obstetric trauma surgery
art and science

cervix prolapse
kees anatomic fixation

kees waaldijk
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babbar ruga national fistula hospital
katsina
nigeria
obstetric trauma surgery
art and science
setting standards by evidence-based practice

total cervix/uterus prolapse surgery
kees anatomic fixation

step-by-step
in line with the functional pelvis anatomy

the corpus intrapelvinum is responsible for
the suspension of pelvis organs

whilst

the pelvis floor can neither prevent nor stop
pelvis organ prolapse

kees waaldijk
obstetric trauma surgery
art and science

series of textbooks each with a specific topic

setting evidence-based standards

this series has been developed for setting evidence-based standards in the training and management of the obstetric trauma in all its forms in the developing as well as in the industrialized world

the name of the series has been changed from obstetric fistula to obstetric trauma surgery since the fistula is only one aspect of the complex obstetric trauma

though a systematic approach is being followed this seems to be a utopia since the material is too extensive and it would take too long

each time a specific topic has been finalized it will be published as a separate entity; with later on an update if needed

then somewhere along the line a comprehensive summary will be produced in order to have a representative overview

the emphasis is placed on the functional anatomy of pelvis, pelvis floor and pelvis organ(s), the female urine and stool continence mechanisms, the mechanism of action and the principles of reconstructive and septic surgery

for training reasons it will follow a step-by-step approach and repetition; together with schematic drawings and photographs

the whole series is based on kees archives of obstetric trauma with so far 25,000 reconstructive and conservative procedures in 20,000 patients with a rare "complete" documentation of each procedure and results as to healing and continence by electronic reports with 150 parameters, over 100,000 pre/intra/postoperative digital photographs and a comprehensive database as personal experience over a 30-year period from 1984 up till now

as such it is considered to be a full scientific evidence-based report; though it has not followed the "you peer me, i peer you" doctrine

it is also not following the strict protocol of the international scientific journals or the so-called established theories; since only dead fish follow the flow of the river; and strict protocols kill any creativity; the message is not in the format

since it is the life work of the author it is written in his own words and in his own style

writing things down helps the author in organizing his own understanding and ideas
total cervix/uterus prolapse is a major health problem world wide though its incidence and prevalence are not known

these are probably as high as or may be even higher than those of the obstetric fistula

with as most prevalent factor/finding a wide pelvis with a broad span in between the ischium spines; as expressed by a wide pubic arch

then when the author started this type of surgery in 1997 as part of his obstetric trauma surgery he soon realized the solution had to be sought in reconstruction of the functional pelvis anatomy

however, the functional pelvis anatomy is complicated and not well understood; see the enormous amount of literature and contradictory theories and operation technics

the most important structure in stabilizing/securing the cervix in its variable anatomic position is the intrapelvic urogenitodigestive diaphragm as a specialized condensed part of the corpus intrapelvinum as the archaic matrix for the different pelvis organs

actually the cervix is the centrum tendineum intrapelvinum since all the musculofascia structures of the intrapelvic diaphragm are attached to it whilst the pelvis floor/wall does not play a role of importance in stabilizing/securing the cervix; contrary to the general belief at the moment

there are numerous theories and operation technics propagating the use of artificial plastic materials as developed to strengthen the multibillion dollar medical industry with an enormous financial conflict of interest; certainly not reconstructive surgery

with increasing evidence-based insight into the functional pelvis anatomy during his extensive obstetric trauma surgery the author developed a straightforward “anatomic” fixation of the cervix using the available autologous structures; as real reconstructive surgery of the functional pelvis anatomy

it is now time for the author to present his theory and operation technics as another textbook in the series obstetric trauma surgery; art and science

claiming his full intellectual and scientific property rights

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the author 15th september 2017
intrapelvic urogenitodigestive diaphragm
cervix
centrum tendineum intrapelvinum
# table of contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>foreword</td>
<td>3</td>
</tr>
<tr>
<td>drawing iugd diaphragm</td>
<td>4</td>
</tr>
<tr>
<td>photo iugdd/pubocervical musculofascia</td>
<td>6</td>
</tr>
<tr>
<td>introduction</td>
<td>7</td>
</tr>
<tr>
<td>concomitant lesions</td>
<td>10</td>
</tr>
<tr>
<td>photos decubitus ulcer</td>
<td>11</td>
</tr>
<tr>
<td>what is needed before starting</td>
<td>12</td>
</tr>
<tr>
<td>intrapelvic urogenitodigestive diaphragm</td>
<td>13</td>
</tr>
<tr>
<td>drawings iugdd</td>
<td>16</td>
</tr>
<tr>
<td>drawings cervix fixation</td>
<td>18</td>
</tr>
<tr>
<td>prolapese mechanism of action</td>
<td>21</td>
</tr>
<tr>
<td>cervix prolapse c1 and c2</td>
<td>24</td>
</tr>
<tr>
<td>drawings operation technic I</td>
<td>27</td>
</tr>
<tr>
<td>cervix prolapse c3 and c4</td>
<td>29</td>
</tr>
<tr>
<td>drawings operation technic II</td>
<td>32</td>
</tr>
<tr>
<td>combination prolapse/incontinence</td>
<td>36</td>
</tr>
<tr>
<td>photos operation technic III</td>
<td>37</td>
</tr>
<tr>
<td>discussion</td>
<td>38</td>
</tr>
<tr>
<td>experiences so far</td>
<td>39</td>
</tr>
<tr>
<td>essentials functional pelvis anatomy</td>
<td>40</td>
</tr>
<tr>
<td>corpus intrapelvinum</td>
<td>42</td>
</tr>
<tr>
<td>drawings corpus intrapelvinum</td>
<td>49</td>
</tr>
<tr>
<td>mechanism of obstetric trauma</td>
<td>50</td>
</tr>
<tr>
<td>defects intrapelvic urogenitodigestive diaphragm</td>
<td>52</td>
</tr>
<tr>
<td>drawings defects</td>
<td>57</td>
</tr>
<tr>
<td>remarks about prolapse</td>
<td>61</td>
</tr>
<tr>
<td>questions pop-q system</td>
<td>64</td>
</tr>
<tr>
<td>abbreviations</td>
<td>65</td>
</tr>
<tr>
<td>normal measurements</td>
<td>67</td>
</tr>
<tr>
<td>references</td>
<td>68</td>
</tr>
</tbody>
</table>
intrapelvic urogenitodigestive diaphragm
pubocervical musculofascia
smooth muscle
introduction

the pelvis organs including the cervix are suspended within the corpus intrapelvinum or connective tissue organ/body of pelvis

one of its specialized structures is the intrapelvic urogenitodigestive diaphragm which if intact prevents the high(er)-pressure organs from prolapse first into the zero- or low-pressure vagina and then if not corrected thru the vagina to the outside

once defects develop within the intrapelvic urogenitodigestive diaphragm the process of prolapse starts

the location of the defect within this diaphragm determines which high-pressure organ, urethra, bladder, cervix/uterus, intraperitoneal contents, (ano)rectum will prolapse into the zero- or low-pressure vagina

since the distal vagina is anchored into the perineum outlet diaphragm the proximal vagina walls are dragged with the organ(s) like intussusception

though pelvis organ prolapse involves multiple organs we would like to concentrate upon cervix/uterus prolapse even when combined with other organs

the cervix is anchored into the intrapelvic urogenitodigestive diaphragm and as such can be considered as the centrum tendineum intrapelvinum since all the musculofascia structures are firmly attached to it

the normal anatomic position of the cervix is highly variable and depends upon body position such as standing, sitting, squatting, lying and upon the filling of the adjacent organs like bladder uterus, vagina and rectum and upon hydrostatic abdominal pressure whilst deepest point reaches up to some 3-4 cm proximally from the hymen ring

once the cervix herniates/comes nearer to the hymen ring one speaks of prolapse which according to the pop-q system can be classified as

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>c0</td>
<td>normal position up to –3 to –4 cm proximally from hymen</td>
</tr>
<tr>
<td>c1</td>
<td>deepest point of cervix up to –2 cm proximally from hymen</td>
</tr>
<tr>
<td>c2</td>
<td>deepest point of cervix from –1 cm proximally to +1 cm out of hymen</td>
</tr>
<tr>
<td>c3</td>
<td>deepest point of cervix more than +2 cm out of hymen</td>
</tr>
<tr>
<td>c4</td>
<td>total cervix/uterus prolapse far out of hymen/vulva</td>
</tr>
</tbody>
</table>

the position in which the prolapse is most prominent is **squatting + cough**

in the lying position there is already some reduction by traction due to gravity forces and change in position of abdominal/pelvis organs and a decrease in intraabdominal hydrostatic pressure even more so in the (exaggerated) lithotomy position

so even if traction applied a cervix prolapse c4 may become a c3 and a prolapse c3 may become a c2 in the lying/lithotomy position
the main complaint is heavy feeling inside the pelvis in c1 and c2 or something coming out in c2, c3 and c4; and may be accompanied by urine incontinence or difficulties in micturition and defecation

the most persistent factor is a wide pelvis as expressed by a wide pubic arch of > 90°; the same as in genuine intrinsic urine incontinence and sphincter ani rupture

in cervix/uterus prolapse c3 and c4 there may also be decubitus ulcer(s) of the cervix

it is not known how often cervix prolapse c1 and c2 are accompanied by intrinsic urine incontinence though genuine intrinsic urine incontinence is often accompanied by cervix prolapse c1 or c2

however, cervix prolapse c3 and c4 are normally not accompanied by intrinsic urine incontinence whilst masked incontinence upon reduction of the prolapse cannot be confirmed by the author; this is due to physiologic compensation by narrowing of distal urethra and external urethra opening = euo with increase in outflow resistance

cervix/uterus prolapse c3 and c4 may be accompanied by difficulties in micturition and difficulties in defecation which is only possible by manual reduction of the prolapse and eventual manipulation by the patient

cervix prolapse c1 does not require reconstructive surgery; but when an operation is performed for genuine intrinsic urine incontinence the cervix is fixed into its anatomic position by the reconstruction of the intrapelvic urogenitodigestive diaphragm since this is an inherent logical part of the operation technic (at least by the author)

normally prolapse c2 does not require reconstructive surgery unless upon special wish of the patient or as part of the operation technic for genuine intrinsic urine incontinence

cervix/uterus prolapse c3 and c4 require reconstruction of the functional pelvis anatomy by using available autologous structures

however, there is minimum and maximum surgery, and the author prefers minimum surgery especially in elderly patients; but that to the utmost of his insight, experience, conscience and skills

in dealing with the complex obstetric trauma the author is privileged to see and study and deal with the experiments of nature

during his obstetric fistula surgery the author in certain situations had to (re)fix the cervix as part of the operation technic either in closing the fistula or in ensuring continence

still it took until 1997 when he really became interested in total cervix/uterus prolapse as part of the complex obstetric trauma since more and more patients presented and asked for help

however to deal with cervix/uterus prolapse one must first know the anatomic position of the cervix and how it is kept in this position by the corpus intrapelvinum as matrix since it starts with loosening of the cervix from the intrapelvic urogenitodigestive diaphragm as specialized condensed part of the connective tissue body/organ of pelvis
then one must know the mechanism of prolapse action and which cause congenital, obstetric or ageing processes.

since the paravesical spaces were an open book for him he started with fixation of the cervix onto the anterior ischium spine periost/combined arcus tendineus/iliococcygeus muscle at the R side.

though the fixation was ok since patients delivered vaginally afterwards, one even 5 times, with the cervix still properly fixed, cystocele development in some patients was an unwanted side effect.

and fixation at the L side is more natural for a right-handed surgeon in instrumentation of the deschamps aneurysm needle.

therefore he started to fix the cervix onto the obturator internus muscle fascia/ischium bone periost at posterior obturator foramen/obturator membrane at the L side whereby elevation of the pubocervical musculofascia with the adherent anterior vagina wall was ensured; at least on the fixation side.

after which as evidence based patients can become pregnant again and even deliver vaginally with the cervix still in its variable anatomic position even after multiple vaginal deliveries.

even if prolapse should recur the same technique can be applied.

the author would like to present 3 evidence-based physiologic operation techniques as developed by him personally over the years in order to reconstruct the functional pelvis anatomy by minimum approach.

since every cervix/uterus prolapse is different and a specific separate entity these are only guidelines which have to be customized to the specific situation at hand.

it is up to the reader to decide for himself.

the opposite of cervix prolapse is cervix retraction as seen after cs due to direct or indirect scarring/adhesions of the uterus to the anterior abdominal wall whereby on cough the uterus/cervix moves paradoxically cephalad and then exerts traction upon the posterior urethra wall which may cause urine incontinence; whilst also the cervix may be fixed towards one of the ischium spines after obstructed labor.

the author

september 2017
concomitant lesions

though isolated cervix prolapse is possible, most of the time it may be associated with a series of other lesions

other pelvis organ prolapse
though isolated cervix prolapse is possible (elongation), most of the time it is associated with prolapse of other pelvis structures like cystocele, enterocele and/or rectocele however, cervix prolapse c3 and c4 are the main complaint

cervix ulcer(s)
cervix prolapse c3 and c4 are often associated with decubitus ulcer(s) of the anterior or posterior or complete cervix; and also of the vagina wall

micturition problems
though free spontaneous micturition is the norm cervix prolapse c3 and c4 may be associated with difficulties in spontaneous micturition for which the patient needs to manually reduce the prolapse and eventually by suprapubic pressure

defecation problems
though free spontaneous defecation is the norm cervix prolapse c3 and c4 may be associated with difficulties in spontaneous defecation for which the patient needs to manually reduce the prolapse and eventually by intravaginal pressure

vaginal sexual intercourse
cervix prolapse c3 and c4 may interfere with sexual vaginal intercourse

genuine urine intrinsic incontinence
though genuine urine intrinsic incontinence is often associated with cervix prolapse c1 and c2 it is not known how often cervix prolapse c1 and c2 are associated with genuine intrinsic incontinence

urine continence is the norm in cervix prolapse c3 and c4
though cervix prolapse c3 and c4 may be associated with urine incontinence, the norm is full continence as reported subjectively by the patient and as found objectively on cough even after reduction only upon overcorrection with pull/traction on the posterior urethra wall incontinence may be demonstrated

sphincter ani rupture
since both conditions are associated with a wide pelvis
what is needed before a start is made

one has to master the complicated anatomy of the pelvis, the pelvis organs and the pelvis wall/floor

one has to understand the functional anatomy as interaction between the different structures in order

to understand the physiology of the urine and stool continence mechanisms in the female

one has to understand the physiology of the urine and stool continence mechanisms in the female

one must be able to identify the individual structures of the functional anatomy in the living female

which is different from the postmortem dead anatomy

one has to study and understand the mechanism of action of the obstetric trauma, what it does to the functional anatomy of the individual structures and master the enormous variety of lesions

one must be able to identify and assess the individual obstetric trauma defects in the living female

one must study, understand and master the mechanisms of action of urine and stool incontinence and of prolapse in the female

then one must make a plan of action how to reconstruct the functional anatomy as customized to the individual findings and needs

one must master the principles of general, gynecologic, urologic, colorectal and reconstructive surgery and since the vagina is never sterile also the principles of septic surgery

one must understand and respect the natural tissue forces inside the human body

one must master the physiologic healing processes in order to promote the enormous natural healing potential of the human body

preferably one undergoes a practical training with a step-by-step approach where the basic skills are demonstrated in order to learn these skills

though the skills can be demonstrated and be practiced step by step under strict supervision there is NO automatic transfer of these skills and the ultimate responsibility for any surgery rests upon the performing surgeon

the decisive factor in surgery is the surgeon
intrapelvic urogenitodigestive diaphragm
in the female
with cervix as its central point

introduction

the intrapelvic organ and organ support situation in the female differs radically from the situation in the male by the interposition of the large female genital tract in between the distal urinary tract anteriorly and the distal digestive tract posteriorly

all embedded into the corpus intrapelvinum of the tela urogenitalis, together with their vascular, lymphatic and nervous supply

though the situation of the “pelvis diaphragm” is more or less the same since the levator ani muscles are not affected; except for a wider pelvis

the perineum outlet diaphragm is severely weakened by the large vagina opening; so instead of two now a third and large opening has been pierced thru punched out

so the pelvis floor in the female is prone to dysfunctioning

there is increased hydrostatic intraabdominal pressure due to the weight of the female genital organs; especially during pregnancy

also the support of the anatomic female urine continence mechanism changed since in the male it is well supported by the prostate

as compensation in order to support the female bladder and urethra and the uterus and cervix and to withstand the intraabdominal pressure the corpus intrapelvinum formed a functional dynamic structure as the author would like to call the

intrapelvic urogenitodigestive diaphragm

from the pubis bone bodies anteriorly to the sacrum posteriorly and circumferentially connected to the pelvis wall like the skin of drum or trampoline with the cervix as its center; and fusing anteriorly with the perineum outlet diaphragm

in between the high-pressure distal urinary tract, proximal genital tract, intraperitoneal contents and distal digestive tract and the low- or zero-pressure vagina

with a small opening anteriorly for the urethra and a larger one posteriorly for the rectum

it consists of a mixture of connective tissue for strength, elastin for passive elasticity and plasticity and smooth muscle fibers for active dynamic non-fatigue tonus and relaxation under autonomic nervous innervation

it is the first line of counteracting the hydrostatic intraabdominal pressure and contributes to compression pressure by increase or decrease of its tonus; especially since its main component is smooth muscle fibers
whilst the rest pressure is dealt with by the pelvis floor structures, especially by the perineum outlet diaphragm

it supports the posterior urethra, uv-junction and bladder neck in their anatomic position and as such contributes to the anatomic urine continence mechanism

it prevents the high-pressure organs posterior urethra, posterior bladder (base), cervix, intraperitoneal contents and rectum from herniating into the zero-pressure vagina

it is divided into specialized parts as the pubovesical/posterior pubourethral ligaments, pubocervical musculofascia, arcus tendineus fasciae, cardinal and broad ligaments, rectovaginal musculofascia and sacrouterine ligaments with the cervix as centrum tendineum intrapelvinum since all its musculofascia structures are firmly connected to it

**pubovesical/posterior pubourethral ligaments (= muscles)**
anchor the most anterior part of the pubocervical musculofascia as part of the intrapelvic urogenitodigestive diaphragm onto the pubis bone bodies and

securing the posterior proximal urethra, uv-junction and bladder neck in their anatomic position and so supporting the female urine continence mechanism

once they become defective intrinsic stress incontinence may develop

**pubocervical musculofascia**
like a triangle from the pubis bone body and bilateral atf to the cervix as the anterior part of the intrapelvic urogenitodigestive diaphragm as part of the corpus intrapelvinum

the musculofascia is well developed and seems to consist of longitudinal collagen/smooth muscle fibers (from anterior towards posterior) and underneath the mid/distal urethra also transverse collagen/smooth muscle fibers (in between the 2 median inferior surfaces of the pubis bones) interwoven by elastin

the longitudinal arrangement seems likely since longitudinal median defects are found intraoperatively at genuine incontinence, cystocele and cervix prolapse surgery

the anterior transverse arrangement seems likely since the median longitudinal defects stop at 1.5-2 cm to the external urethra opening

the intact pubocervical musculofascia secures and stabilizes the (posterior) bladder base/neck, uv-junction and urethra in their anatomic position and as such supports the female urine continence mechanism; it also stabilizes the cervix anteriorly and bilaterally

the intact pubocervical musculofascia prevents the pre/subperitoneal contents bladder base/uv-junction/urethra and the cervix from herniating into the vagina

the **axis** of the pubocervical musculofascia as to horizontal/ground is 25-30° from symphysis to ischium spine in the upright position

the posterior wall of the urethra, uv-junction and the bladder trigonum are not expanding during the asymmetric filling of the bladder; therefore these structures are firmly fixed to the pubocervical musculofascia whilst
the anterior vagina wall is rapidly expanding and deflating with shearing during sexual intercourse and even more during childbirth and as such is loosely connected/fixed to the pubocervical musculofascia, except for in the region of the urethra where it is firmly fixed to it

arcus tendineus fasciae = atf
as bilateral fixation/insertion of the intrapelvic urogenitodigestive diaphragm/pubocervical musculofascia whilst

the arcus tendineus fasciae is further connected to the lateral pelvis wall (arcus tendineus of levator ani muscle and oburator internus muscle fascia) via a narrow triangular fascia sheath

cervix as centrum tendineum intrapelvinum

the cervix is considered to be the centrum tendineum intrapelvinum since all the musculofascia structures of the intrapelvic urogenitodigestive diaphragm are firmly anchored onto it whilst the cervix itself is firmly anchored into the central pierced thru punched out opening within the intrapelvic urogenitodigestive diaphragm

pubocervical musculofascia
like a triangle from the pubis bone body and bilateral atf to the cervix as the anterior part of the intrapelvic urogenitodigestive diaphragm as part of the corpus intrapelvinum; and securing the cervix anteriorly

cardinal ligaments and broad ligaments
since they radiate into the cervix they support the intrapelvic urogenitodigestive diaphragm restricting its downward movement; and securing the cervix bilaterally

sacrouterine ligaments
as posterior fixation of the intrapelvic urogenitodigestive diaphragm onto the sacrum since they fix/connect the cervix posteriorly onto the rectum and sacrum

rectovaginal musculofascia
In between the vagina and rectum and anchored onto the posterior cervix in between the sacrouterine ligaments

with lateral fixation to the pelvis wall (coccygeus muscles, sacrospinous ligaments and priformis muscle) via fascia sheaths

weakest point in the intrapelvic urogenitodigestive diaphragm

considering the anterior cone-like triangular shape with the narrowest at the pubis bones and the broadest in between the ischium spines the weakest point is in the median at the anterior cervix

and the broader the pelvis (with broad span) the more prone for median defects and as such for stress incontinence, urethrocele, cystocele and cervix prolapse
cervix

cardinal ligaments

sacrouterine ligaments

pubocervical musculofascia

rectovaginal fascia

intrapelvic urogenitodigestive diaphragm cervix

centrum tendineum intrapelvinum
intrapelvic urogenitodigestive diaphragm
smooth muscle
autonomic innervation

perineum outlet diaphragm = pelvis floor
striated muscle
somatic innervation
urogenital and digestive prolapse

mechanism of action

as based on intraoperative findings

introduction

since the vagina is a low- or zero-pressure organ the vagina cannot herniate into its adjacent organs with high(er) pressure whilst these high-pressure organs can easily herniate into the vagina once defects develop within the separating and supporting corpus intrapelvinum musculofascia structures in between these organs

once these organs herniate into the vagina they can further prolapse unopposed to the outside whilst dragging the vagina (wall) with them

the distal end organs of the urinary tract, genital tract and digestive tract together with their respective anatomic continence mechanism are anchored into the perineum outlet diaphragm

so these end organs can only prolapse to the outside by kind of intussusception, for instance like total cervix/uterus prolapse thru the introitus

the pelvis floor with its large hernia-prone openings can neither prevent nor stop this process

the wider the pelvis the wider the span in between its side walls and the more chance of developing prolapse

considering a pubic arch (indication of pelvis width) of 85° as normal; as corresponding with a normal width pelvis

a pubic arch of 90° seems to be the critical point

in almost all the patients the author operated for some kind of prolapse he found a pubic arch of ≥ 90° since he started measuring this arch

this was also found in patients with genuine intrinsic stress incontinence and in patients with obstetric anterior sphincter ani rupture

prolapse

urethrocele
herniation of the posterior urethra into the vagina thru a median defect within the urethrovaginal fascia as most anterior part of the intrapelvic urogenitodigestive diaphragm

cystocele
herniation of the posterior bladder into the vagina thru a median defect within the pubocervical musculofascia as anterior part of the intrapelvic urogenitodigestive diaphragm
**cervix/uterus prolapse**
herniation of the cervix/uterus into the vagina thru a central defect in the intrapelvic urogenitodigestive diaphragm

**enterocele**
herniation of intraperitoneal contents (ileum) thru a defect within the rectovaginal fascia in between the sacrouterine ligaments as posterior part of the intrapelvic urogenitodigestive diaphragm

**rectocele**
herniation of the anterior rectum thru a median defect within the rectovaginal fascia and perineal body as most posterior part of the intrapelvic urogenitodigestive diaphragm

these prolapses may occur isolated or combined in any combination

**rectum prolapse thru anus**
intussusception of the rectum thru a defective anatomic stool continence mechanism

**urethra caruncle**
intussusception of urethra mucosa thru external urethra opening

**mechanism of action**

the intact intrapelvic urogenitodigestive diaphragm with its specialized musculofascia structures stabilizes and secures the bladder and urethra and the cervix in their variable anatomic position and prevents the intraperitoneal contents from herniating into the vagina

except for the distal urethrovaginal fascia where the fibers seem to be transverse the fibers of the pubocervical musculofascia seem to be longitudinal

their weakest point is in the midline (where the span is the broadest and the pressure the highest) where due to hydrostatic pressure the longitudinal fibers may start to divide/split whereby these fibers retract (bi)laterally and median defect(s) will develop

and then depending upon the location of the defect the posterior urethra, bladder base, cervix and/or intraperitoneal contents (ileum) herniate thru this defect into the zero-pressure vagina as urethrocele, cystocele, cervix prolapse or enterocele

if not corrected the herniated organs may prolapse unopposed to the outside thru the vagina thru openings within the pelvis floor dragging the proximal vagina wall with them by intussusception

the mechanism of rectocele is a bit different since hydrostatic pressure is not involved but it is by obstetric or other trauma causing a median defect within the rectovaginal musculofascia and perineal body

then the high-pressure (anterior) rectum (wall) will herniate thru this defect into the zero-pressure vagina and may further prolapse unopposed to the outside thru the opening into the pelvis floor dragging the posterior vagina wall with it by intussusception
Discussion

It is crucial to understand that the mechanism of action is by defects within the musculo-fascia structures of the corpus intrapelvinum between the high(er)-pressure adjacent organs and the zero-pressure vagina.

And as such, the organs will first herniate into the vagina; only at a later stage they may slide thru the vagina and prolapse unopposed thru the hernia-prone opening(s) in the pelvis floor to the outside dragging the vagina (wall) with them as intussusception.

The same as with fistulas whereby urine and/or stool will leak from the high-pressure bladder respectively high-pressure rectum first into the zero-pressure vagina and then further leak thru the vagina to the outside.

The notion that the levator ani muscles play a major role in prevention, if intact and well functioning, and in mechanism of prolapse, if weak, cannot be confirmed to the author it looks far-fetched since there is nowhere direct contact between these organs (wall) and the levator ani muscles; not even when herniated/prolapsed.

Whilst the levator ani muscles are part of the pelvis wall and do not belong to the corpus intrapelvinum as connective tissue organ of pelvis.

By what mechanism would the action of the levator ani muscles contribute if there is no contact how can the levator muscles now prevent the development of defects within the musculofascia structures between the organs and the vagina.

Prolapse is not thru the levator ani muscles and other pelvis floor structures but is thru defects in the intrapelvic urogenitodigestive diaphragm due to which the bladder and/or cervix and/or intraperitoneal contents and/or rectum are no longer supported and start to descend/herniate.

If there is herniation, the herniated organ will slide unopposed thru the vagina dragging the vagina (wall) with it and may prolapse to the outside.

This process also cannot be prevented or stopped by the levator ani muscles or other pelvis floor structures, either relaxed or contracted.

Since the intrapelvic urogenitodigestive diaphragm is also supporting the female urine continence mechanism prolapse may be accompanied by urine incontinence if the defect results in loss of support.

**NB** Another though seldom form of mechanism of action is by extensive necrotic tissue loss of the cervix anchoring musculofascia structures due to prolonged obstructed labor with a narrow pelvis; and pubic arch of ≤ 80°.
cervix prolapse c1 and c2

introduction pop q c1 and c2

when the lowest point of the cervix comes up to 2 cm proximally from hymen ring this is called cervix prolapse c1 according to the pelvis organ prolapse quantification system

this is a frequent finding in parous females

normally this does not need surgery

when the lowest point of the cervix reaches between 1 cm proximally and 1 cm distally from the hymen ring this is called cervix prolapse c2

this may need reconstructive surgery if the woman complains about it or if combined with urine incontinence; as part of the operation technic; same as for cystocele

genuine intrinsic urine incontinence is frequently combined with cervix prolapse c1 or c2 in combination with wide pelvis as expressed by pubic arch of ≥ 90°

kees intrapelvic urogenitodigestive diaphragm reconstruction with cervix re-anchoring under spinal anesthesia in the exaggerated lithotomy position

a measure pubic arch in degrees
b measure vagina length in cm
c suture both labia minora onto inner side of the upper legs/buttocks
d check for urine intrinsic incontinence by asking the patient to cough with cervix prolapse and after reduction of the prolapse
e if necessary a median episiotomy can be performed but normally this is not indicated since wide pubic arch of ≥ 90°
f place self-retaining auvard speculum over posterior vagina wall = pvw
g measure distance euo to bladder wall = euo/bw in cm by metal sound
h insert foley ch 18 catheter and drain bladder half; leave some urine inside to check later for bladder trauma (bloody urine)
i remove foley catheter
j measure urethra length = euo/b in cm; normally it is reduced ≤ 2 cm (vesicalization) due to rotational descent of posterior urethra wall/uv-junction/bladder base
k then calculate longitudinal bladder diameter as euo/bw minus euo/b in cm
physiologic large curved incision anterior vagina wall = avw at 2 cm from euo within ruga folds towards both underlying ischium spines

sharp dissection of avw up to cervix so pubocervical musculofascia (as part of the intrapelvic urogenitodigestive diaphragm) becomes exposed

identify the musculofascia; do not look for a fascia but look for smooth muscle fibers

measure the extent of the longitudinal median defect within the intrapelvic urogenitodigestive diaphragm in cm

reconstruct the intrapelvic urogenitodigestive diaphragm by longitudinal repair of the defect by single layer of polyglycolic acid (vicryl)

make sure the most proximal suture picks up the cervix as well so the cervix will be re-anchored into its anatomic position as centrum tendineum intrapelvinum

check if the intrapelvic urogenitodigestive diaphragm is well fixed onto the pubis bones and its bilateral arcus tendineus fasciae = atf

if not refix the pubocervical musculofascia onto its anatomic origin: pubis bones and atf

check if the cervix is now mobile in its anatomic position; if not see next chapters

check for incontinence by asking the patient to cough

reinsert foley catheter

check for urine flow; catheter inside bladder, at least one urine functioning and patient not in shock

if bloody urine one knows bladder has been traumatized; this will heal by longer post operative catheterization

remove catheter

measure urethra length again

normally this will be 1-2 cm more than at the beginning (re-urethralization) since the repaired intrapelvic urogenitodigestive diaphragm ensures physiologic configuration of urine continence mechanism with normalization of outflow resistance

adapt avw by everting interrupted vicryl or nylon sutures ensuring hemostasis

reinsert foley catheter and leave it for couple of days

vagina pack up to the preference of the surgeon

operation time 20-25 min

blood loss 50-100 ml
discussion

cervix prolapse c1 and c2 are frequently found and only need surgical repair on special wish or as part of the operation technic for genuine urine intrinsic incontinence

in the more than 350 genuine urine incontinence reconstructions so far there was an evidence-based success rate of > 95% without intra- and postoperative complications

since the functional pelvis anatomy is reconstructed by a minimum approach step by step in a logical and systematic way using the available autologous structures

re-anchoring the cervix into the intrapelvic urogenitodigestive diaphragm is an essential part of reconstructing the functional pelvis anatomy

the tricks using artificial materials may function but these have nothing whatsoever to do with reconstructive pelvis surgery

since besides using foreign-body materials the underlying defects are not corrected so actually nothing is reconstructed

and seem to be more for the financial benefit of the surgeon and medical industry than for the well-being of the woman

there were some failures with congenital urine incontinence but these may have been due to a concomitant neurologic component

if not successful or if recurrence after subsequent deliveries exactly the same technic was performed again with excellent results

in identifying the intrapelvic urogenitodigestive diaphragm (components) one has to look for smooth muscle tissue and not for fascia tissue

since there is no anatomic tissue loss but splitting of the fibers with bilateral retraction the musculofascia structures could always be identified/found by the author and were sufficient for the reconstructive surgery

the author uses the same technic for cystocele with or without incontinence and with or without cervix prolapse c1 and c2

this technic as described is totally different from anterior colporrhapsy which the author considers as rather mutilating using a mutilating longitudinal incision with poor access, just suturing some kind of unidentified tissue and then removing healthy valuable tissue which is against any reconstructive surgery principle

nb in post-fistula-repair incontinence with anatomic tissue loss one has to look for the responsible defects within the intrapelvic urogenitodigestive diaphragm and then repair them all meticulously
genuine intrinsic/stress incontinence
cervix prolapse c1 and c2

physiologic incision
anterior vagina wall

anterior vagina wall dissected
median defect pubocervical musculofascia

repair pubocervical musculofascia
first proximal suture thru cervix

longitudinal repair pubocervical musculofascia

longitudinal repair pubocervical musculofascia
adaptation anterior vagina wall
mutilating incision
anterior vagina wall

physiologic incision
anterior vagina wall

additional fixation sutures
at 0 and 2 cm
(sub)total cervix prolapse c3 and c4

introduction pop q c3 and c4

when the lowest point of the cervix comes up to +3 cm or more distally outside the hymen ring this is called cervix prolapse c3 according to the pelvis organ prolapse quantification system

when the cervix/uterus comes out completely from the introitus/vulva this is called cervix prolapse c4

cervix/uterus prolapse c3 and c4 are normally combined with wide pelvis as expressed by pubic arch of ≥ 90°; however, they are normally not combined with genuine intrinsic incontinence though narrow shortened urethra is found though the combination is possible

though in the industrialized world cervix prolapse c3 and c4 is not so prevalent and if present is mostly found in elderly women

in africa it is probably as prevalent as the obstetric fistula and found in all age groups already after only one delivery at age 15 years and even congenital

there are 2 mechanisms of action

the most common is dis-anchoring of the cervix from the intrapelvic urogenitodigestive diaphragm by hydrostatic intraabdominal pressure combined with a wide pelvis

far less common is by extensive necrotic soft tissue loss due to prolonged obstructed labor combined with normal or narrow pelvis

there are many operation technics, all with their success, complication and failure rate

over the years the author developed safe evidence-based technics for two different groups of women

a for women older than 60 years and those without genuine intrinsic incontinence fixation of the L cervix onto the obturator internus fascia with 2 nylon sutures thru the upper brim = origin of the obturator internus muscle/obturator membrane/ischium bone periost at the posterior edge of the obturator foramen 4 cm from ischium spine just frontally from the attachment of the parametrium to the pelvis wall so that the cervix (with adherent pubocervical musculofascia) will be in direct broad contact and unite with the obturator internus fascia forming a kind of strong “ligament” by a mini-invasive approach taking only 5 min

b for women up to 60 years of age and those with major incontinence reconstruction of the median defect within the intrapelvic urogenitodigestive diaphragm with re-anchoring of the cervix and then if necessary fixation of the cervix onto the obturator internus fascia; taking some 25-30 min

of course the age of the woman should be flexible depending upon her general health and so should be the operation technic whilst the principles remain the same
characteristic findings in cervix prolapse c3 and c4

pre operation

**wide pelvis**  
**pubic arch > 90°**

as indicated by a wide pubic arch of > 90°

the pubic arch is measured as routine in all obstetric trauma procedures

the intertuberosity distance is a good indicator as well; however, we have not been doing this but will start

**narrow pubic arch is rare**

though sometimes found in cervix prolapse c4 due to extensive necrotic pelvis soft tissue loss after prolonged obstructed labor

though the norm is a fixed cervix with vagina shortening/stenosis

**normal vagina length**  
10-12 cm

the vagina length/depth is measured as routine in all obstetric trauma surgery

**increased longitudinal bladder diameter**  
> 15 cm

in cervix prolapse c1 and c2 the longitudinal bladder diameter is in the upper limits of normal (11-12 cm) or in the transitional zone (13-15 cm)

but in cervix prolapse c3 and c4 it is normally increased > 15 cm

the mechanism for this still eludes the author though he is sure an explanation will be found

the longitudinal bladder diameter is measured as routine in all obstetric trauma surgery

**decreased urethra length**  
< 2 cm

due to vesicalization (funneling) of the uv-junction and proximal_mid urethra due to rotational descent of the posterior bladder neck/uv-junction/proximal urethra

with spontaneous re-urethralization after cervix fixation since the pubocervical musculo fascia will be elevated as well

the urethra length is measured as routine in all obstetric trauma surgery

**narrow distal urethra_euo**  
in anatomic position

due to the enormous regenerating power of the human body

**full urine continence**  
due to increase in outflow resistance

even with urethra length of only 0.5 cm

before and after reduction of the prolapse

post operation

**spontaneous re-urethralization after cervix fixation**

after cervix fixation (with elevation of musculo-fascia) as will be described there is an increase in urethra length of at least 1-1.5 cm due to re-urethralization

**minor forms of incontinence I and II will disappear after fixation**

since the configuration of the continence mechanism is improved by cervix fixation the outflow resistance will increase and minor forms of incontinence will disappear
kees anatomic cervix fixation

solution for total cervix/uterus prolapse

step-by-step pure vagina mini-invasive operation technic
under spinal anesthesia

a in exaggerated lithotomy position
b check for urine (in)continence before and after reduction
c measure longitudinal bladder diameter and
d measure urethra length
e small 2 cm longitudinal incision L anterior vagina wall in ruga folds
f with transverse extension up to L cervix
g and quartercircular extension at L cervix
h sharp dissection to create ample wound surface area for good broad fixation
i sharp opening L paravesical space; normally this space is free
j identification of ischium spine
k place two nonabsorbable nylon sutures thru brim of obturator internus muscle/obturator membrane/ischium bone periost frontally from parametrium attachment some 4 cm from ischium spine using sharp deschamps aneurysm needle and leave them long
l then suture both ends of one suture thru posterior cervix and
m both ends of the other suture thru anterior cervix
n fix the posterior cervix onto the obturator internus muscle fascia by tight tying of first suture without loose loop
o fix the anterior cervix onto obturator internus muscle fascia by tight tying of second suture without loose loop
p check fixation by pulling onto cervix
q check urethra length again; normally this has increased by at least 1-2 cm
r check hemostasis
s leave indwelling foley bladder catheter for couple of days

operation time 5 min
blood loss 50 ml
total cervix prolapse

incision

dissection anterior vagina wall

first fixation suture thru posterior cervix

second fixation suture thru anterior cervix

fixation sutures tied without loose loop end result
pelvis
surgeon’s view
prolapse

after fixation
sound in cervix canal
combination of both technics

kees intrapelvic urogenitodigestive diaphragm reconstruction with cervix re-anchoring and anatomic cervix fixation

for total cervix prolapse in patients younger than 60 years or if combined with genuine intrinsic incontinence

a in exaggerated lithotomy position
b check for (in)continence before and after reduction
c reduction of cervix
d measure longitudinal bladder diameter and
e measure urethra length
f physiologic curved anterior vagina wall incision at 2 cm to euo
g sharp awv dissection up to cervix to
h expose pubocervical musculofascia; look for smooth muscle tissue
i identify median longitudinal defect within intrapelvic urogenitodigestive diaphragm
j longitudinal repair of median defect with proximal suture thru cervix (as centrum tendineum intrapelvinum) re-anchoring the cervix
k check for (in)continence and
l if necessary complete reconstruction of intrapelvic urogenitodigestive diaphragm and
m if necessary sharp opening L paravesical space and
n continue cervix fixation as explained already
o check fixation by pulling onto cervix
p check urethra length again; normally this has increased by at least 1-2 cm
q check hemostasis
r leave indwelling foley bladder catheter for couple of days

operation time 25-40 min; on the average some 30 min
blood loss 50-150 ml; on the average some 100 ml
incision + dissection

© kees

proximal suture thru cervix

© kees

longitudinal reconstruction completed

© kees

fixation point

© kees

fixation suture thru cervix

© kees

fixation sutures completed

© kees
discussion

the rationale of the technic is to bring the lateral cervix ( + adherent musculofascia) into direct broad contact with the obturator internus muscle fascia

so after healing a broad “ligament” will be formed keeping the cervix in place as is seen after suture removal 6 mth after operation

some 30-40% of the younger patients reported whilst being pregnant and some after subsequent vaginal delivery and the cervix was found mobile in the midline in its anatomic position c0-c1

this “ligament” is so strong that in one patient after 5 subsequent vaginal deliveries the cervix was found mobile in the midline in anatomic position c0-c1

the transverse incision thru the anterior vagina wall up to the cervix will heal with some kind of scar contracture since deliberately it is perpendicular to the natural tissue forces as indicated by the ruga folds

as positive spin-off minor forms of urine incontinence will be cured as well since the pubocervical musculofascia as anterior part of the intrapelvic urogenitodigestive diaphragm is elevated with anterior movement of the posterior urethra wall resulting in re-urethraization of the vesicalized urethra with improvement of the configuration of the anatomic continence mechanism and increased outflow resistance

an important orientation point is to identify the ischium spine and from there onwards identify the superior brim/origin of the obturator internus muscle

the exact point of fixation is some 4 cm cephalad/anteriorly from the ischium spine where the sharp aneurysm needle should go through the brim of the obturator internus muscle (at its origin), thru the obturator membrane and thru the ischium bone periost at the origin of the internus obturator muscle at the junction obturator membrane/ischium bone at the posterior edge of the obturator foramen and frontally from the attachment of the parametrium

in the beginning the fixation point was thru the ischium bone periost just anteriorly from the ischium spine but though the fixation was safe and ok there was a high incidence of large neo-cystocele development since the musculofascia was pulled down

since we changed our fixation point with elevating the musculofascia there was no neo-cystocele development

the paravesical spaces are an open book to the author due to his extensive obstetric trauma reconstructive surgery

for a right-handed surgeon fixation at L is the most convenient way; for a left-handed surgeon fixation at R is the most convenient

if the fixation fails or if it should recur after another vaginal delivery exactly the same procedure is followed either on the same side or on the other side
kees cervix fixation for total cervix/uterus prolapse
with a report of 348 patients

over the years a uterus/cervix sparing technic has been developed according to the functional pelvis anatomy so exact knowledge of anatomy needed

in elderly patients who only want nothing hanging out

pure vagina technic under spinal anesthesia

with two nylon sutures the cervix is fixed onto L obturator internus muscle fascia/obturator membrane/ischium bone periost into its anatomic position

operation time 5 minutes

blood loss not up to 50 ml without exception

monofilament sutures to be removed after 6 months though they can stay in for life

no complications were encountered

in younger patients who still want children

in addition to this anatomic-correct fixation

longitudinal repair of the median defect within the intrapelvic urogenitodigestive diaphragm thru which the cervix prolapsed with cervix re-anchoring

operation time 25-30 minutes no complication encountered

blood loss some 100-150 ml

results

so far 348 patients have been operated with excellent results

most of the younger patients became pregnant and delivered again (mostly vaginally) with afterwards the cervix still in anatomic position

one patient delivered 5x vaginally with cervix still in its anatomic position

concomitant urine incontinence was cured at the same time due to urethralization as positive spin-off effect of the technic

in the beginning in some 10% of patients there was a failure with recurrence of the prolapse; they were operated again using the same technic at the same or opposite side with good results; however, with increasing experience and creating ample wound surface for better broad contact failure rate dropped to below 2-5%

conclusion: these reconstructive technics are safe and effective
true pelvis cavity
a confined space for the distal outlet organs of the urinary tract anteriorly, the genital tract in the middle and the digestive tract posteriorly with hydrostatic and compression pressure; normally in a continent way and divided into

- **anterior pre_subperitoneal compartment**
  for the distal end parts of the urinary tract: pelvic ureters, bladder and urethra

- **median subperitoneal compartment**
  for the (also distal end parts of) genital tract: uterus, adnexa, cervix and vagina

- **posterior retro_subperitoneal compartment**
  for the distal end parts of the digestive tract: rectum, anorectum and sphincter ani

enclosed by

- **parietal pelvis fascia**
- **parietal peritoneum**

as connected to each other by

- **tela urogenitalis**

**corpus intrapelvinum as dynamic matrix**
connective tissue organ of pelvis consists of a cohesive mixture of collagen for strength, elastin for passive elasticity and plasticity and mostly smooth muscle fibers for active non-fatigue tonus in a loose, dense or condensed form as a dynamic matrix into which the organs and their supply are embedded and suspended/connected to the pelvis wall and each other by highly specialized structures protecting the organs and their supply against trauma and stabilizing/securing them in their variable anatomic position as coordinated by the autonomic nervous system

**intrapelvic urogenitodigestive diaphragm**
highly specialized structure of corpus intrapelvinum from symphysis anteriorly to sacrum posteriorly as connected to its bilateral arcus tendineus fasciae with cervix as centrum tendineum intrapelvinum since all musculo fascia structures are connected to it as first line of counteracting intraabdominal hydrostatic pressure and supporting the urogenital continence mechanisms in their anatomic position and preventing herniation of the urogenital tract and intraperitoneal contents and of the distal digestive tract into the zero-pressure vagina

**pelvis floor as one functional unit**
levator ani muscles connected firmly to the perineum outlet diaphragm via perineal body and external sphincter ani muscle supporting and reinforcing each other levator ani muscles as “pelvis diaphragm” highly overrated with direct action on stool continence mechanism and only indirect action on urine continence mechanism perineum outlet diaphragm into which the end outlet organs with their striated sphincter mechanisms are anchored and supporting directly and the urine and stool continence mechanisms
female urine continence mechanism over in total 4-5 cm
bladder neck, uv-junction and whole urethra
supported by the intrapelvic urogenitodigestive diaphragm
there is an internal smooth muscle sphincter and an external striated rhabdosphincter
with washer effect by the mucosa and submucous vascular plexus
continence potential over its whole length

female genital continence mechanism over in total 3-4 cm
with cervix as internal smooth muscle sphincter as anchored into intrapelvic urogenitodigestive diaphragm

female stool continence mechanism over in total 4-5 cm
anorectum and external sphincter ani
anchored within perineum outlet diaphragm
there is an internal smooth muscle sphincter and an external striated sphincter ani
muscle with washer effect by mucosa and submucous vascular plexus

urine stress incontinence mechanism genuine and post fistula repair
distortion of smooth muscle arrangement of the urethra with weakening of the intrinsic closing forces and decrease in outflow resistance due to backward rotation/shifting of mobile posterior urethra wall away from the immobile anterior urethra wall
by downward/caudad traction/push, by posterior traction towards sacrum due to defects within the support by the intrapelvic urogenitodigestive diaphragm and by defects within the anchoring into perineum outlet diaphragm; isolated or combined

pelvis floor muscle exercises
have a positive effect upon the urine and continence mechanism since the perineum outlet diaphragm contributes to the urine and stool continence mechanism by further stabilizing the outlet parts
the levator ani muscles contribute directly to the stool continence mechanism to which they are anatomically connected but only indirectly to the urine continence mechanism with no anatomic connection whatsoever
with simultaneous reflex contraction of the external striated muscle sphincters with increase in tonus of smooth muscle fibers of the intrapelvic urogenitodigestive diaphragm by reflex action by the sympathetic part of the autonomic nervous system

obstetric trauma
due to hydrostatic pressure, dilatation of birth canal, (in)direct cutting thru, shearing and compression; and in prolonged obstructed labor due to pressure necrosis resulting in an enormous variety of defects from minimal to extensive

urogenital and digestive prolapse
herniation of adjacent high(er)-pressure organs into the zero-pressure vagina and then further prolapse thru the vagina dragging vagina wall with them as intussusception due to defects within the separating and supporting fascia structures of the corpus intra pelvinum between these organs and the vagina
levator ani muscles and perineum outlet diaphragm do not play a role in this process since there is no anatomic contact between those organs and these structures

reconstructive surgery
the science is to identify the specific defects whilst the art is to reconstruct the functional anatomy using the available autologous structures
corpus intrapelvinum

multifunctional connective tissue body/organ of pelvis

as archaic matrix

introduction

the whole complex of intrapelvic connective tissue is called the corpus intrapelvinum or connective tissue organ/body of pelvis; as matrix for the organs with their arterial blood supply, venous drainage, lymphatic drainage and innervation

it is also called endopelvic fascia or fascia endopelvina (conjugans), however, its main component consists of smooth muscle tissue/fibers; so the term fascia is misleading

though its basic anatomic structure and functions are easy to understand it is difficult to comprehend and visualize its exact anatomic extent with highly specialized functions according to the different physiologic needs

especially since there are no clear demarcations which make it difficult to demonstrate this body/organ with different structures by dissection and/or indirect imaging

however, it is only by studying its full anatomic extent and understanding its functions that progress will be made in reconstructive pelvis surgery

since weakness and defects in this important corpus intrapelvinum are responsible for the development of genuine intrinsic incontinence, urogenital prolapse, enterocele and rectocele

the amount of literature is enormous with confusing and contradicting terminology and various complicated theories

however, the anatomy and functional anatomy do not change and the author would like to give an outline as based on existing anatomic textbooks, especially

lehrbuch der topographischen anatomie as written by anton hafferl as second edition from 1957

by analyzing the topographic position in relation to the urinary and genital tract the paramount role of the levator ani muscles in these theories seems to be overvalued and highly questionable

the author thinks another concept is needed with regard to the functional anatomic urine (in)continence mechanism and urogenitodigestive anatomic position and prolapse

therefore he would like to introduce the concept of intrapelvic urogenitodigestive diaphragm as part of the corpus intrapelvinum as first line for counteracting the intra abdominal hydrostatic and compression pressure, as support of the urine continence mechanism and for securing the organs in their variable anatomic position
basics of serous membranes

the body cavities are enclosed by bones and muscles covering the bone and muscles bridging the gaps in between the bones

the **fascia interna** is the total fascia inner lining of the cavity

the **serosa** (peritoneum, pleura) is connected to this fascia by

the **tela subserosa**

depending upon the width in between the fascia and the serosa the tela subserosa may develop from minimal with its basic loose archaic texture to extensive with a cohesive mixture of collagen, elastin and smooth muscle tissue as connective tissue body/organ in a loose, dense or condensed form

the intracavity organs are embedded into the tela subserosa together with their blood supply, venous drainage, lymphatic drainage and innervation; whilst the tela subserosa also connects/suspends the organs to the cavity wall and each other

abdominopelvic cavity

the total fascia inner lining of the abdominopelvic cavity is called fascia abdominis interna; the serosa is called parietal peritoneum; the connective-tissue layer connecting the fascia abdominis interna to the parietal peritoneum is called the tela subserosa

the width between the internal fascia and peritoneum is small at the upper anterior abdominal wall from the umbilicus upwards and at the thoracoabdominal diaphragm and the fascia interna may “fuse” with the parietal peritoneum

however, the distance between the parietal peritoneum and posterior abdominal wall, anterior caudal abdominal wall and pelvis wall becomes wider and wider resulting into extensive development of the tela subserosa as tela urogenitalis

pelvis cavity

the total fascia inner lining of the pelvis cavity is part of the fascia abdominis interna; and here it is called

the **fascia pelvis parietalis**

the **serosa** is called peritoneum parietale

the **tela urogenitalis** is that part of the tela subserosa which is filling up the large gap between the fascia pelvis parietalis and peritoneum parietale

the intrapelvic organs are embedded into the tela urogenitalis together with their arterial blood supply, venous drainage, lymphatic drainage and innervation; whilst the tela urogenitalis also connects/suspends the organs to the pelvis wall and each other
from the tela subserosa urogenitalis 3 structures develop

- **fascia visceralis**
  - encapsulating the organs and ensheathing the blood/lymphatic vessels and nerves

- **corpus intrapelvinum**
  - cohesive mixture of collagen, elastin and smooth muscle tissue/fibers in a loose, dense or condensed form; its main component is **dynamic** smooth muscle tissue/fibers
  - loose connective tissue
  - filling up the spaces not occupied by the corpus intrapelvinum

### fascia visceralis

- as part of the tela urogenitalis which encapsulates the organs and then is named after the organ like fascia visceralis vesicae = visceral bladder fascia; and which as well ensheaths the blood and lymphatic vessels and the nerves

- the space in between the fascia visceralis and the organ wall is filled up by loose connective tissue allowing the organs like the bladder to expand and deflate rapidly by filling and emptying within a short time span

- when the organ does not expand and deflate rapidly like the uterus which grows slowly during pregnancy the fascia visceralis “fuses” with the organ wall and grows slowly together with the uterus; after emptying by childbirth it involutes slowly together with the uterus during the puerperium

### corpus intrapelvinum = connective tissue body/organ of pelvis

- as part of the tela urogenitalis; it constitutes a multifunctional connective tissue organ/body and consists of a cohesive mixture of collagen, elastin and smooth muscle tissue fibers in loose, dense or condensed form according to whatever is needed

- collagen for strength, elastin for passive elasticity and plasticity and smooth muscle fibers for active dynamic tonus and relaxation under autonomic nervous system coordination

- the smooth muscle component is the main component; even if some parts of it are called fascia or ligament it is still prevalent

- its extensive 3-dimensional mesh-like structure ensures a seamless combination of static and dynamic functions

- as a whole together with components of the organ walls as embedded into it, the corpus intrapelvinum is the major force in resisting hydrostatic and compression intraabdominal pressure due to its non-fatigue tonus which can be increased by reflex action and as such contributes to compression pressure

- the pelvis floor with its large hernia-prone openings is secondary in taking care of the rest pressure

- it also protects the organs with their supply from physiologic trauma during walking, sexual intercourse and childbirth
the specialized parts of it are called fasciae, septa, ligaments, plicae which all together form the corpus intrapelvinum each with a specialized function for the organs with their supply and then combined for the whole biomechanicophysiology of the pelvis cavity

it has to be considered as one multifunctional organ where the basic archaic texture has developed into individual specialized structures according to the physiologic needs

the space between one organ and another or between an organ and the adjacent cavity wall is called a spatium filled up by connective tissue in a condensed form as septum/fascia or in a loose form or in a loose form with a thin fluid film

it embeds the organs and their arterial blood supply, venous drainage, lymphatic drainage and innervation; and stabilizes and secures the organs in their variable anatomic position depending upon the degree of filling of the organ itself or filling of the adjacent organ(s); in whatever body position

it suspends/connects the intrapelvic organs to the pelvis wall with so called pillars for arterial blood supply, venous drainage, lymphatic drainage and innervation

it is responsible for the blood flow inside the valve less intrapelvic veins towards the vena cava inferior

it allows the organs to expand rapidly by filling and deflate rapidly by emptying

it allows the organs to move smoothly and independently from or simultaneously with each other

depending upon the physiologic needs it condenses to dense fascia plates or septa in between the organs and ligaments from the organs to the (bi)lateral pelvis wall and also loose structures like plicae; since the ligaments are smooth muscle tissue they are called muscles as well

though it is one continuous 3-dimensional mesh-like body/organ it is subdivided into overlapping para- structures

paracystium
that part of corpus intrapelvinum into which the bladder is embedded with condensation as bladder pillar at posterior bladder base cephalad to the ischium spine containing the blood and lymphatic vessels and nerves, and the pelvic ureter; connecting/suspending the bladder to the pelvis wall

parametrium
that part of corpus intrapelvinum which embeds the uterus/cervix, tubes and ovaries with condensation as uterovaginal pillar at uterus isthmus in the frontal plane thru and cephalad to the ischium spine containing the blood and lymphatic vessels and nerves and the pelvic ureter; connecting/suspending these organs to the pelvis wall

paracolpium
that part of corpus intrapelvinum which embeds the vagina with condensation as uterovaginal pillar in the frontal plane thru and cephalad to the ischium spine containing the blood and lymphatic vessels and nerves; connecting/suspending the vagina to the pelvis wall
paraproctium
that part of corpus intrapelvinum which embeds the rectum with condensation as rectum pillar in the region of the ischium spine containing the blood and lymphatic vessels and nerves; connecting/suspending the rectum to the pelvis wall

and into the condensed parts in between the organs like septum; these are not separate parts but fit into the corpus intrapelvinum as part of the fascia between the organs like pubocervical musculofascia

septum vesicocervicale
in between posterior bladder and anterior cervix as vesicocervical fascia

septum vesicovaginale
in between posterior bladder and anterior vagina wall as pubocervical musculofascia

septum rectovaginale
in between anterior rectum and posterior vagina wall and is fixed to centrum tendineum perinei (perineal body) as rectovaginal musculofascia

the space between the septa and the visceral fascia of the organs is filled up by loose connective tissue allowing friction free movement of the organ wall against the septum; ideally this is the layer or space of interest for surgeons in bloodless dissection

spatium prevesicale
between bladder and symphysis in continuity bilaterally with

spatium paravesicale
between bladder and (bi)lateral pelvis wall
all filled up by loose connective tissue and thin adhesive fluid film allowing the bladder wall to slide against the pelvis wall and anterior abdominal wall without coming loose

spatium vesicocervicale
between bladder and cervix

spatium vesicovaginale
between bladder and vagina

spatium rectovaginale
between vagina and rectum and up to and into perineal body

spatium pararectale
(bi)laterally between rectum and pelvis wall in connection with

spatium retrorectale
between rectum and sacrum
continues cephalad into the spatium retroperitoneale

it reacts to hormones and reconfigures under physiologic stress

one highly specialized structure consisting of the pubocervical musculofascia, cervix, cardinal ligaments, broad ligaments, sacrouterine ligaments and prerectal musculofascia
in between the bladder, uterus, peritoneum and rectum and the vagina forms within the corpus intrapelvinum as a whole a dynamic functional intrapelvic urogenitodigestive diaphragm

the cervix is anchored into the corpus intrapelvinum and as such if present is part of this diaphragm

actually, the cervix can also be considered the centrum tendineum intrapelvinum since it constitutes the center of the intrapelvic urogenitodigestive diaphragm and

all the different musculofascia structures of this diaphragm like pubocervical musculo fascia, broad/cardinal ligaments, sacrouterine ligaments and rectovaginal fascia are firmly connected to it

the function of this diaphragm has already been explained in a previous chapter

loose connective tissue

as part of the tela urogenitalis in a loose archaic form filling up the spaces not occupied by the corpus intrapelvinum; these spaces are of interest to the surgeon for a bloodless dissection

this allows friction-free movement/sliding of the organ wall against the structures of the corpus intrapelvinum without becoming loose from each other

and together with a thin adhesive fluid film it allows the bladder wall to slide against the anterior abdominal wall and anterior and lateral pelvis wall without becoming loose

and ensuring that the anterior urethra wall is always adherent to the posterior symphysis and as such does not rotate; not even if the posterior urethra wall rotates backwards away from the posterior symphysis due to defective connective tissue support and then resulting into progressive funneling or vesicalization of the urethra starting proximally

innervation

like all other structures in the human body the corpus intrapelvinum is under control and coordination by the autonomic nervous system; via a complicated reflex mechanism

the sympathetic system for stimulation by increasing the tonus of the smooth muscle fibers and the parasympathetic system for relaxation of the smooth muscle fibers

since its main component is smooth muscle tissue/fibers the corpus inrapelvinum forms a highly dynamic organ/body due to its non-fatigue tonus which can be increased or relaxed immediately upon whatever is needed at a certain moment by reflex action
discussion

how to describe an important 3-dimensional mesh-like collagen, elastin and smooth muscle connective tissue organ without clear demarcations in its full anatomic extent and full **dynamic** multi-functionality

as based on findings during his obstetric trauma surgery and evidence based results it became clear that another concept was needed; as one major function of the corpus intrapelvinum

the problem is that since there are no clear demarcations between this body/organ and the organs except for the visceral organ fascia and between the different structures of the corpus intrapelvinum it is difficult to demonstrate it as a whole and/or demonstrate its different structures by surgical dissection and/or indirect imaging

however, once one starts looking for this dynamic corpus and its different structures as a surgeon one will find it and its structures and then starts realizing its **paramount** importance for the functional pelvis anatomy

though the different structures have their own specific function their actual strength is that their function will be reinforced by the simultaneous functioning of the whole corpus intrapelvinum as one **dynamic mechanico-physiologic organ**

embedding the organs and their arterial blood supply, venous drainage, lymphatic drainage and innervation and being responsible for the independent physiologic functioning of the organs, for stabilizing/securing the organs in their variable anatomic position, for suspending/connecting the organs to the pelvis wall and to each other, for protecting the organs and their supply against physiologic trauma during walking, sexual intercourse and childbirth and for supporting the continence mechanisms of the urinary, genital and digestive tract

genuine intrinsic urine incontinence, urogenital prolapse like cystocele and cervix/uterus prolapse, intraabdominal content prolapse like enterocele and digestive prolapse like rectocele are all due to localized defects within the corpus pelvinum in isolated form or combined

though the author believes strongly in this concept, time and evidence-based results and challenges by other reconstructive surgeons will tell if he is right or wrong

for understanding the function look for smooth muscle action as its main component
fascia pelvis parietalis

peritoneum parietale

tela urogenitalis
corpus intapelvinum

anterior pre_subperitoneal compartment
urinary tract

median subperitoneal compartment
genital tract

posterior retro_subperitoneal compartment
digestive tract
mechanism of obstetric trauma

obstetrics constitutes always a major challenge to all pelvis organs with their different structures and there are several mechanisms by which the intrapelvic organs may be affected which will influence the functional pelvis anatomy in one way or the other

first by hormonal flooding

second by continuously increasing hydrostatic pressure due to pregnant uterus

third by dilatation of the cervix with opening up of the intrapelvic urogenitodigestive diaphragm

fourth by direct or indirect cutting thru of the head thru the cervix, thru the gap between the puborectalis ledges and thru the opening within the perineum outlet diaphragm

fifth by shearing forces during actual childbirth when the head passes thru the cervix, thru the vagina, thru the gap between the levator ani ledges and thru the opening in the perineum outlet diaphragm

sixth by compression of the soft tissues between the hard fetal skull and the hard bony maternal pelvis

seventh iatrogenic by intervention by health workers

eighth eclampsia

i hormonal flooding

all the tissues will first “hypertrophy” to withstand the increased hydrostatic pressure and later on will soften as preparation for childbirth and will involute during the puerperium

ii hydrostatic pressure

since the fetus and the uterus will grow slowly there is a continuously increasing hydrostatic pressure which may traumatize the intrapelvic urogenitodigestive diaphragm despite “hypertrophy”; in the involution phase defects may be resolved spontaneously or small defects remain with subsequent pregnancies/deliveries these remaining defects may become larger up to a point where support of the urinary continence mechanism becomes defective and/or the securing/stabilization of the organs become defective

iii dilatation of cervix + opening of intrapelvic urogenitodigestive diaphragm

during the first stage of labor the cervix will efface and the urogenitodigestive diaphragm will open up with possible trauma to anchoring of the cervix into this diaphragm when the head passes thru this opening it may further stretch/traumatize the tissues either bluntly or sharply

iv cut-thru trauma

when the passing of the head thru the birth canal goes too quick or when the birth canal is not fully dilated and the tissues have not time to stretch the head may cut thru the tissues either bluntly or sharply as
blunt cut-thru
in combination with stretching the bilateral ledges of the puborectalis muscles may be traumatized
in combination with stretching the perineum outlet diaphragm may be traumatized resulting in a wide introitus
sharp cut-thru
when the cervix is not fully dilated the head may further traumatize the cervix and its anchoring into the intrapelvic urogenitodigestive diaphragm
when the perineum outlet is too stiff the head may cut thru the perineum, sphincter ani and rectum resulting in the complex sphincter ani rupture

v shifting/shearing
when the head of the infant passes thru the birth canal always shearing will take place in minor or major form
between the head and the vagina wall
between the vagina wall and the intrapelvic urogenitodigestive diaphragm,
between the urogenitodigestive diaphragm and its attachment to the pubis bone and obturator internus muscle fascia and
between the arcus tendineus of the levator ani muscles and the obturator internus muscle fascia

vi compression trauma
when the head passes thru the vagina there will be compression of the soft tissues between the hard fetal skull and the hard maternal bony pelvis
normally this is not a problem during physiologic childbirth but when obstructed labor develops which is not relieved in time pressure necrosis will develop in an endless variety; from minimal to extensive anatomic tissue loss, with fistula development

vii iatrogenic trauma
additional trauma by episiotomy, by vacuum, by forceps, by internal version and pedal extraction, by craniotomy or by cesarean section

viii eclampsia
may cause death, stroke, mental confusion, transitional blindness

discussion
there are always tissue changes and tissue trauma during pregnancy and childbirth even in physiologic pregnancy/labor
normally these changes/trauma will be resolved during the involution period of the puerperium though small defects may remain
repeat pregnancies/deliveries will repeatedly add to these small defects and may result in real pathologic defects
however, when labor becomes obstructed and this is not relieved in time by active intervention pressure necrosis will develop resulting in an endless variety of anatomic tissue loss with devastating consequences for the woman affected

conclusion
the obstetric fistula is more than only a fistula and has to be handled within the context of the complex obstetric trauma
defects intrapelvic urogenitodigestive diaphragm
with and without anatomic tissue loss

mechanism of pathophysiologic action

downward intraabdominal pressure upon the intrapelvic urogenitodigestive diaphragm may lead to defects within this diaphragm

the downward pressure increases during the course of pregnancy with highest pressure at the median just where the cervix is anchored into the intrapelvic urogenitodigestive diaphragm

the broadest part of the pubocervical musculofascia is in between the ischium spines where it stabilizes and secures the cervix and

this is exactly where splitting/division of the longitudinal smooth muscle/collagen fibers at the median starts and then continues from proximally to distally with bilateral retraction of the fibers towards the pelvis wall

normally the most distal 1-2 cm stay intact since the short span is able to withstand the pressure and the smooth muscle/collagen fibers are longitudinal and transverse

it is good to remember that during childbirth itself the pressure changes from downward caudad to upward cephalad and that semicircular compression and shearing occur at where the fascia is attached to pubis bone and atf

so, other locations are possible as well

in prolonged obstructed labor pressure necrosis may develop and lead to anatomic tissue loss defects at any location within the intrapelvic urogenitodigestive diaphragm

then there may be direct trauma (penetration, surgery) and trauma due to infection

defects within the intrapelvic urogenitodigestive diaphragm

there are two types of defects viz defects without anatomic tissue loss like those due to intraabdominal pressure or shearing and defects with anatomic tissue loss varying from minimal to (sub)total loss like those due to pressure necrosis in prolonged obstructed labor or due to infection or due to surgery

a defects without anatomic tissue loss

since it is the first line of withstanding intraabdominal hydrostatic pressure especially during pregnancy and also withstanding shearing forces during sexual intercourse and physiologic vaginal childbirth

it is clear that defects may develop whilst weakening the intrapelvic urogenitodigestive diaphragm in varying degrees from minor to extensive
it is good to realize that during pregnancy the direction of long-term pressure is from cephalad to caudad whilst during childbirth the short-term pressure is from caudad to cephalad upon this diaphragm

since it has multiple functions, like supporting the urine continence mechanism and securing the organs in their anatomic position, defects within the diaphragm will have different effects depending upon their location

the possibilities are as following: anterior, median, lateral, central and posterior; isolated or in any combination

**anterior defects**
with weakening of the urine continence support since the posterior urethra wall will “rotate backward” away from the symphysis causing vesicalization of the (proximal) urethra since fixed/adhesive anterior urethra wall

by this mechanism genuine or postrepair intrinsic stress incontinence develops

**median longitudinal defects**
derpending upon its location the posterior urethra, bladder base may herniate thru this defect into the zero-pressure vagina and eventually prolapse to the outside only if there is also concomitant weakening of the support or dorsal-directed pull on the posterior urethra wall towards the sacrum the urine continence mechanism may be involved

**central defect**
the cervix/uterus will herniate thru this defect into the vagina and then may prolapse unopposed to the outside thru the hernia-prone opening in the pelvis floor dragging the proximal vagina wall with it like intussusception only infrequently if there is concomitant weakening of the support or dorsal-directed pull on the posterior urethra wall towards the sacrum the urine continence mechanism may be involved

normally there is full urine continence in (sub)total 3° cervix/uterus prolapse c3 and c4 even with a urethra length of only 0.5-1 cm however, with increased longitudinal bladder diameter, shortened urethra and narrow external urethra opening

**posterior defect**
this will result in herniation of the intraperitoneal contents into the zero-pressure vagina or if further posterior herniation of the anterior rectum wall into the vagina

**lateral defects at atf**
this will result in loss of tonus of the intrapelvic urogenitodigestive diaphragm and an increase in the caudad/cephalad movements but not in herniation/prolapse of an organ thru this defect

**lateral defects of the fascia sheath in between the atf and atlam**
this will result in medial displacement of the atf with loss of tonus and hypermobility of the intrapelvic urogenitodigestive diaphragm but not in herniation/prolapse of an organ thru this defect

**other location**
due to penetrating trauma or forceps delivery or vacuum delivery
b defects with anatomic tissue loss

it is good to realize that in any obstetric urine fistula there is anatomic tissue loss of the pubocervical musculofascia as well

the extent and location of pressure necrosis lesions in prolonged obstructed labor may be from minimal to extensive and from one location to the other in an endless variation which makes the obstetric trauma so intriguing

circular punched out defects
the same size as the fistula or (slightly) bigger than the fistula

transverse curved defects
bigger than the fistula whereby the fistula is somewhere within this defect

quartercircular defects
with partial or total anatomic loss of atf and atlam and possible partial loss of levator ani muscles, obturator internus muscles and obturator membrane
with fistula formation and possible opening of the paravesical spaces

semicircular defects
with partial or total anatomic tissue loss of atf and atlam; and with partial tissue loss of the levator ani muscles, obturator internus muscles and obturator membrane; eventually with bare bones
with fistula formation and opening of the paravesical spaces

(sub)total pubocervical musculofascia loss
regularly (sub)total fascia loss with extensive fistula formation and anterior vagina wall loss and total loss of atf and atlam and (partial/extensive) loss of levator ani muscles, obturator internus muscles and obturator membranes is found with bare bones in a so-called empty pelvis

(sub)total urogenitodigestive diaphragm loss
from time to time total loss of the whole diaphragm may be found with extensive soft tissue loss resulting in extensive urine/stool fistulas as cloaca; for these unfortunate women nothing can be done

however, anatomic tissue loss may also be found

due to surgery whereby tissue is excised

or due to necrotizing infections like postmeasles noma vaginae

reconstructive surgery

it is important first to identify the real (extent of the) defect(s) and then reconstruct the functional anatomy meticulously using autologous structures so that normal physiology will be ensured whilst
special attention has to be given that all fascia structures are firmly (re)connected to the cervix as the centrum tendineum intrapelvinum
discussion

the intrapelvic urogenitodigestive diaphragm as specialized structure of the corpus intra
pelvinum is an important dynamic structure

it constitutes a real diaphragm with the cervix as its center with a small anterior median
opening for the urethra and a larger posterior median opening for the rectum

separating the distal urinary tract, proximal genital tract, intraperitoneal contents and
distal digestive tract (rectum) from the zero-pressure vagina

counteracting as first line the hydrostatic intraabdominal pressure (rise) due to the non-
fatigue tonus of its smooth muscle component either by increase or relaxation under
autonomic nervous coordination; the rest pressure is dealt with by the pelvis floor
structures

contributing to intraabdominal compression pressure by increase in its tonus as reflex
action by the sympathetic nervous system

contributing to securing and stabilizing the pelvis organs in their variable anatomic
position and as such

supporting the anatomic urine and genital continence mechanisms

defects in this diaphragm are rather common and may be due to (increased) hydrostatic
pressure, shearing by vaginal childbirth, pressure necrosis during prolonged obstructed
labor, penetrating trauma and necrotizing infection; as also influenced by hormonal and
ageing processes

depending upon (the large variety of) the anatomic location and extent of these defects
the following is possible

intrinsic stress incontinence, ?cervix incompetence?, urethrocele, vesicocele, cervix
prolapse, enterocoele and rectocele; either isolated or in combination

there is a clear correlation between genuine intrinsic urine incontinence, cystocele and
cervix prolapse with a wide pubic arch of ≥ 90° as indication of wide pelvis

simply since the wider the pelvis the broader the span by the diaphragm and the more
chance the longitudinal fibers will split/divide in the midline; with its weakest point just
anteriorly from the cervix where the span is the widest

though lateral defects due to hydrostatic and/or shearing atf level and lateral defects in
the narrow triangular fascia sheath between atf and atlam are possible this will not lead
to herniation of the posterior bladder wall thru these defects into the vagina

at least the author has not encountered this as the cause of cystocele; the only time the
author encountered a lateral defect with cystocele formation was in a patient who
developed a fourth obstetric fistula after successful repair of three previous obstetric
fistulas including an extensive type IIBb
in quartercircular and semicircular defects with anatomic tissue loss of the intrapelvic urogenitodigestive diaphragm and with fistula formation ensuring an empty bladder, another mechanism comes into play according to the natural tissue forces which is the opposite of what one would expect due to the balloon-like structure of the bladder with anterior bladder wall adherent/sticking to the posterior symphysis this will result in anterior and cephalad pull onto the posterior bladder (neck) wall whereby the loose pubocervical musculofascia is pulled as well and will re-attach onto the posterior pubis bones and bilateral pelvis wall at a more anterior and cephalad level due to the natural tissue forces actually, the saucer-like shape of the empty bladder in the normal anatomic situation is caused by the fact that the fixation of the posterior bladder wall onto the urogenitodigestive diaphragm prevents the natural tissue forces from adapting the posterior bladder wall onto the anterior bladder wall

in identifying the intrapelvic urogenitodigestive diaphragm look for smooth muscle tissue
intrapelvic urogenital diaphragm

small anterior trauma

large anterior trauma

longitudinal trauma

longitudinal trauma

large longitudinal trauma
anterior longitudinal median trauma

anterior trauma atf/atlam loss

transverse trauma

transverse trauma

atf/atlam loss

quartercircular trauma

semicircular trauma
remarks about pelvis organ prolapse

the author is privileged to study the experiments of nature about the prolapse mechanism in the female as presented by the complex obstetric trauma

his findings of anatomic tissue loss, his physiologic operation techniques to step-by-step reconstruct the functional anatomy, his evidence-based results and his theory are in sharp contrast with the current theory about prolapse in the female

functional pelvis anatomy

the pelvis organs with their supply structures are embedded into the connective tissue organ of pelvis = corpus intrapelvinum and suspended/connected to the pelvis wall and to each other by highly specialized structures of this connective tissue organ

however, there is no direct anatomic connection between the pelvis organs and the pelvis wall and/or floor

except for the fact that the continence mechanisms of the urinary tract, genital tract and digestive tract are anchored into the perineum outlet diaphragm as pelvis floor

the corpus intrapelvinum with its highly specialized structures is responsible for the variable anatomic position of the pelvis organs in all possible body positions and all physiologic filling phases of the pelvis organs

the perineum outlet diaphragm = pelvis floor is the ultimate barrier between the pelvis contents and the outside; the same function as the anterior abdominal wall; though with the anchored continence mechanisms as outlet

and in quadrupeds this structure is the side wall with anchored continence mechanisms and the anterior abdominal wall the floor of the abdominopelvic cavity

so the abdominopelvic side wall in quadrupeds became the floor in bipeds

one highly specialized structure of the corpus intrapelvinum is the intrapelvic urogeni todigestive diaphragm with cervix as its center

which separates the high-pressure organs of the distal urinary tract, proximal genital tract and cervix, intraperitoneal contents and distal digestive tract from the zero- or low-pressure vagina

and if intact keeps the pelvis organs in their anatomic position and

as such supports the urinary, genital and digestive continence mechanisms and

prevents the high-pressure organs from entering the zero- or low-pressure organ the vagina
the levator ani muscles form part of the lateral walls of the pelvis and also belong to the pelvis floor = perineum outlet diaphragm as combined with perineal membrane, perineal body, transversus perinei muscles, bulbocavernosus and ischiocavernosus muscles and posteriorly sphincter ani complex and levator plate with anococcygeal ligament, (ischio)coccygeus muscles and sacrospinal ligaments

despite the functional anatomy, though contrary to popular belief, the pelvis floor structures as perineum outlet diaphragm can neither prevent nor stop the process of pelvis organ prolapse; and do not play a role of paramount importance

as it is far more logical and surgically proven that defects within the intrapelvic urogenito digestive diaphragm are involved in the development of (urethro)cystocele and cervix prolapse and rectocele as pelvis organ prolapse

real mechanism of action in prolapse

median defects of the fascia are involved in the development of (urethro)cystocele since the posterior bladder and/or urethra wall herniate thru the defect

transverse, quartercircular, semicircular and lateral defects are also possible but these lead not to cystocele; when these defects occur the loose intrapelvic urogenitodigestive diaphragm seems to move anteriorly and cephalad due to retraction of the bladder towards fixed anterior bladder wall; due to the natural forces in a balloon like structure where one side is fixed

median/central defects of the intrapelvic urogenitodigestive diaphragm in combination with loosening of scarouterine, broad and cardinal ligaments may lead to cervix/uterus prolapse and the cervix will herniate thru the median defect

median defects do occur since the span is too wide and the weakest point is the median where the longitudinal fibers may split/divide due to hydrostatic and intra peritoneal compression pressure; and the defect becomes larger and the fascia retracts bilaterally towards the arcus tendineus fasciae due to the elastin and muscle fibers and becomes thicker; since the span is the widest proximally in between the ischium spines that is where it starts and then moves distally whilst normally over the last distal 2 cm the fascia will stay intact since here the span is narrow

the wider the pelvis the greater the chance that this will happen; therefore normally (urethro)cystocele and cervix prolapse are combined with a wide pelvis with pubic arch of > 90° as found by the author during his surgery

pregnancy and childbirth may accelerate these processes though prolapse may be found in nulliparous patients as well

during the course of pregnancy there is increasing (due to increasing fetus weight) hydrostatic pressure upon the intrapelvic urogenitodigestive diaphragma from cephalad to caudal; as well the diaphragm strengthens first and then softens up under hormonal influences
during actual childbirth the pressure upon the intrapelvic urogenitodigestive diaphragm changes 180° and becomes from caudad to cephalad during a short period whilst the cervix and with it the diaphragm opens up

lateral defects of the pubocervical musculofascia are normally not involved in cervix prolapse; however, they may be found in extensive obstetric trauma in combination with other pressure necrotic lesions of broad, cardinal and sacrouterine ligaments even in patients with narrow pelvis with pubic arch of $\leq 80°$ and then lead to cervix prolapse which is seldom

once the prolapse has started the organs may slide unopposed thru the vagina towards the outside thru the opening(s) in the pelvis floor as perineum outlet diaphragm

the emperor's clothes

some of these things the author considers like the emperor's clothes: nobody is willing or able to contradict the sayings of experts in order not to be ridiculed in public

also the author cannot follow the mri images and ultrasound images where somewhere an arrow points to something vague

the author prefers to rely on his own eyes during the course of surgery

the author cannot skip the feeling that those theories have been developed to back up the artificial products of the multi-billion dollar medical industry

consequences for reconstructive surgery

in female genital prolapse the defective structures have to be identified exactly so that the available autologous structures are used in the real reconstruction of the functional pelvis anatomy

the corpus intrapelvinum is responsible for the suspension of pelvis organs whilst

the pelvis floor can neither prevent nor stop pelvis organ prolapse

the anterior vagina wall lacks the stiffness and pressure dragging the diaphragm down instead of pushing it up
it seems the pop-q system has been developed by theoreticians who have no evidence-based practice, the same as other types of strict protocols, since

in real reconstructive surgery practice things look different

first question

the most prominent body position in pelvis organ prolapse is squatting + cough since then the hydrostatic pressure on the organ is the greatest; as followed by the standing position

already in the lying position the hydrostatic pressure is far less and gravity forces onto the organ(s) change direction pulling them back towards and into the pelvis cavity

even more so in the exaggerated lithotomy position

so even with traction applied and under anesthesia with full relaxation a cervix prolapse c4 may become a c3 and a cervix prolapse c3 may become a c2

**squatting + cough is the ideal position** to determine the degree of prolapse; followed by standing

but **is this feasible??** surgeon lying on the floor in front measuring in cm

whilst normally the quantification is done under anesthesia just before the surgery is started in the lithotomy position

second question

in most of the patients the author operated there was no sign left of the hymen ring so it makes more sense to use the introitus as reference point even though it is not sharply demarcated; but far better than a non-existing reference point

third question

what about the causative defects within the intrapelvic urogenitodigestive diaphragm as highly specialized part of the corpus intrapelvinum which actually will determine the type of prolapse and the type of reconstructive pelvis surgery

conclusion

the pop-q system is of some value as a guideline but on its own has no value for type of reconstructive operation procedure and outcome of surgery
abbreviations

vvf  =  vesicovaginal fistula
rvf  =  rectovaginal fistula
uvvf =  urethrovaginal fistula
vcvf =  vesicocervicovaginal fistula
vuvf =  vesicouterovaginal fistula

cx   =  cervix
avw  =  anterior vagina wall
pvw  =  posterior vagina wall
pcmf =  pubocervical musculofascia
atf  =  arcus tendineus fasciae
atlam=  arcus tendineus of levator ani muscle
lam  =  levator ani muscle
pcm  =  pubococcygeus muscle
ilcm =  iliococcygeus muscle
iscm =  (ischio)coccygeus muscle
iom  =  obturator internus muscle
pm   =  piriformis muscle
sul  =  sacrouterine ligament
bl   =  broad ligament
cl   =  cardinal ligament

ch   =  charrière
g    =  gauge
h    =  hegar

p    =  parity
sb   =  stillborn
cs   =  cesarean section
sth  =  subtotal hysterectomy
tah  =  total abdominal hysterectomy
tvh  =  total vaginal hysterectomy
euo = external urethra opening
iuo = internal urethra opening
uv(-junction) = urethrovesical (junction)

euo/f = distance between euo and fistula
f/c = distance between fistula and cervix
f/v = distance between fistula and vagina vault;
euo/b = distance between euo and catheter balloon
euo/bw = distance between euo and bladder wall (fundus)
a/f = distance between anus and (rectovaginal) fistula
i/v = distance between introitus and vagina vault; vagina length

pa = pubic arch
ap = anterior to posterior pelvis diameter
ar = anal reflex

gm = gastrocnemius muscle
sm = soleus muscle
at = achilles tendon

min = minute
hr = hour
wk = week
mth = month
yr = year

R = right
L = left

bladder capacity by longitudinal diameter (euo/bw minus euo/b)
small < 4 cm
moderate 5-6 cm
normal 7-12 cm
transitional 13-15 cm
increased > 16 cm
normal measurements

vagina length  10-12 cm

euo/c  6-7-8 cm

anatomic urine continence mechanism  4-5 cm

anatomic stool continence mechanism  4-5 cm

urethra length  3.5-4 cm

longitudinal bladder diameter (euo/bw minus euo/b)  7-12 cm

anorectum  4-5 cm

symphysis  5-6 cm broad
axis inclination  30-45° as to horizontal in the upright position

pubic arch  85-90°

atf  7.5-8 cm
inclination  25-30° as to horizontal from pubis bone to ischium spine

atlam  7-7.5 cm
inclination  25-30° as to horizontal from pubis bone to ischium spine

angle between symphysis and atf/atlam  110-125°

inter ischium spine distance  8-9 cm

inter ischium tuberosity distance  10-11 cm

pelvis inlet plane  inclination 55-60° to horizontal from superior symphysis edge to promontory in the upright position

pelvis outlet  10-15° to horizontal from inferior symphysis to tip of coccyx in the upright position

anterior triangle pelvis outlet from inferior symphysis to ischium tuberosity in one plane with -10 to -15° inclination to horizontal in upright position

posterior triangle pelvis outlet from ischium tuberosity to tip of coccyx in one plane with 65-70° inclination as to horizontal in upright position

pelvis outlet surface 75-80 sq cm

gap between puborectalis edges  25-30 sq cm

diameter recta from inferior symphysis up to tip of coccyx 9.5 cm; up to 10.5-11 cm during delivery
ashton-miller j a and delancey j o l
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