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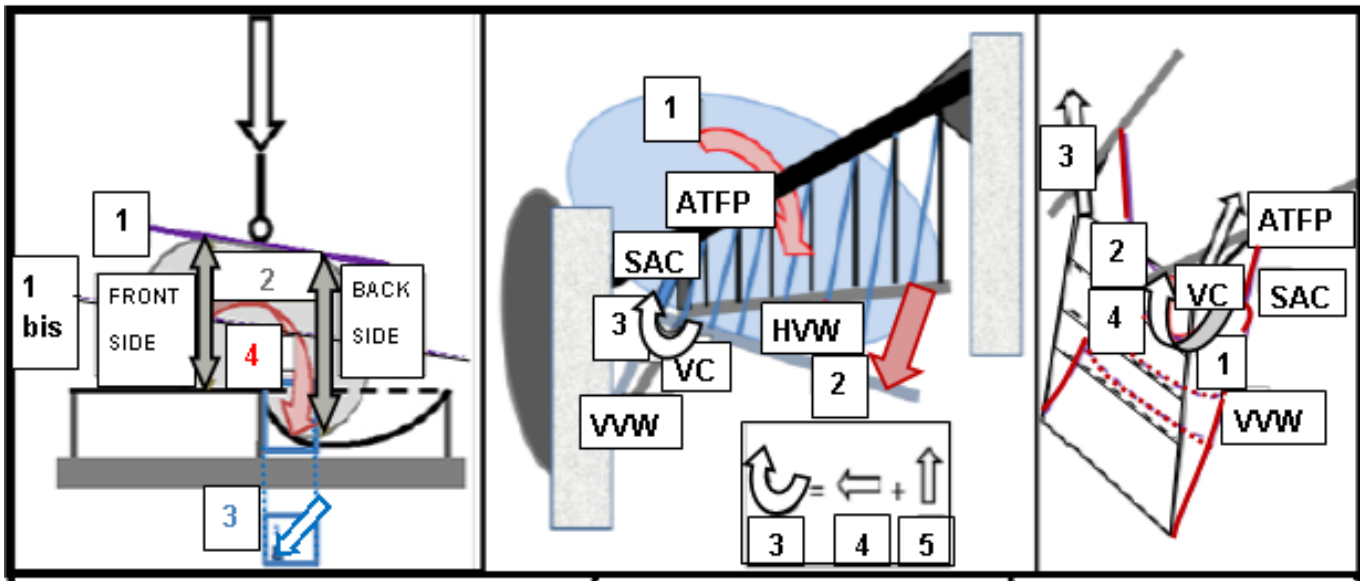
OVERACTIVE BOWEL (OAB) SYNDROME IN MIXED URINARY INCONTINENCE: 1) CAN A NEW PATHOPHYSIOLOGICAL MODEL BE DEMONSTRATED?

Hypothesis / aims of study:
Prior studies of urinary incontinence do not provide a sufficiently clearly explanation of the pathophysiology of OAB syndrome in mixed incontinence. The aim was hence to demonstrate the function and the dynamic behavior of each anatomical element taken separately upon straining, and to formulate these behaviors with one another so as to define a new pathophysiological hypothesis.

Study design, materials and methods: A schematic model was generated that separately considers each anatomical element, and the theoretical deformation of each element was modeled.



Effects of squashing the balloon (Bladder) on two segments with different elasticities

1: Switch of the hinged faceplate toward the more elastic rear portion. 1 bis: Identical horizontal switch of the balloon toward the rear.

2: Asymmetrical heights, higher for the more elastic rear side, lower for the front side.

3: Downward and rearward tilt of the resilient structure located against the central post (blue window); and downward and forward movementof the portion of the resilient structure located against the central post.

4: Movement of the fluid content of the balloon.

The vaginal suspension bridge induces VC pendulum movement following urine mobilization

1: urine mobilization.

2: Downward and frontward HVW propulsion.

3: VC pendulum movement.

4: Forward horizontal component of VC pendulum movement.

5: Upward vertical component of VC pendulum movement.

VC pendulum movement stiffens VVW upper part

1: VC pendulum movement .

2: VC raised forward and upward.

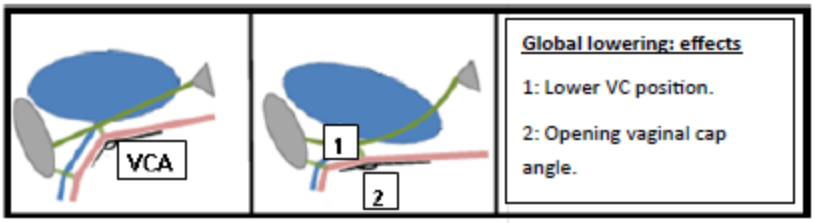
3: VC tension upward and outward (external position of ATFP from VC).

4: The canvas (VVW) tension setting is greater in its upper part.

Results
1st) The arcus tendineus fasciae pelvis (ATFP) extends between two non-deformable bone structures. The vesicouretral system rests on the anterior vaginal wall, and it is divided in two segments: the vertical (VVW) and horizontal (HVW). These are separated by the vaginal cap (VC), and suspended from the pelvis bones via the endopelvic fascia and the ATFP. The VC itself is suspended not by individual ligaments, but by a strong anatomic connection (SAC). The vagina is hence suspended by two separate hammocks: a vertical one which is smaller in size, and more rigid, one that is larger in size and more flexible. In light of this, pressure in the bladder is absorbed, which lessens and delays the increase in pressure in the bladder by 250 ms (1).
2nd) By resting on a more flexible structure at the rear, the bladder deforms in an asymmetric manner, which brings about movement of the urine toward the HVW.
3rd) The vagina is an organ suspended by pelvic fascia to the ATFP. The ATFP acts like the catenary-shaped cable of a suspension bridge, a proposition adopted by the integral theory (2). When viewed in terms of the “technical” characteristics of a

suspension bridge, it is possible to get a better understanding of its functioning, and to change the meaning of the movements described below.
The first characteristic is that the ATFP runs from the symphysis to the ischial spine; in a woman in an upright position it runs front to back, medial to lateral, and particularly from the bottom to the top. The pylons of the suspension bridge are hence not at the same height, with those at the rear being higher. The second characteristic is that the bridge is attached directly to the front pillar, the vagina being attached to the symphysis by the pubourethral ligaments (PUL). At the rear, the bridge is attached to a mobile entity (the uterine cervix) instead of a solid structure. The third characteristic is that the bridge comprises two segments: the VVW and the HVW, joined at the VC junction. The two segments do not have the same lengths, with the VVW being much shorter than the HVW. When the suspension bridge is drawn with these characteristics, and the downward and forward movement of the HVW is exerted by the difference in elasticity, it can readily be seen that the difference in elasticity on either side of the VC passively brings about a pendulum motion in front of and above the VC.
4th) The forward and upward pendulum motion places tension on the upper part of the VC which becomes more rigid. It equates to the same effect as the upper part of a tent wall becoming taught when the poles are raised on each side. Thus, supported by a vagina that has been rendered rigid at this level, the upper part of the urethra remains occluded. The absence of a pendulum motion translates into the urethra funneling, and the urine then reaches the level of the neck of the bladder, thereby inappropriately stimulating the receptors present at this level. The function of these receptors is to activate detrusor contraction to initiate micturition, their inappropriate stimulation thus underlying the basis of OAB.

Interpretation of the results
The forward movement is described in the integral theory (3), although it is attributed to a muscular action. The upward movement, and the ensuing closing of the posterior vesicouretral angle, may be masked by the overall downward deformation of the whole.



Summary conclusion
The difference in elasticity on either end of the VC leads to a pendulum motion of the VC allowing the posterior side of the upper urethra to be supported upon straining as a result of the upper part of the VVW becoming more rigid. Failure of this pendulum motion underlies the urethra funneling, itself the basis for the OAB. Some anatomical defects underlying SUI are probably identical to those that cause the pendulum motion, and hence the basis of mixed incontinence: particularly and probably lesions of the SAC.

References
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