Update

Surgical mesh reconstruction for post hysterectomy vaginal vault prolapse. Part I: Introduction, pathophysiology, diagnosis

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Abstract: Pelvic organ prolapse (POP) entailing many subgroups as vaginal wall relaxation, uterine prolapse, post hysterectomy vault prolapse (PHVVP) and others, occurs with up to 50% of parous women. It was reported to cause a variety of urinary, bowel and sexual symptoms and to necessitate surgical correction in 11% of the female population. Up to 30% of all females suffer from pelvic floor relaxation which has progressed to a level which has a negative impact upon their quality of life. Hysterectomy probably results in damage to the integrity and blood supply of the endo-pelvic fascia as well as to the innervation of the pelvic floor musculature. This might potentially contribute to a subsequent POP manifestation. As well as a lack of data, there is considerable debate as to the role of vaginal hysterectomy in POP repair, with opinion divided whether hysterectomy is essential or contra-indicated for a long lasting repair. The natural history of post hysterectomy pelvic floor status has never been looked at properly to determine whether the prolapsed uterus should be removed or preserved in terms of POP cure. The perioperative complications and general QoL outcomes including the impact on female body image and sexuality following hysterectomy in comparison with preservation of the prolapsed uterus or uterine cervix is also controversial. Nevertheless, post hysterectomy vaginal vault prolapse commonly challenges the healthcare practitioner, requiring a thorough understanding of the surgical pathology and adequate skills to treat it. Various aspects of PHVVP are discussed in depth, including pathophysiology, management, complications, and associated pathologies.

Key words: Post hysterectomy vaginal vault prolapse; POP; Prolapse surgery; Prolapse mesh reconstruction; Recommendations.

1. POST HYSTERECTOMY VAGINAL VAULT PROLAPSE: BACKGROUNDS

The accurate occurrence of post hysterectomy vaginal vault prolapse (PHVVP) is obscure. It is presumed that the reported rate only reflects the tip of the iceberg. Pelvic organ prolapse (POP), entailing many subgroups such as vaginal wall relaxation, uterine prolapse, PHVVP and others, occurs in up to 50% of parous women. It was reported to cause a variety of urinary, bowel and sexual symptoms and to necessitate surgical correction in 11% of the female population. Up to 30% of all females suffer from pelvic floor relaxation which has progressed to a level which has a negative impact upon their quality of life. The affected women frequently require manual assistance to urinate and report frequency, urgency and urge incontinence as well as sex and bowel function-related symptoms. The lifetime risk of undergoing prolapse surgery is one in eleven; whereas up to 30% of those who underwent surgery eventually will have repeat prolapse surgery, part of them after hysterectomy. Being age-related, it is assumed that the prevalence of POP will further increase with the ageing of the population.

2. VAGINAL APEX SUPPORT NATURAL ARCHITECTURE

Based on cadaver dissections, three pelvic levels of support are described: the first relates to the upper vagina, found to be suspended with paravaginal tissue fibers, connected to the cardinal ligaments. The second one supports the mid vagina by fibers connecting it to the arcus tendineus facia pelvis and the levator muscles. The lower vaginal part is supported with the perineal membrane and the perineal body. These vaginal supporting fibers and ligaments are actually condensations of the endo-pelvic fascia, forming anterior support: the cervico-pubic ligaments, lateral support: the cardinal ligaments and posterior support: the sacro-uterine ligaments. The endo-pelvic fascia attaches the supportive pelvic floor musculature, mainly the levator muscles to the vagina, assembling the supportive effect. The pelvic floor plate consists of the endo-pelvic fascia and musculature (mainly the levator muscles) and forms a supportive trampoline. This pelvic floor anatomical specific unit is ligamentarily stretched both on the antero-posterior and lateral dimensions. Thus, carrying the pelvic organs, it enables their proper function.[4-5]

3. POST HYSTERECTOMY VAGINAL VAULT PROLAPSE: DEFINITION.

Prolapse is defined as protrusion of an organ or structure beyond the normal anatomical position. Mild prolapse is very common and is generally not associated with quality of life impairment, thus it is regarded as a non-pathologic situation. PHVVP, according with Baden classification is defined as: 1st degree: the vaginal vault is slightly descended from the natural level, 2nd degree: the vaginal vault is visible at the introitus, 3rd degree (procidentia): the vaginal vault is protruded out of the introitus, at any extension. Prolapse of the apical segment of the vagina was redefined by the International Continence Society Standardization Committee, on 2002, to be: "any descent of the vaginal cuff scar (after hysterectomy), below a point which is 2 cm. or more, less than the total vaginal length above the plane of the hymen", and the prolapse degree is defined according with the ICS Pelvic Organ Prolapse Quantification System (POPQ). According with the POPQ is the normal position of the vaginal apex (C point) level measured 8 cm above the genital opening, hence defined as (-)8. Total vaginal vault prolapse is measured as 8 cm below the genital opening, defined as (+)8. The vaginal vault prolapse might be isolated or combined with prolapse of the anterior vaginal wall and anterior pelvic floor compartment, including bladder prolapse (cystocele) and/or urethral prolapse (urethrocele) at various degrees. Similarly the posterior vaginal wall and the posterior compartment of the pelvic floor may be affected by the supportive defect, and enterocele, rectocele and/or perineal body damage can be associated with the apical prolapse.[6]

4. POST HYSTERECTOMY VAGINAL VAULT PROLAPSE: INCIDENCE

Pelvic organ prolapse is very common, and to some degree normal, especially among older women. Over all

pelvic organ prolapse (POP) may occur in up to 50% of parous women. It is reported to significantly impair quality of life and necessitate surgical correction in 11% of the female population. Up to 30% of those who underwent surgery will have repeat prolapse surgery for failure within 3 years. The accurate incidence of over all vaginal apex supportive defect and particular PHVVP has never been properly evaluated. It is probably correct to assume that hysterectomy, vaginal rather than abdominal, aggravates the risk for further vaginal prolapse. This might be due to surgical damage as well as to unaddressed preexisting weakness of the pelvic floor. It is widely accepted that the reported rate of post hysterectomy vaginal vault prolapse reflects only the iceberg tip of the problem and that the accurate incidence of it is yet poorly defined.[7-9]

5. POST HYSTERECTOMY VAGINAL VAULT PROLAPSE: RISK FACTORS

Pelvic floor relaxation and pelvic organ prolapse is related to some well established risk factors. Among those are parity, obstetrical pelvic floor trauma, obesity, tobacco smoking, aging, chronic bronchial asthma and constipation. All these are regarded as related to increasing intra-abdominal pressure. Then, extra strain is applied to the supportive structure and pelvic nerves, yielding further damage and eventually prolapse of various degrees. Another risk factor is lately identified - the tissue factor. The tissue inherited strength is gaining recognition as a crucially important one, manly the tissue collagen content and structure. Patient having a bio-molecular alteration with the collagen amount, architecture, bio-degradability or production, might be predisposed to POP. This condition may arise from a genetically inherited predisposition. Post hysterectomy vaginal vault prolapse could be related to surgical factors, as failure to suspend the vaginal apex to the sacro-uterine ligaments or further suture break down. This might be due as well to unaddressed preexisting weakness of the pelvic floor, rather common with circumstances attached to vaginal hysterectomy performance.[10-12]

6. POST HYSTERECTOMY VAGINAL VAULT PROLAPSE: SYMPTOMS.

Symptoms may be vague, and are not necessarily indicative of the degree of prolapse. In extreme prolapse the lump emerging from the introitus may interfere with simple daily activities as walking and sitting. A significant degree of cystocele, enterocele, rectocele and enlarged vaginal hiatus is often associated with specific symptoms such as urinary urge and stress incontinence, urgency and frequency, urinary obstruction. Pelvic floor relaxation may mask stress incontinence which becomes evident after surgical correction of the prolapse. Posterior pelvic floor compartment relaxation might be associated with fecal urgency and frequency, urge and stress incontinence. In general, POP might lead to sexual intercourse mechanical impairment; negatively affecting the body image and self esteem of the patient and cause severe QoL impairment. The POP women frequently require manual assistance with prolapse reduction for facilitation of urination and defecation. The association between the site of anatomical defect, the nature and degree of prolapse and the symptoms is comprehended with the aetiology of the pelvic floor relaxation on the function and malfunction of the pelvic organs. Understanding the causative factors enables targeted corrections of specific defects to preserve and restore physiological pelvic organs functions.[13-16]

7. POST HYSTERECTOMY VAGINAL VAULT PROLAPSE DIAGNOSIS: ANATOMIC AND FUNCTIONAL CLINICAL ASSESSMENT

Accurate POP diagnosis is crucial for proper design of comprehensive therapeutic plan. Therefore, obtaining patient history is the key to understanding the patient's needs and expectations. Pre-interview completion of pelvic floor impact questionaires may help to clarify the impact of prolapse on quality of life. Then a pelvic examination under Valsalva maneuver is mandatory, as post hysterectomy vaginal vault prolapse frequently coexists with anterior and posterior vaginal walls prolapse. Differential diagnosis and accurate mapping of the patient’s whole pelvic floor is essential. It is easy to differentiate as the bladder neck is clearly seen when it is not emptied, as the anterior vaginal wall is normally rich with rugae, the cervix or the dimpled points marking the sacro-uterine ligaments insertion are visible to define the vaginal apex. The posterior vaginal wall with entero-rectocele is defined-able as well. Prolapse level of each and every site of the pelvic floor is to be properly determined by any acceptable measurement method, both for therapy planning and for cure assessment. Other issues of importance are the vaginal mucosa status (local estrogen therapy might be considered to reinforce this tissue when atrophy is present prior to surgery), evidence of urinary and fecal incontinence, hiatus dimensions and perineal body integrity. Functional impairments, related to the pelvic floor herniation process, such as urine and fecal storage and emptying problems and sexual intercourse difficulties are to be addressed when clinical pelvic floor assessment is carried out. All these above mentioned anatomical defects and functional deprivations might coexist with various combinations and different prolapse degrees. The preoperative clinical data collection should be accompanied by some laboratory studies. Further to the standard preoperative ECG, chest x-ray, blood and urine analysis, ultrasound scan might be of benefit to rule out coexisting pelvic organ pathology including urinary obstruction. In the presence of fecal storage or passage abnormality is an ano-rectal work-up indicated. The accurate place of urodynamic studies in terms of pointing the best therapeutic approach and prediction of cure or complication rates is in dispute. Many argue the benefit to be of no clinical value while others claim that the information provided enriches the understanding of the individual pathological backgrounds and hence improves the treatment.[17-19]

8. POST HYSTERECTOMY VAGINAL VAULT PROLAPSE: DIAGNOSIS, QUALITY OF LIFE (QOL) ASSESSMENT

Given that the main therapeutic goal is restoration of the pelvic function rather than anatomical reconstruction, one must acknowledge the importance of QoL assessment tools. These tools, namely validated questionnaires, are crucial for both, preoperative as well as postoperative evaluations. Comparison of the two will determine the true treatment value from the patient’s point of view. The surgeon's judgment was found to differ largely from the self reported patient's perspective, as the physician tends to strongly underestimate the patient's complaints, this is partially explained with complains being relatively mild, thus not mentioned at the interview. Another bias leading to the surgeon's – patient's judgment discrepancies emerges out of slight differences with the questions presented to the patient at interview and on the questionnaires: the questionnaires were validated properly, while the frontal interview verbal communication varies profoundly. The use of pelvic floor oriented and validated questionnaires is of great importance

for proper preoperative evaluation and therapeutic plan design. Among the frequently used questionnaires are the IIQ-7 and the UDI-6.[20]

9. POST HYSTERECTOMY VAGINAL VAULT PROLAPSE: PATHOPHYSIOLOGY

The causative process leading to pelvic floor supportive impairment yielding PHVVP, is presumed to be multifactorial: age, genetic connective tissue weakness, previous obstetrical trauma and poor surgical technique. Pelvic surgery is a major contributing factor for the occurrence of prolapse, but genetic factors, leading to connective tissue metabolism and biochemistry impairment, are important cofactors responsible to connective tissue weakening and POP formation. This explains the familial occurrence often seen with POP, and was demonstrated to be related to alterations with collagen total content and variants, cross linking, morphology and biodegradability. The female patient age is widely accepted as contributing to POP, especially with true procidentia. This age to POP correlation is mostly significant up to the sixth decade of life. This might be a result of estrogen deprivation at the menopause. Vaginal delivery is strongly attached to future POP as the pelvic supportive components, mainly the levator ani muscles and endopelvic fascial ligaments might be severely and irreversibly traumatized during the fetal journey through the birth canal. Previous pelvic surgery, especially retropubic colposuspension, is accepted to be associated to further apical and entero-rectocele formation, related to the change with vaginal longitudinal axis. When hysterectomy was previously performed, all the above mentioned conditions might be cofactor to the surgical damage caused at hysterectomy to the endopelvic fascial and ligamentary supportive architecture. Hysterectomy, vaginal more than abdominal, is often performed with preexisting pelvic floor relaxation at various degrees, frequently improperly addressed at surgery. Thus, an accurate indication, other than prolapse, should ground the indication for hysterectomy, especially with POP conditions, and uterine cervix sparing hysterectomy should be considered when adequate. These might contribute to PHVVP prevention by both avoiding surgical injury leading to herniation, and pelvic fascial, neural and vascular damage as well as preservation of the pelvic ligamentary architecture to be recruited for the reconstructive efforts. Previous pelvic floor reconstructive surgery was shown to increase by 12 the incidence of further prolapse reoccurrence necessitating reoperation, and it was unrelated to hysterectomy performed for non prolapse reasons. Others found that 12 months post POP reconstructive surgery prolapse recurred in 58% of the patients.[21-22]

10. POST HYSTERECTOMY VAGINAL VAULT PROLAPSE MESH RECONSTRUCTION: ANATOMIC AND FUNCTIONAL OUTCOME ASSESSMENT

After completion of the therapy, the accurate outcome is to be properly assessed, especially on research setups and when adopting new techniques. The postoperative anatomical pelvic floor under Valsalva maneuver status should be assessed properly using an accepted prolapse quantification method as the Baden or the ICS POP-Q system. The patient is frequently reluctant to report dissatisfaction with the therapeutic results, considering that as impoliteness regarding the surgeon. Hence, the objective and independent patient self assessment validated questionnaires are an important tool for judgment of the accurate value of pelvic organ prolapse as for any other medical procedure. Thus, the accurate assessment of the various aspects of the pelvic floor relaxation related quality of life with validated questionnaires such as the IIQ-7 and the UDI-6 is essential.[23]

11. POST HYSTERECTOMY VAGINAL VAULT PROLAPSE MESH RECONSTRUCTION: REDUCING FAILURE RATE

Proper training, skill maintaining and keeping good surgical technique are the keys for failure rate reduction. Proper mesh arms introduction to accurate points at SS (Sacro-Spinous) ligament & ATFP (Arcus Tendineus Fascia Pelvis) on one side and secure anchoring to the vaginal apex or preferably to the cervical ring if not removed earlier on the other one, are crucial for long lasting apical support. Proper mesh flattening and fixation to both lateral pelvic aspects prevent mesh shifting and further lateral supportive defects.

12. POST HYSTERECTOMY VAGINAL VAULT PROLAPSE MESH RECONSTRUCTION: FAILURE MANAGEMENT

Vaginal vault prolapse reoccurrence might be due to detachment of the mesh arms from the anchoring points at the supporting pelvic ligaments or to vaginal vault, or to mesh shifting from lateral sidewalls. With either, should the failed surgical technique not be repeated but rather replaced by another technique. Thus, a failed vaginal procedure could be followed with an abdominal one and vice versa. As surgeons are generally familiar mainly with one single surgical method, referring the patient to an experienced colleague should be considered.

13. POST HYSTERECTOMY VAGINAL VAULT PROLAPSE MESH RECONSTRUCTION: ADEQUATE PATIENT SELECTION

The only indication for supporting the prolapsed vaginal apex is clear diagnosis of such. Hence, only patients with true PHVVP should be appointed to apical reconstructive surgery. Relative contraindications might be previous pelvic irradiation, immuno-depressive state, active infection, systemic steroid use and poorly controlled diabetes. Some of these patients might be subject to other therapeutic and palliative modalities as pessary placement or colpoclesis operation. Adoption of these guidelines will promotes success and reduces avoidable failures.[24]

14. POST HYSTERECTOMY VAGINAL VAULT PROLAPSE MESH RECONSTRUCTION: PATIENT INFORMED CONSENT

Patients enrolling for pelvic reconstruction must have informed consent. This consent should focus on the anticipated postoperative anatomical and functional prognosis including sexual activity and urine and feces storage and leaking problems. Patient's expectations from therapy, regarding each different aspect of physical function as well as quality of life improvement and impairment, arising from conditions related to pelvic organ prolapse and repair should be discussed. The post operative course including sexual and other physical activity restrictions, vaginal bleeding, discharge and pain, pointing the expected level and duration of each detailed feature should be pictured. The raw existing data concerning non-mesh against mesh implantation operations recurrence rate must be presented, as well as other data concerning mesh implantation, complications nature and rate, specific surgeon's training and experience and other commonly performed operations. All these will properly prepare the patient for the operation she is scheduled for, re-adjust her expectations and reduce unrealistic fantasies and improve satisfaction.

15. POST HYSTERECTOMY VAGINAL VAULT PROLAPSE MESH RECONSTRUCTION: PREOPERATIVE MEASURES

The operation related morbidity was never proved to reduce with prophylactic antibiotics, enema, bowel preparation, lower extremities bandaging, indwelling urethral catheter and even vaginal antiseptic lavage. Nevertheless not supported by any solid data, these measures are widely used for theoretical preventive benefits.

16. POST HYSTERECTOMY VAGINAL VAULT PROLAPSE MESH RECONSTRUCTION: INTRAOPERATIVE SAFETY MEASURES

Bladder drainage with urethral catheter was never proved as beneficial in terms of urethral and bladder injury reduction; some feel though that unemptied bladder provides better burdens anatomical identification, thus correct dissection and bladder protection might be facilitated with a filled bladder. The mode of anesthesia was shown to have no influence on cure rates and safety levels; intraoperative cough test was not proved to reduce the failure rate of the anti incontinence surgical steps. Some do feel that performing this non physiological diagnostic measure might contribute to elevation of postoperative bladder outlet obstruction rate. No data supports the routine use of anticoagulant medications, neither is performance of routine diagnostic cystoscopy, either prior to surgery or at completion of the operation, unless iatrogenic bladder injury is suspected. Rectal examination was advocated following posterior compartment mesh implantation, as rectal injury was reported with such. Vaginal routine tampon packing at the end of surgery never proved efficacy with improving cure or with postoperative bleeding reduction. On the other hand this is causing significant discomfort and even pain to the patient.

17. POST HYSTERECTOMY VAGINAL VAULT PROLAPSE MESH RECONSTRUCTION: EARLY POSTOPERATIVE MEASURES

Pain management: the postoperative pain level is usually less that 5 according with a visual analog pain scale ranging 0 to 10. This is frequently dealt with oral analgesic medications repeated every 3 to 5 hours for 1 to 2 days. More effective analgesics are seldom indicated. Stool softeners are beneficial for easing defecation for the first postoperative week. Hospital stay varies between 24 and 72 hours after vaginal operations, depending on successful pain management. This is significantly longer after abdominal operation, as up to 7 postoperative hospitalization days are frequently then required. Recommendations regarding post operative activity restrictions refer mainly to refraining from sexual intercourse which is strictly forbidden for 6 weeks, in order to prevent dispareunia, suture break down and mesh exposure. Heavy lifting is usually advocated to be avoided as well as any other activities leading to increased intraabdominal pressure and local pressure applied the operative field before complete tissue healing is achieved. Follow up appointment is to be scheduled for the first and sixth postoperative month and yearly thereafter. At these, postoperative complications are to be looked for, including mesh exposure, granulation tissue formation, urine and feces storage and passage control impairments, sexual functions difficulties, vaginal or pelvic pain and various prolapse recurrence features.

18. POST HYSTERECTOMY VAGINAL VAULT PROLAPSE MESH RECONSTRUCTION: CONTINUOUS POSTOPERATIVE THERAPY

Patient's quality of life after operation might be improved with some simple adjuvant therapeutic measures, as stool bulking and softening agents to facilitate defecation. Bladder overactivity symptoms, such as urinary urgency, frequency and urge incontinence, either preoperatively existing or de novo appearing since, should be considered to be dealt with by anticholinergic medications. Local or systemic estrogens could nicely reduce vulvovaginal itching and dispareunia, by improving surface tissue atrophy. Physiotherapy for pelvic floor muscles reinforcement might often contribute to improving patient's quality of life regarding pelvic floor functions reestablishment.

19. POST HYSTERECTOMY VAGINAL VAULT PROLAPSE MESH RECONSTRUCTION: SURGICAL AND CLINICAL AVAILABLE DATA

Reviewing the literature for high level evidence concerning POP surgery reveals some important conclusions: The non-mesh operations anatomical and functional long term outcomes in terms of cure and complications are not well reported. This is true for vaginal hysterectomy for the cure of procidentia, for paravaginal and site specific prolapse repair, and for abdominal sacrocolpopexy as well. Nevertheless, vaginal sacrospinal fixation and abdominal sacrocolpopexy have remained the "gold-standard" for repair of vaginal apical suspension defects. Being less invasive, the vaginal approach is safer and is associated with fewer side effects, yet shorter lasting than the abdominal for the surgical cure of post hysterectomy vaginal vault prolapse repair. Similarly, the use of mesh was found to be justified in terms of postoperative prolapse recurrence and surgery related complications only for anterior pelvic floor reconstruction. Questions regarding the preferred mesh type, mesh for central and posterior pelvic floor compartment reinforcement and conservation of the prolapsed uterus remain improperly addressed and unanswered for the time being. As the relevant data referring to the various mesh armamentarium is rather poor as yet, the decision which mesh is to be used- if at all, depends heavily on individual surgeon's training and experience. This is obviously insufficient for properly supporting this decision, which should a clearly evidence based decision making process.[25-35]

20. POST HYSTERECTOMY VAGINAL VAULT PROLAPSE MESH RECONSTRUCTION: WELL ACCEPTED RECOMMENDATIONS.

A Cochrane review, analyzing 22 trials, including 2368 patients, shows that abdominal sacrocolpopexy (SCP) yields lower rates for POP recurrence and dispareunia when compared with vaginal colpo-sacro-spineous fixation (VCSSF). On the other hand, the VCSSF is shorter in terms of operation time and recovery period. Mesh implants where found to reduce prolapse recurrence at the anterior vaginal wall reconstruction, and the vaginal approach was found to be superior to the transanal for posterior compartment repair. Many other authors acknowledged the relative shortage of relevant data needed for proper decision making regarding the operation choice for POP cure, including PHVVP and that the evidence available is not significant to guide practice. At the same time is recognized an unacceptable high rate of recurrence with the non-mesh POP reconstructive surgery. Thus, it is widely agreed that meshes implantation should be further investigated prior to withdrawal of solid recommendations regarding their usage. Simultaneously, despite relative lack of evidence-based information regarding long term efficacy and safety, is the use of grafts for POP vaginal reconstruction growing rapidly. The mesh implantation must be considered carefully for

each potential candidate, taking into account that the ultimate goal is QoL improvement, by correcting both the anatomical and functional derangements. For the time being there are not any data based guidelines recommendation for proper patient and surgery selection, perioperative management and surgeon's training. There is a considerable debate regarding the performance of vaginal hysterectomy in association with POP surgery, whether is it beneficial or not.[36-41]

21. POST HYSTERECTOMY VAGINAL VAULT PROLAPSE MESH RECONSTRUCTION: TRAINING THE SURGEON

The preferred potential trainee for acquiring POP surgery skills must be expected to perform more than 20 operations with any specific POP type operation yearly, otherwise skill maintenance would not be feasible. Preliminary requirements are thorough theoretical knowledge regarding general pelvic floor medicine and familiarity with advanced pelvic floor surgery. The candidate training should be done with a very experienced trainer, and should include 20 operations of any type of surgery, to overcome the requested learning curve. Thorough knowledge and awareness concerning complications, including prevention, diagnosis and management is essential.[39,41]

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