p_{abd}, or both, with spikes always visible in p_{det}.

Cause of artefact. Knocking of one or both tubes. In the example, the knock is first on the p_{ves} line, then on the p_{abd} line.

Remedial action. Ensure tubes are away from the cause of the knock. Ignore these spikes when analysing the trace.

Patient Position Change

Effect observed. A lasting change in p_{ves} and p_{abd} of equal magnitude on both, usually between 8 and 35 cmH_2O.[2] It is often accompanied by noisy signals as the lines are knocked.

Cause of artefact. A change in patient position. In the example, the patient has begun supine, stood up, then sat down on the

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commode at a position below the level of the transducer. The level of the transducers was then adjusted to the level of the symphysis pubis.

Remedial action. Ensure the transducers are moved to the level of the symphysis pubis after any patient position change. Transmission of pressure should also be checked after patient movement.

Expelled Vesical Catheter

Effect observed. A sudden drop in p_{ves}, usually to well below zero, with no response to transmission checks.

Cause of artefact. The vesical catheter is expelled from the patient, normally by the pressure of voiding.

Remedial action. Recatheterise and repeat the test, if the urodynamic question has not been answered.

Expelled Rectal Catheter

Effect observed. A sudden drop in p_{abd}, usually to well below zero.

Cause of artefact. The abdominal catheter is expelled from the patient, normally by the pressure of valsalva or straining.

Remedial action. Recatheterise and repeat the test, if the urodynamic question has not been answered

Flushed Catheter

Effect observed. An abrupt large increase in a single pressure trace, maintained for some seconds, followed by a sudden normalisation of pressure.[2]

Cause of artefact. Water is pushed through the transducer dome in order to remove air from the catheter and tubing.

Remedial action. Check for good pressure transmission after the flush. Ignore the high pressure generated when analysing trace.

Line Open to Syringe

Effect observed. Repeated flushes of the line do not restore a good response to a cough signal.

Cause of artefact. The syringe inadvertently remains connected to the water line, and acts as a damper on the signal. Since an air bubble is not the problem, flushing fails to resolve it.

Remedial action. Set the taps correctly, so the syringe is not connected to dome. Repeat the cough test for good pressure transmission.

Empty Bladder (Poor Response)

Effect observed. Response of the intravesical catheter to a pressure transmission test is poor when bladder volume is low.

Cause of artefact. When the bladder is empty, the catheter may touch the bladder wall, so pressure changes within the lumen cannot be registered.

Remedial action. Fill the bladder slightly (e.g. 50 ml) and test the pressure transmission again.

Empty Rectal Catheter

Effect observed. Deterioration in abdominal pressure transmission, with or without a change in pressure, during filling or voiding.

Cause of artefact. Reduction of water in the rectal balloon. The balloon fails to connect effectively with the rectal wall as a result.

Remedial action. Refill balloon and test for good pressure transmission

Poor Cough Response

Effect observed. One cough spike is visibly smaller than the other, despite a cough affecting p_{ves} and p_{abd} equally.

Cause of artefact. Usually an air bubble in the water-filled line, reducing the transmission of pressure from patient to transducer.

Remedial action. Flush the line through with water, pushing the air bubble from the tube. The next cough should be registered equally on both traces. If not, flushing should be repeated.

Poor Response to Live Signal

Effect. Live signal is observed on one trace (in this case p_{ves}) and on p_{det}, despite a previous cough test being satisfactory.

Cause. Usually an air bubble in the water-filled line, reducing the transmission of pressure from patient to transducer, in this case in the abdominal line. It could also be the pump or patient causing noise on the affected line.

Remedy. Check that there is no interference on the affected line by visual inspection and stopping the pump. If it is still present, flush the line through with water (not visible on this trace), pushing the air bubble from the tube.

CONCLUSIONS

Poor quality urodynamic testing may easily result in inadequate or wrong diagnosis. Maintaining good quality of pressure transmission, recording, and display, and being able to interpret the traces correctly are therefore critical for patient benefit. Recognising artefacts in the pressure signals and dealing with them appropriately is an essential component of maintaining this quality. By following the guidelines in this teaching module, good quality urodynamics can be more readily achieved.

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