Committee 5

Pelvic Organ Prolapse

Chairman

L. Brubaker (USA)

Members

R. Bump (USA),

B. Jacquetin (France),

B. Schuessler (Switzerland),

A. Weidner (USA),

P. Zimmern (USA),

R. Milani (Italy)

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L. Brubaker

R. Bump, B. Jacquetin, B. Schuessler , A. Weidner, P. Zimmern, R. Milani

I. PELVIC ORGAN PROLAPSE

Pelvic organ prolapse (POP) has a strong inter-relationship with the urinary tract. Urinary incontinence commonly co-exists with POP and the converse relationship is also true. Many studies that have been done for evaluation of urinary incontinence have not reported the effects of POP, thus limiting clinicians' ability to use the conclusions of the study for women with POP. Likewise, surgery designed to cure urinary incontinence may exacerbate POP necessitating further treatment, even further surgery. Thus, it is important for incontinence specialists to have a well-grounded understanding of POP in order to provide optimal patient care for the many women worldwide whose quality of life is impacted by pelvic floor disorders.

This chapter will provide an overview of evidence relating to POP, especially its interaction with the urinary tract. In addition, the significant gaps in knowledge will be highlighted focusing on high-priority opportunities for additional research.

II. ETIOLOGY OF PELVIC ORGAN PROLAPSE

Most of the literature regarding risk factors for POP is based on epidemiological studies (see section III), case control studies, and observational studies. A major qualification of the interpretation of epidemiological data is that association does not mean causation. Many epidemiological associations have been embraced without thoughtful confirmatory experiments.

The few studies that examine the association of POP with pregnancy implicate vaginal delivery as an important risk factor for POP. In the Oxford Family Planning Association prolapse epidemiology study parity was the strongest risk factor for the development of POP with an adjusted relative risk of 10.85 (4.65-33.81) [1]. While the risk increased with increasing parity, the rate of increase slowed after two deliveries. Samuelsson et al also found statistically significant associations of increasing parity and maximum birth weight with the development of POP [2].These same relationships relating POP to increasing parity and birth weight were observed in the case control study of women who developed prolapse under the age of 45 and in a clinical observational study of women over age 18 [3, 4]. Finally, a study of 21,449 Italian women attending menopausal clinics demonstrated a significant association between uterine prolapse and vaginal birth (OR for 3 births compared to none being 3.0 [2.1-4.3]) but not with delivery of a baby weighing >4500 grams [5]. To date, specific events of the birth process have not been studied sufficiently to identify them as risk factors for POP. Rinne & Kirkinen found no significant relationship of POP with forceps or vacuum delivery or the duration of the second stage of labor [3]. Klein et al found an association between episiotomy and diminished pelvic floor strength three months post partum but not with subjective symptoms of bulging [6]. In contrast, Taskin et al showed that routine episiotomy when combined with antepartum [7]. Kegel exercises were as effective as Cesarean delivery in avoiding advanced POP two months after delivery in a group of 100 women who had their management determined by the day of their enrollment for prenatal care.

As noted in the section on epidemiology, virtually all studies examining prolapse or surgery for prolapse demonstrate an increased prevalence with aging. Few studies look at the effect of menopause on POP risk and results are conflicting; Swift showed a significant increased risk with menopause while Olsen and the Progetto Menopausa Study Group did not [4, 5, 8].

Evidence linking constipation to POP relate to data linking POP to pelvic floor denervation and neuropathy. While vaginal childbirth has been implicated as a major

inciting event for pelvic neuropathy and prolapse, chronic constipation with repeated prolonged defecatory straining efforts has been shown to contribute to progressive neuropathy and dysfunction [9 - 13]. In one case control study, constipation and straining at stool as a young adult before the onset of recognized POP was significantly more common in women who subsequently developed POP (61%) than in women who did not develop PFD (4%) [14]. The Swedish prolapse study provided evidence for progressive decreases in pelvic floor muscle strength with increasing age and parity. This decrease in pelvic floor muscle strength was a significant independent determinant of the risk of POP, again supporting an association between pelvic neuromuscular dysfunction and prolapse [2].

Occupational physical stress has been examined as a contributing factor for POP. One report has implicated the extreme stress associated with airborne training (including parachute jumps) with pelvic floor dysfunction and prolapse in women previously subjected to laparoscopic uterosacral ligament transection [15]. A study using the Danish National Registry of Hospitalized Patients included over 28,000 assistant nurses (who are traditionally exposed to repetitive heavy lifting) aged 20-69 and compared their risk of surgery for POP and herniated lumbar disc (a condition associated with heavy lifting at work) to the risk in over 1.6 million same-aged controls [16]. The odds ratio for the nurses compared to controls was 1.6 (1.3-1.9) for POP surgery and 1.6 (1.2-2.2) for disc surgery, suggesting that heavy lifting may contribute to POP. An Italian study demonstrated an increased risk of prolapse with lower levels of education, a possible indicator of harder physical labor, although this was not specifically investigated [5].

Obesity is another condition that is associated with chronically increased abdominal pressure [17]. Some studies have demonstrated significant relationships between increasing weight and body mass index and the risk of POP or surgery for POP [1, 5]. Others have not demonstrated this correlation or have demonstrated a loss of correlation once analysis was corrected for confounders such as age, parity, or pelvic muscle strength [2, 3]. Another medical condition associated with chronic episodic increases in abdominal pressure is chronic pulmonary disease. One case control study examined this and reported significantly more pulmonary disease (such as asthma) in women ≤ 45 years of age who developed prolapse (14%) compared to controls (2.4%) [3].

In the Oxford Family Planning Study the POP surgical incidence rates were higher for women who had undergone a prior hysterectomy for reasons other than prolapse (29 per 10,000) and highest for women who had undergone hysterectomy for prolapse (158 per 10,000) [1]. Marchionni et al demonstrated some degree of vaginal vault prolapse 9-13 years after hysterectomy in 11.6% of women who had the hysterectomy for prolapse and in 1.8% of women who had the hysterectomy for other benign disease [18]. Swift also demonstrated a significant association of POP with a prior history of hysterectomy or prolapse surgery [4]. While any prolapse procedure can fail for a variety of reasons, it has been suggested that certain procedures have higher risks of specific pelvic support defects. These include enterocele formation after Burch colposuspension and anterior superior segment prolapse after sacrospinous ligament fixation [19, 20, 21]. In addition, there is evidence that the vaginal route of prolapse correction is associated with damage to the pudendal nerve and results in anatomic outcomes and higher re-operation rates than abdominal route prolapse surgery [22, 23]. Finally, there have been five case reports implicating laser laparoscopic uterosacral ligament ablation for chronic pelvic pain as a cause of uterine prolapse in young women [15, 24].

There are data that link clinical, laboratory, and genetic syndromes of abnormalities of collagen to pelvic organ prolapse [25 - 30]. In addition, Rinne and Kirknen linked POP in young women with a history of abdominal hernias, suggesting a possible connection with abnormal collagen [3].

Finally, there is evidence from several case control studies that variations in axial and pelvic skeletal structure can be associated with increased risks of POP. These include increasing degrees of thoracic kyphosis, a decrease in lumbar lordosis and in vertical orientation of the pelvic inlet, and an increase in the transverse diameter of the pelvic inlet [31, 32, 33]. The association between early age advanced stage POP and the severe disruption of pubic bone and pelvic muscle structure in women with bladder exstrophy is well recognized [34].

III. EPIDEMIOLOGY OF PELVIC ORGAN PROLAPSE

There are few epidemiological studies of POP in contrast to urinary incontinence, probably because POP has no specific symptom complexes, especially for early state disease, and thus the condition does not lend itself well to traditional epidemiological survey techniques. Some studies utilize links to managed care, hospital, and/or surgical databases to diagnose POP rather than including a physical examination for prolapse [1, 8, 35, 36]. More recently, others have used a standardized examination technique to document the status of pelvic support [2, 4, 37]. One study determined post-hysterectomy vault prolapse incidence using both approaches in the same population [18].

Appendix One shows prevalence rates for examination confirmed prolapse in four studies. The prevalence of prolapse to the level of the hymen varies from 2% to 48%. This broad range likely results from differences in sources of study populations, age, race, parity and examination techniques. Each of the four demonstrated an increased prevalence of prolapse with aging except the study by Bland et al which did not report any age analysis [37]. There is a lack of epidemiological information about POP in racial groups other than whites.

Much of our information regarding POP comes from surgical databases. Using a computerized provincial database, Allard and Rochette reported that uterine prolapse is the most frequent indication for hysterectomy in older women [35]. One third of all hysterectomies in women ≥ 50 were for prolapse in 1988 while fewer than 7% of women aged 15-49 had that indication. Eighty-one percent of vaginal hysterectomies (representing about 16% of hysterectomies) were performed for prolapse. The yearly incidence of hysterectomy for prolapse peaked in the 65-69 year age group at around 30 per 10,000 (0.3%). In a similar study from Finland, the proportion of hysterectomies for prolapse varied between 8.8 and 13.8% from 1971-1986 while the annual incidence varied from 8.0 to 12.7 per 10,000 women. Data were not stratified by age [36]. Olsen et al assessed the age-specific incidence of surgery for prolapse in a large managed care population in Oregon [8]. The annual incidence of surgery for POP varied between 0.4 per 10,000 in women aged 20-29 and 34.3 per 10,000 in women aged 70-79. When data for POP and POP + Continence Surgery (but not continence surgery alone) were combined, the surgical incidence rate in the later age group was 49 per 10,000. The Oxford Family Planning Association study followed over 17,000 women aged 25-39 from enrollment between 1968 and 1974 for up to 26 years until 1994 [1]. The annual incidence of hospital admission with a diagnosis of prolapse was 20.4 per 10,000 while the annual incidence of surgery for prolapse was 16.2 per 10,000.

The number of women with POP who are managed without hospitalization and surgery and the number with POP who never seek medical attention is unknown. Incidence and prevalence estimates based only on surgical procedure rates almost certainly underestimate the magnitude of POP. Using a surgical database, Marchionni et al estimated the 9-13 year incidence of prolapse following hysterectomy in their institution in Florence to be between 0.2 and 0.4% [18]. The incidence performing a physical exam on a random sample of the same population was over ten times greater at 4.4%

In summary, POP is a frequent indication for hysterectomy and pelvic surgery in women, with an annual age-related surgical incidence in the range of 10 to 30 per 10,000 women confirmed in several large surgical database studies. The incidence of surgery for POP increases with aging. The population prevalence for POP beyond the hymen (≥ Stage II) is probably between 2 and 4% but may be much higher in clinical populations seeking gynecological care. There is a need for well designed multi-racial and multi-ethnic random sample population based studies, which include physical examination confirmation of pelvic support, to determine the true prevalence of POP.

IV. PELVIC CO-MORBIDITIES

1. URINARY TRACT DYSFUNCTION AND PROLAPSE

Women with anterior vaginal wall support defects often have bladder neck hypermobility with genuine stress incontinence, as well as concurrent defects of uterine and posterior wall support. However, with greater degrees of anterior vaginal wall prolapse (Stage III and IV) fewer women have symptoms of genuine stress incontinence [38]. Severe prolapse can descend and obstruct the urethra, making assessment and management of the continence mechanism in such patients problematic [2] [38] [39] [40]. Multiple studies have described an occult incontinence rate after various methods of reducing the prolapse during preoperative testing of 23-50% [41] [42] [43]. However, Bump et al described an only 4% *de novo* incontinence rate in women with Stage III or IV prolapse who had been randomized to a bladder neck plication procedure as their only prophylaxis, also concluding that preoperative barrier testing was not useful in identifying women who required a urethropexy [21]. Klutke et al determined that preoperative barrier testing was most useful in identifying those women who do not leak with reduction of the prolapse, since such patients did not undergo urethropexy and had better outcomes with regard to both GSI and DI rates [44]. Because of this uncertainty, the least invasive method of bladder neck stabilization seems preferred for such patients [45].

Pelvic organ prolapse can also negatively affect voiding function, although one study noted that the majority of women with severe prolapse still void effectively [46]. Fitzgerald found that preoperative voiding studies with the prolapse reduced by a pessary was the best predictor of normalization of residuals post operatively [47].

The impact of pelvic organ prolapse on the upper urinary tract is not well described in the surveyed literature, consisting primarily of case reports of acute and acute on chronic renal failure attributed to ureteral obs-

truction by Stage IV uterine or vaginal vault prolapse. Hydroureter and hydronephrosis was demonstrated in such cases, resolving post repair [48, 49].

2. Gastrointestinal dysfunction and POP

Repeated reports document disparities between physical exam and defecography in patients with prolapse, particularly those with large vaginal eversions. Two series of defecographies in consecutive patients with prolapse and/or evacuation disorders describe defecographic findings that changed the patient's diagnosis (though not always the management) in 46 of 62 of cases and noted enteroceles that were not found on physical exam in approximately 50% of cases [50, 51, 52]. Use of defecography as a 'gold standard' for exam in these series raises concerns, since normal asymptomatic women may have focal defecographic abnormalities, but it is clear that it is challenging to assess the posterior compartment in severe prolapse. For instance, sigmoidoceles are present in 4-11% of reported series, and are nearly always missed on physical exam [52, 53].

Relatively few of the published studies of outcomes of posterior compartment repairs provide an analysis of gastrointestinal co-morbidities as risk factors for failure. However, the prevalence of abnormal colonic transit time is approximately 20% in patients presenting with evacuation disorders [54]. An abnormal preoperative colonic transit study is the most consistently cited risk factor for failure of rectocele repair to relieve evacuatory symptoms, regardless of the surgical technique [55, 56, 57]. Recognition of the multifactorial etiology of constipation and evacuatory symptoms is advisable to help avoid disappointing surgical results.

Fecal incontinence is a more frequent complaint among women with incontinence and prolapse than in the general population, occurring in approximately 17% of patients presenting for evaluation, especially those with urinary incontinence, abnormal external anal sphincter tone, and irritable bowel syndrome [58]. There is some evidence that rectocele repair can diminish both maximal anal resting and squeeze pressures, possibly contributing to the development of incontinence in patients already at risk with abnormal preoperative manometry [60].

V. RELEVANT NOMENCLATURE

The nomenclature of POP has been troublesome for more than 100 years [59]. Brubaker and Norton summarized the impact of a non-standardized POP nomenclature [60]. The International Continence Society responded to this quandary by creating a committee to recommend a standardized nomenclature. The final approved POP terminology report of this committee was published in 1996 [61] One part of this report describes a system to describe quantitatively the position of 6 vaginal points (two anteriorly, two posteriorly, and two apically) and the length of the genital hiatus, perineal body, and vagina and is referred to as the POP-Q exam (pelvic organ prolapse – quantified). The POP-Q system has been adopted by major organizations including the International Continence Society, the Society of Gynecologic Surgeons and the American Urogynecologic Society, and the NIH as an accepted method of describing pelvic support and comparing exams over time and after interventions. The POP-Q has been shown to have reproducibility in several centers when the exam is conducted in a standardized fashion. Many aspects of physical examination are not mandated although investigators are admonished to specify their methods for determining that the full extent of the prolapse has been demonstrated. The POP-Q system has been criticized for being cumbersome and difficult to learn, although an instructional video tape available through www.augs.org facilitates the learning process. The POP description section of the POP terminology document also includes and ordinal staging system based on the quantitative POP-Q exam.

The POP-Q system itself does not include findings that some investigators believe to be essential for complete patient description, such as vaginal caliber, status of paravaginal sulci, pelvic muscle strength, or the presence of symptoms, although all of these issues are considered in three other sections of the terminology document dedicated to ancillary evaluation techniques, pelvic floor muscle testing, and symptom assessment. In summary, the POP standarization document is an important advance for researchers and clinicians who treat POP, although the POP-Q system in and of itself does not represent the sum of information needed to formulate treatment or assess the impact of treatment.

VI. NATURAL HISTORY OF PELVIC ORGAN PROLAPSE

There are no published data on POP remission. Clinically, POP does not seem to regress, although some improvement may be seen with the chronic retention of a pessary. Since prolapse is often asymptomatic until the descending segment is through the introitus, POP may not be recognized until advanced disease exists. Some women progress rapidly from mild to advanced stages of POP, while others remain stable for many years. One goal of adopting standardized systems of POP quantitation and staging is to allow clinicians and

researchers to document the course of POP reliably and accurately over time. There is a need for large-scale longitudinal studies using such techniques [61].

VII. EVALUATION

Evaluation for research purposes may often be different from evaluation for clinical care. In patients seeking relief of POP-related symptoms, evaluation is often limited to physical examination, as described in the Chapter on Physical Examination. The comprehensive pelvic floor assessment should include POP examination that documents that the maximal protrusion is confirmed by the patient. Currently, most clinical care worldwide is given following simple physical examination. However, additional tools are useful in the clinical care of complex patients and essential for describing patients participating in research studies. These additional tools include various imaging modalities and urodynamic tests.

1. Imaging

Fluoroscopy has been used throughout the world using various techniques with various goals. Probably, the most important fluoroscopic technique is the evacuation proctography or defecography, which involves imaging of rectal expulsion of a barium paste enema. It is a test of voluntary rectal evacuation and thereby yielding both anatomic and functional information.

During evacuation proctography, the wall of the rectum can be outlined by first introducing a small amount of liquid barium into the rectal cavity. A thick barium paste approximating the consistency of semi-solid feces, is then instilled into the rectum. The rectum is filled until the patient has a feeling of rectal distension, sufficient for defecation. During injection the syringe is pulled back to outline the anal canal and the skin behind the anal orifice. The vagina is filled with a small amount of contrast [62]. Lateral images are made during rest, during squeezing and on straining (without evacuation). Finally the patient is asked to evacuate the rectum. Continuous recording during the evacuation is important otherwise rapid changes or subtle findings will be missed [63]. Investigators have used a variety of techniques for rectal opacification.

As discussed previously in this chapter, POP frequently co-exists with other pelvic disorders. Therefore, many investigators prefer a combination technique that provides additional information regarding adjacent systems. This technique may include small bowel opacification with oral barium suspension and a radiopaque marker for the perineum [65]. The most comprehensive technique includes bladder filling, in order to perform a dynamic cystoproctography [64]. Advocates of this technique recommend performing the cystographic phase before rectal filling to avoid artifactual compression of the bladder secondary only to the effect of rectal filling. The cystography can be combined with urodynamic pressure measurements.

A normal rectal evacuation study has to met the five criteria of Mahieu [65].

1. Increase of anorectal angulation;

2. Obliteration of the puborectal impression;

3. Wide anal canal opening;

4. Total evacuation of contrast; and

5. Normal pelvic floor resistance.

Posterior wall prolapse is mostly seen as a bulging of the rectal wall during evacuation and, it may retain contrast after defecation [66]. The prolapse can also be filled with small bowel or sigmoid. This can be differentiated on evacuation proctography in the post-evacuation phase with an empty rectum. Accurate diagnosis of anterior wall prolapse requires bladder and vaginal contrast [66]. Pelvic organ prolapse should be described quantitatively because of the absence of normative data during fluoroscopy (Figure 1, 2).

Evacuation proctography facilitates simultaneous diagnosis of structural and functional abnormalities and allows a comprehensive, dynamic view of the pelvis. As with all tests, no single finding in isolation should be used to dictate clinical treatment when patient symptoms are inconsistent with that finding. Abnormalities of rectal configuration are common in vaginally parous

Figure 1 : The pressary is in place in the vagina, effectively reducing the pelvic organ prolapse.

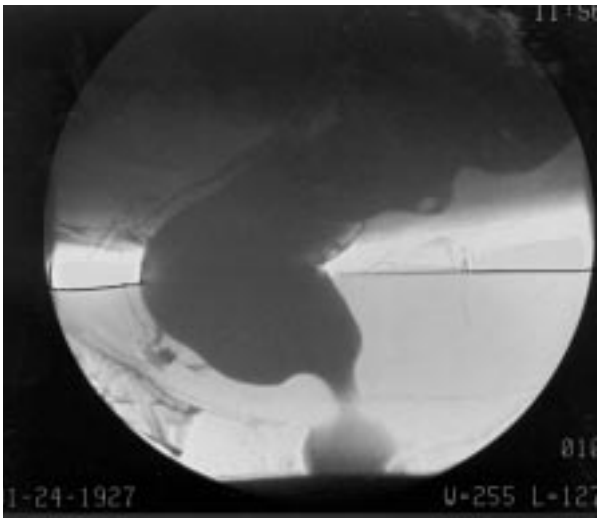

Figure 2 : During straining for defecation, the bladder vaginal apex descend abnormally. A large protrusion of small bowel is seen. Interestingly the rectum empties well indicating the absence of "rectocele".

women and may be over-interpreted, causing excessive surgical intervention in otherwise normal women [67]. Whether evacuation proctography can assist clinical understanding and management is a very relevant question. Unfortunately there is no prospective controlled study in which patient outcome with and without evacuation proctography has been evaluated.

Finally, fluoroscopy is commonly used to evaluate the bladder neck in women undergoing fluoro-urodynamic evaluation. This evaluation is more specifically addressed in other portions of this text, however, caution should be exercised when interpreting such images in women with POP. The finding of "open bladder neck" or "funneling" in women with POP should not be equated with intrinsic urethral dysfunction for purposes of treatment planning.

2. Ultrasound

Although the most important clinical results of ultrasound in urogynaecology are related to functional aspects, there are a few papers describing a clinical application of ultrasound in prolapse assessment. Perineal ultrasound can be used to assess vaginal prolapse, although only preliminary reports have been used the advantage being that it does not impede movement of the bladder neck [68], [69], [70]. A transrectal scan has been described as a useful tool in the diagnosis of enterocele [71].

It has been reported that women with a prolapse have greater bladder neck mobility than incontinent women, and the extent of the movement correlates well with the anterior wall descent [71], [72], [73].With ultrasound it is possible to visualise the pelvic floor muscles. A perineal approach has been described to image the levator ani muscle with a 5MHz probe [74], [75], [76]. However, a transvaginal approach with the use of a 7.5MHz transrectal probe guarantees a better and complete image of the levator ani with the possibility to visualize its full extension and to take width measurements [77]. With this technique, it is also possible to visualize lateral vaginal defects, otherwise impossible to see, and the levator hiatus, which has been found, compared to controls, to be larger in women with prolapse [78], [79] This last finding correlates well with the measurement of the urogenital hiatus using a ruler. A larger urogenital hiatus has been found in women who have a prolapse or have had unsuccessful surgical treatment. The urogenital hiatus is the same in women without a prolapse and in those treated for a prolapse with successful surgery. Finally, a renal ultrasound assessment can be used to assess the presence of hydronephrosis in women undergoing surgery for a prolapse.

3. MRI and prolapse

Dynamic cystoproctography, which includes opacification of the bladder, small bowel, vaginal lining, and a proctography, is a relatively invasive procedure involving ionizing radiation and only images the lumen of the opacified organs [80]. MRI is an alternative imaging technique. However, before MRI can be incorporated in clinical practice standardization of pelvic floor structures and of their normative variations with aging must be accomplished.

4. MRI technology

Since the classic description of the MRI of the female pelvis by Hricak in 1986, several MRI techniques have become available (vaginal, endorectal, open configuration) [80 - 83]. Image acquisition is improving with faster sequences (rapid sequence dynamic MRI with HASTE (Half –Fourier- acquisition single shot turbo spin echo technology) reducing the overall procedure time [84 - 86].

5. Normative studies

The 3D anatomy of the healthy female pelvic floor derived from MR images showed:

1. the average width of the levator hiatus, at the level of the transverse urethral ligament, is constant in the healthy female population at approximately 4 cm [87]. A widened levator hiatus was reported in association with pelvic organ prolapse.

2. In continent women, the levator plate nearly parallels the pubococcygeal line [79], [84], [88].

3. At rest, the bladder base lies above the pubococcygeal line in healthy volunteers [88], [89].

4. The mean anorectal junction position lies on the pubococcygeal line [89].

5. During pelvic floor muscle contraction, an inward cranial lift was demonstrated, confirming prior clinical observations and ultrasound findings [90]. The range of movement was from 1 to 21 mm, which is less than suggested by Kegel in 1952, although Kegel's observations were made in the supine position. A surprising finding was the movement of the coccyx during a pelvic floor muscle contraction.

6. Due to cost limitations, dynamic MRI data with Haste have not been obtained in asymptomatic nulliparous women [86, 91]

6. Comparison between MRI and other studies

a. In one small study on post hysterectomy vault prolapse (13 patients), MRI was compared to intra-operative and ultrasound findings and showed no superiority towards planning a better repair [92].

b. In another study of 40 patients, dynamic MRI was found to be superior to fluoroscopic proctography because patients could be left in privacy while the images were continuously acquired without any concern for radiation exposure [93].

c. In a large study of 125 POP patients staged by dynamic MRI (image acquisition time of 2.5 minutes), prolapse was objectively graded (HMO classification), standard imaging (cystourethrography, pelvic ultrasound, or intravenous urography) was obviated, and additional pelvic pathology detected at a cost of $540 per test including interpretation [86]. Compared with intraoperative findings, MRI staging was found accurate except for rectocele [91].

7. Urodynamic testing

Presence of stress urinary incontinence (SUI) is often masked by prolapse that protrudes from the vagina. However, when the prolapse is reduced by speculum, pessary, or gauze, occult stress incontinence can thus be revealed [94 - 98].When a pessary can be retained for several weeks and does not obstruct the bladder and/or proximal urethra, it can be used to determine whether incontinence is present and whether it is clinically bothersome [99]. Urodynamic studies are usually performed with a prolapse reduction to determine whether an urethropexy is needed during an upcoming repair, or even during a sling procedure when sphincteric insufficiency is detected [100, 101, 102, 104]. Some physicians accept urodynamic information at face value and will leave the urethra unsupported if the patient did not leak during the procedure [105, 106]. Conversely, some will perform a formal urethropexy or a sling depending on the valsalva leak point pressure or on the urethral closure pressure measured during the urodynamic test. Another approach is to systematically stabilize urethral support at the time of the prolapse surgery and to consider a periurethral injection or a sling procedure if SUI occurs secondarily [107].This latter approach applies particularly to older women who may have precarious lower urinary tract function, some degree of chronic retention, or who already have some urge incontinence from bladder instability. Appropriate randomized clinical trials are needed to address the utility of urodynamic testing with prolapse reduction, and the optimal surgical management for these patients.

VIII. TREATMENT

The indication for treatment of POP is uncertain. The fact that there is no standardization of this aspect of POP care is an urgent research topic.

Besides a few indications necessitating prolapse treatment (e.g. obstructed upper urinary tract and urosepsis; rectal prolapse and incarcerated bowel) the majority of interventions is based on relative indications, primarily on symptoms of the prolapse itself. The lesser the extent of prolapse the more difficult is its correlation to symptoms (e.g. bulging, difficulties during intercourse). Data on the association between the extent of a prolapse and related symptoms is weak. Furthermore, there is yet no clear cut-off between "normal" and "abnormal" anatomy especially in parous women. Based on the outcome of a recent NIH Terminology workshop on Female Pelvic Floor Disorders any pelvic organ prolapse less than Stage II needs careful assessment of the relationship between symptoms and prolapse before treatment especially surgery is applied [108].

If symptoms are not directly related to the prolapse but rather to organs involved (e.g. obstructed defecation; voiding difficulties and recurrent UTI) testing is recommended to explore the relationship between prolapse and symptoms. Treatment options are either surgery or a pessary. Physicians vary widely in their use of pessaries. Some physicians offer a pessary to all patients requesting POP treatment, whereas others never use the pessary. Most likely, there is a subgroup of women from whom the pessary is a superior option to surgery. All information regarding pessary care is anecdotal and designed for clinical care. Unfortunately, there are no randomized trials comparing the pessary with observation (natural history) or surgery. Some physicians offer a pessary to all patients requesting POP treatment, whereas never use a pessary. Most likely there is a subgroup of women for whom a pessary is a superior option to surgery (Figure 1).

Surgery is frequently offered to women with POP. The optimal procedure (or group of procedures) is not known. Experts agree that the intervention should lead to improvement of subjective outcome and quality of life. Furthermore, these issues have to be achieved with minimal complications. If preservation of specific functions are not necessary anymore (e.g. vaginal intercourse) its reconstruction may be omitted to permit a minor surgical intervention. For purposes of this chapter, surgical treatment of the relevant POP-Q sites will be addressed individually.

1. Apical prolapse (points C and D)

Simple vaginal hysterectomy is not effective to correct uterovaginal prolapse [109]. When the uterus is present, effective POP treatment requires specific steps to suspend the apex. In patients who do not want to maintain fertility or who have passed reproductive years, hysterectomy with vaginal vault suspension is commonly preferred. A wide variety of options exist and there is no clinical trial that compares one procedure against another. Expert opinion suggests that apical suspension that is performed "prophylactically" should be limited to the use of endogenous materials and aim to restore normal vaginal axis. Thus, procedures that distort the vaginal axis, such as sacro-spinous ligament suspension should not be used unless apical prolapse is present.

There is no trial that compares uterine preservation with hysterectomy when treating POP. There are significant practice differences in this regard. Uterine preserving procedures have been reported, but only in small case series. The Mancheseter procedure (amputation of the cervix with uterus suspension to the cardinal ligaments) is largely of historical interest only because of the significant rate of complications including, but not limited to, cervical incompetence, cervical stenosis, postoperative bleeding, infertility**.** Variations of the sacrospinous ligament suspension have been recommended and have the stated advantage of fertility preservation without damage to the cervix, maintenance of a normal vaginal axis, and closure of space for potential enterocele. Sutures are unilateral to preserve rectal caliber and normal defecation. A variety of abdominal approaches have been described that attach the isthmic region to the sacrum using a supportive material. The original Gilliam procedure which is known to have high failure rates when using round ligaments can be enhanced using synthetic or fascial augmentation. There are few patients represented in the reports of these procedures and no long term data. The wide variations in rate of subsequent pregnancy and term deliveries warrant extreme caution when counselling patients regarding uterine preservation for fertility indications.

Following hysterectomy, the term "post-hysterectomy" prolapse is often used. It is important to recognize that the underlying disorder may be the same, regardless of the presence of the uterus. Thus, the principles of surgical repair include repair of vaginal walls and suspension of the vaginal apex. Treatment of the apex can be effectively accomplished by a wide variety of techniques and includes both abdominal and vaginal routes of surgery. There are no published laparoscopic series of POP outcomes using a modern outcome measures, such as POP-Q with a minimum of one-year follow-up.

Surgeons generally have a preferred mode of access for treatment of apical disorders. Only one randomised trial had compared these two routes and found that the abdominal approach is superior, although this trial has been criticized for the ancillary procedures that were selected [110]. Surgeon preference for the abdominal approach may be related to patient age, although this idea is not evidence-based. Several non-randomized studies comparing sacrocolpopexy to sacrospinous fixation have been published [110,11,112,113,114]. Vaginal procedures have the surgical advantages of decreased immediate operative morbidity that must be balanced against growing concerns of surgical induced neuropathy, accelerating neuro-muscular decline. These preferences are not evidenced-based at this time (Appendix 2).

There are two retrospective clinical series dealing with vaginal length and dyspareunia after abdominal and vaginal prolapse surgery respectively (Given et al.; Anthuber et al.) [115,116]. Both conclude that vaginal length is preserved better by the abdominal approach and dyspareunia is less likely to occur.

Vaginal apical suspension can be done at the time of hysterectomy or as a separate procedure remote from the hysterectomy. These procedures include the McCall culdeplasty, the high utero-sacral suspension, the endopelvic fascia fixation, the coccygeous muscle fixation, the iliococcygeus fascia attachment and the sacrospinous ligament suspension. These procedures have been scantily reported in the literature and are listed in Appendix Two.

The sacrospinous literature reflects more patients in more institutions than any other procedure (Appendix 3). Only one trial compares two vaginal suspension methods. Colombo et al compared McCall culdeplasty with sacrospinous ligament suspension, and demonstrated an excess anterior wall recurrence with the sacrospinous (21% v 6%) [117]. Although this is consistent with expert opinion, this study has not been replicated. Overview of the existing literature gives apical (POP-Q point C) success rates between 63 and 97 %, with an associated rate of recurrent anterior failure between 0 % and 92 %.

Sacrocolpopexy has been popularised over the past forty years. This technique requires an abdominal approach, but has high cure rates which have been

demonstrated by multiple surgeons in multiple institutions [118] [119] [120]. Aside from the need for an abdominal approach, surgeons express concern for the known risks of mesh which is frequently used in this procedure. Autologous fascia has been used, although cadaveric tissue has failed in this procedure. There is no ideal synthetic material for reconstructive pelvic surgery [121].

There is good evidence (II - 1) that the abdominal route is able to adequately fix the vaginal cuff or the vagina together with the uterus to the hollow of the sacrum or the promontory. This approach offers successful reposition of uterine or vaginal cuff prolapse even in cases with maximal extent. According to a recent systematic review success rates range in between 77,8% and 100% [122].

To bridge the distance between the vaginal cuff and the hollow of the sacrum several materials have been used (Table 1). A review of these materials was recently reported (Iglesia, et al).

Table 1 : Sacrocolpopexy materials

Homologeous
• Cadaveric Fascia lata
• Rectus sheath
Autologeous
Dura mater
Cadaveric Fascia lata
Synthetic
Prolene mesh
Mersilene mesh
Marlex mesh
Teflon
Gore Tex mesh

There is no uniformity as to the optimal site of fixation. Fixation of the cuff at the level of the promotory creates a steep unnatural vaginal axis, while fixing it at the level of S 2/3 and thus imitating natural direction of the vagina may induce high bowl outlet obstruction, if the rectal pillar with its neural supply to the rectum has to be divided [121].

One of the unresolved problems of sacrocolpopexy is the control of concomitant anterior and posterior prolapse. Results of two prospective clinical series (Baessler and Schuessler; Fox and Stanton) indicate that a double pedicle mesh advanced as far down at the anterior vaginal wall as to control for any midline defects seem to offer good results (II-1) [120] [122]. However, in these series colposuspensions and lateral repairs have also been combined.

Results for the control of posterior wall prolapse from above are much more confusing. While Fox and Stanton reported excellent results, results from Baessler and Schuessler were less promising although intraoperatively rectoceles seemed to be effectively controlled. Vaginal rectocele repair followed by abdominal colpoperineopexy concomitantly concomitantly was accompanied in one series by a disastrous mesh erosion rate especially if mesh or suture material was introduced into the abdominal cavity from below [123].

A recent overview of the existing literature on abdominal prolapse repair indicates that the use of synthetic mesh is the major source of complication inducing mesh erosion and/or infection [122]. While eroded macroporous mesh could be trimmed and closed by a layer of vaginal wall, type II and III material has to be removed if erosion/infection occurs. Besides any mesh erosion sacral osteomyelitis at the fixation site of the mesh has been reported [124].

There is no expert consensus on the definition of enterocele. A growing number of specialists believe the presence of small bowel low in the pelvis is a phenomenon secondary to the primary POP support problem. These experts believe that when the vaginal walls are reconstructed and properly suspended, no additional or specific “enterocele” repair is required. Other experts feel that specific procedures are necessary to remedy small bowel which is unusually low in the pelvic. No single procedure has been demonstrated to effectively prevent or treat enterocele, and it is unlikely that such studies will ever be done because of their complexity and the confounding effects of concomitant surgery.

2. Anterior vaginal prolapse

Experts and the majority of published literature suggest that the anterior wall is probably the most challenging part of POP cure. Several techniques for sub-diagnosis of anterior wall have been proposed, either based on specific anatomy or likely etiology. As with many aspects of POP diagnosis, such sub-categories are not evidenced-based nor have they met criteria for inter- and intra-rater reliability. However, these sub-categories are frequently used to plan the procedure(s) best suited to a particular patient. Anterior wall support defects can be primary (abnormality within the wall itself) or secondary (secondary to apical defects). The next portion of this text will discuss procedures used ***when apical suspension is adequate or being treated by a concomitant procedure.***

Anterior POP is most frequently treated by anterior colporrhaphy. Despite the high objective failure rate (approximately 50%), the procedure persists largely

because of the perception of low surgical morbidity and the ease with which it is combined with other vaginal reconstructive procedures [125]. Interpretation of published results should be done with caution because of the wide variations in surgical technique. Many variations are associated with various kinds of bladder neck plications or concomittant needle suspension [126]. The recurrence rate (0 % to 50 %) is probably highly underestimated because "intravaginal" cystoceles are not taken into consideration ; for some authors, only patients needing reoperation are considered as failures, without interest for functional symptoms.

Vaginal paravaginal defect repair is more technically challenging. Since White described paravaginal repair in 1909 it has been reported to repair anterior wall support defects with success rates of 76 % - 100 % [127 - 133]. Appendix five lists surgical series for this procedure. This operation needs a surgeon skilled with vaginal operations according to the large opening of the paravesical space. The procedure can be accomplished abdominally, but still requires a high degree of surgical skill.

The four (or six) corner suspension was originally described by Raz for use in women with stress urinary incontinence [134, 135]. Unfortunately, the anterior wall recurrence rate is unacceptably high (nearly 60 %) indicating that the procedure should not be used for anterior wall restoration [134, 136].

Some surgeons have reported case series with synthetic materials to bolster this area and reduce recurrence of the anterior wall. Overall, this effort has been limited by foreign-body complications. These case series are listed in Appendix 6 [137, 138, 139, 140, 141].

3. Posterior vaginal prolapse

Most experts believe that vaginally parous women have alterations in posterior vaginal wall support. When these become bothersome, surgical repair may be an option. Similar to the anterior wall, posterior wall support defects can be primary (defects in the posterior wall itself or its attachment to the perineal body) or secondary to a loss of apical support. This text will continue to discuss only surgery directed primarily at the posterior wall.

The indications for posterior wall repair are poorly outlined. Isolated recoceles are unusual and should raise suspicion of colonic disorders. A variety of symptoms have been attributed to "rectocele", but these symptoms are non-specific and often persist despite resolution of posterior wall anatomy. These thoughts should caution the reconstructive surgeon, since it is well known that there is a significant risk of painful intercourse following posterior vaginal wall with or without perineal reconstruction. There is some evidence that the risk of dyspareunia increases when the levator muscle is plicated. There is no consensus on the definition of rectocele, either by physical examination or by any imaging modality. However, there are a few surgical studies that use imaging for patient selection and outcome assessment of the surgery.

Retrospective comparisons of a site-specific defect posterior wall repair has been performed, but no randomized trials have been completed to date [142, 143, 144, 145, 146]. The traditional posterior colporrhaphy has been studied in comparison to the trans-anal repair of rectocele.

IX. UNUSUAL FORMS OF POP

On occasion, some unusual condition may cause a mistaken diagnosis of POP. Unusual causes include, cervical elongation, wherein the apical support of the vagina is entirely intact, but the cervix has elongated and is protruding through the hymen. Certain forms of unusual cystic formation in the actual vaginal wall, or glands associated with the vagina may be mistaken for prolapse. Rarely, a prolapsed myoma can be misinterpreted for POP.

There are unusual circumstances which involve true POP including prolapse of a cervical stump, prolapse of a single loop of small bowel through an otherwise supported vaginal tube and recurrent posterior wall support defects which are related to large bowel disorders or masses, undiagnosed presacral or pelvic masses. Fortunately, these conditions are rare, but should be thought of when there is repetitive surgical failure.

X. RESEARCH TECHNIQUES FOR PELVIC ORGAN PROLAPSE

The quality of clinical research is an important issue. Because of historical traditions and the lack of regulatory requirements, evaluation of surgical procedures has not been subject to the same safety and effectiveness standards as medical therapies. The quality of the evidence supporting aspects of the surgical management of many gynecological conditions is poor. A recent systematic review found that the overwhelming majority of the literature on management of urinary incontinence did not allow any substantial assessment of the basic methodological quality of the published research [147]. The quality of research in reconstructive pelvic surgery, and the clinical care of patient based on that research would be greatly improved if certain commonly accepted principles of clinical outcomes research were routinely implemented. Basic principles have been outlined in a report of the Research Committee of the American Urogynecology Society [148].

Investigators should strive to ensure that studies are conducted and described in such a way that readers can assess the internal and external validity of the results. Internal validity refers to the conduct of the study itself—are the conclusions drawn justified by the methods used to achieve the results described? External validity refers to the generalizability of the study results—are the clinical methods and patient population similar to those used by the reader?

1. Internal validity

a) Randomization

Randomization is the preferred method for removing the effects of both intentional and unintentional bias in either the performance of the intervention or in the interpretation of the results, and significantly reduces the possibility of confounding. Important conclusions can be drawn from nonrandomized studies; however, the methodological sophistication required to overcome the inherent limitations of nonrandomized designs is in some ways greater than that required for a randomized trial. Studies where pseudo-randomization techniques are used (such as selecting patients presenting on alternating days of the week) consistently show larger effects than those where sealed envelopes or other methods based on randomly generated numbers are used [149].

b) Adequate description of patients and controls

Recruitment methods and inclusion and exclusion criteria should be specified clearly. Inclusive dates of the recruitment period, severity of the clinical condition in question, data regarding age, body mass index, and ethnicity, as well as any co-morbidities in the study population should be fully delineated. In nonrandomized study designs, criteria used to select which patients underwent the interventions being compared should be described. If these differences are not characterized, then erroneous conclusions may be drawn.

c) Description of length of follow-up

Patient and provider decision-making is dependent on the knowledge of benefits and risks over time. The duration and nature of follow-up after the study intervention is one of the most important elements of a report on management of pelvic organ prolapse, particularly if the intervention in question is surgical. The mean or median and range of duration of follow-up should be stated very clearly. In the case of a surgical intervention, the same evaluation should be performed before and after the procedure, and ideally this should occur long enough and frequently enough after the procedure to ensure adequate evaluation of results. Every effort should be made to provide follow-up of at least five years with surgical outcomes studies. Failing to account for patients lost to follow-up may lead to erroneous conclusions, especially if the loss to follow-up is related to either the underlying disease or the intervention (e.g., patients seeking care elsewhere because of continuing symptoms or unacceptable side effects of treatment). Drop out rates may reflect differences in clinically important variables, such as side effects or treatment response. Failure to account for dropouts may result in erroneous conclusions similar to those seen with failure to account for loss to follow-up. In randomized trials, patients who "dropout" of one arm and receive another intervention under study should be included in the original group for analysis (intent-to-treat analysis).

d) Recognition and description of statistical issues

Power: A considerable portion of the surgical body of literature suffers from a failure to consider the number of subjects needed to achieve results of statistical and/or clinical significance prior to embarking on the investigation. Power calculations should ideally be made prior to beginning the research to determine the feasibility of the study. While it is often difficult to estimate the magnitude of difference (the delta) likely to be found in pilot investigations, an explanation supporting the estimated difference should be described. Studies that lack power to detect differences between groups are at risk for Type II errors, which can lead investigators to erroneously conclude, for example, that important characteristics of cases and controls are not significantly different between groups. This is usually not a problem in a randomized trial of sufficient size, but is frequently seen in nonrandomized studies.

Use of appropriate statistical measures and tests: Many investigators rely on means and proportions to report summary characteristics, and t-tests and chi-square tests to assess differences. Although these are certainly appropriate in many instances, much of the type of data collected in studies of pelvic organ prolapse is not appropriate for these measures. For example, measures such as parity or number of prior surgical procedures, which are only meaningful as integers, should not be expressed as means and standard deviations—a "mean" parity of 1.75 is meaningless. Medians and ranges are more appropriate. Other measures, such as costs or length of stay, are often not distributed normally. Use of means in this case will be influenced by outliersand medians may be more appropriate.

Multivariate and survival analysis: One way to handle the effects of confounding variables is through the use of multivariate techniques such as linear or logistic regression, and these are appropriate for many nonrandomized studies of surgical outcomes. Proper statistical analysis of the time duration until failure of a procedure by any specified criterion involves use of survival analysis, a technique that has been noticeably absent

from the majority surgical outcomes reports. However, investigators need to be aware of the limitations of these techniques, which are as susceptible to misuse as any other. Consultation with investigators familiar with their application is recommended.

2. External validity

a) Description of patient population

Characteristics such as age, race, prior medical, gynecological, and obstetrical history should be described, using standard terminology.

b) Characterization of baseline anatomy

The description of the methods in the study should include objective measurements of anatomy and clearly described measurement techniques. A standard, validated, and reliable method of describing subject anatomy such as the pelvic organ prolapse quantitation system should be used before and after the intervention [60].

c) Characterization of baseline symptoms

While restoration of normal anatomy may be a primary goal of the clinician, the most important goal of a patient undergoing treatment of pelvic organ prolapse is an improvement in her quality of life via a relief from the symptoms. Quality of life scales specific for urinary function, pelvic, sexual, and colorectal function are available, as well as more generic instruments that measure general social and emotional well-being such as the SF-36 or the EuroQOL [147]. Both should be utilized before and after the study intervention to adequately assess its impact on the patient.

d) Description of the timing of outcome measurement

Outcome measures may vary depending on when they are obtained. Description of when outcomes are measured facilitates comparison between studies. Ideally, the same measures will have been used prior to the intervention.

e) Description of validity and reliability of outcome measurement

Measurements of outcomes are only useful if the changes in the outcome being measured are reflected in changes in the measurement (validity) and if these changes are reasonably consistent between the same observer measuring at different times, or between different observers (reliability). References to published documentation of the reliability and validity of the measures used should be provided, or documentation provided within the text of the article.

f) Description of clinical care provided to patients

In studies involving surgical outcome, the surgical procedures involved should be described in detail. Investigations involving surgical procedures that take place over a long time period or with multiple surgeons should include an assessment of all efforts made to minimize changes or differences in technique. All investigations or examinations that are used to document surgical outcomes should be described clearly. For instance, the time until removal of a suprapubic bladder catheter is dependent on the criteria used for removal.

XI. SUMMARY

The inclusion of pelvic organ prolapse in a book on urinary incontinence emphasizes the importance of this topic for providers of continence care. The wide variations in evaluation and treatment of POP mandates worldwide attention and research efforts. Our committee was charged with reviewing a large and clinically troublesome topic. The list of evidence-based facts is strikingly short and the list of needed scientific priorities is simply the beginning of a vast research undertaking. It is our intention that with each edition of this book, the evidence-based portion will increase and the research questions will become more refined and focused. We encourage you to direct your highest quality research work to this area.

1. Evidence rating

Vaginal delivery is a major etiologic agent for POP (Level 2)

Chronic defecation disorders increase the risk of POP (Level 3)

Prior hysterectomy is associated with an increased risk for POP surgery (Level 3)

Defecography is superior to physical exam for rectocele and sigmoidocele detection (Level 4)

Women with Stage III and IV POP have fewer symptoms of genuine stress incontinence than <Stage III POP. (Level 4)

Severe prolapse can descend and obstruct the urethra (Level 2)

Occult incontinence rate may be demonstrated by various methods of POP reduction 23-50% patients. (Level 4)

Preoperative barrier testing was not useful in identifying women who required an urethropexy (Level 2)

Preoperative voiding studies with the prolapse reduced by a pessary was the best predictor of normalization of residuals post operatively (Level 4)

Sigmoidoceles are present in 4-11% of reported series, and are nearly always missed on physical exam. (Level 4)

Abnormal colonic transit time occurs in approximately 20% in patients presenting with evacuation disorders. (Level 4)

Fecal incontinence frequently coexists with POP (Level 2)

Rectocele repair can diminish both maximal anal resting and squeeze pressures, possibly contributing to the development of incontinence in patients already at risk with abnormal preoperative manometry. (Level 2).

The POP-Q system is reproducible. (Level 1)

Patient position affects severity of POP demonstrated on physical examination (Level 2)

Simple hysterectomy, without apical suspension, is ineffective for POP treatment. (Level 2) Apical suspension can be effectively accomplished by vaginal and abdominal routes (Level 3)

RECOMMENDATIONS FOR RESEARCH

Well designed multi-racial and multi-ethnic random sample population based studies, which include physician examination to determine the time prevalence of POP.

Standardization of POP-Q methodology for use in clinical trials

Longitudinal, large- scale studies to document the incidence and prevalence of POP

Determine the value of fluoroscopy (for unselected, and selected, populations of women with POP)

Determine the utility of prolapse reduction urodynamic testing

Determine the best surgical strategy to optimize urinary tract function following POP repair Standardization of indications for POP treatment

The role of hysterectomy in POP surgery requires clarification.

APPENDIX I – Prevalence Rates of POP

	Samuelsson et al 1999	Bland et al 1999	Progetto Menopausa 2000	Swift 2000
Country	**Sweden**	**U.S.**	**Italy**	**U.S.**
N	487	241	21,449	497
Age range	20-59	45-55	Around menopause 1	8 - >70
Race White Black	 100%	 89% 9%	 100%	 47% 52%
Parous	54%	Unspecified	85.6%	93%
Hysterectomy	4%	28%	None	28%
Staging technique	Above, to, beyond hymen	ICS	Uterus only Baden 0, 1, ≥2	ICS
Stage ↓				
0	71.2%	73%	94.5%	6.4%
1	28.8%	23%	3.6%	43.3%
2	2%	4%	1.9%	47.7%
3	0	0		2.6%
4	0	0		0
Source of subjects	76% of every 3 year screen participants	Responded to ad for soybean supplement study	268 first-level menopause clinics in Italy	Routine gynecologic examination

APPENDIX II – Vaginal Vault Suspension Series

Technique Authors	N	Follow-up	Success rate Vaginal vault	Global success rate	Cure assessment
Attachment to iliococcygeus fascia					
- Shull (1993) (62)	42	6 weeks-5 y	95%	79%	objective
- Meeks (1994) (38)	110	up to 3 y	100%	96%	?
Coccygeus fixation					
- Thornton, Peters (1983) (68)	40	6 weeks-13 y	98%	95%	Objective
- Peters, Christenson (1995) (49)	81	mean : 37 mo	96%	95%	
Endopelvic fascia fixation					
- Symmonds (1981) (65)	160	1 – 12 y	94,5%	89%	objective subjective
Mc Call culdoplasty					
- Elkins (1995) (15)	14	3-6 mo	100%	90%	Objective
- Colombo (1998) (10)	62	4 – 9 y	95%	85%	Objective subjective
Levator Myorrhaphy (33)	36	Mean 27 mos.	94% -Apex 86% POP 1 cystocele 2 enterocele		

APPENDIX III – Sacrospinous Ligament Suspension Literature

Authors	Year	Follow-up	N° cases	Success Rate	Outcome Measure
Richter (56)	1981	1-10 y	81	70%	Objective
Nichols* (46)	1982	> 2 y	163	97%	?
Morley,Delancey (45)	1988	1 mo-11 y	92	82%	subjective objective
Brown (5)	1989	8 – 21 mo	11	91%	objective
Kettel,Herbertson (27)	1989	?	31	81%	subjective objective
Cruikshank (13)	1990	8 mo-3,2 y	48	83%	objective
Monk (44)	1991	1 mo-8,6 y	61	85%	objective
Backer (2)	1992	?	51	94%	objective
Heinonen (21)	1992	6 mo-5,6 y	22	86%	objective
Imparato* (23)	1992	?	155	90%	objective
Shull (61)	1992	2-5 y	81	65%	objective
Kaminski (25)	1993	?	23	87%	bjective
Carey (6)	1994	2 mo-1 y	63	73%	objective
Holley (22)	1995	15-79 mo	36	8% (success rate for vaginal vault only : 92% recurrent cystocele : 92%)	objective
Sauer (57)	1995	4-26 mo	24	63%	objective
Peters (49)	1995	48 mo	30	77%	subjective objective
Elkins (15)	1995	3-6 mo	14	86%	objective
Pasley* (47)	1995	6-83 mo	144	94%	subjective objective
Benson (4)	1996	12 – 66 mo (mean : 30)	42	29%	objective
Hardimann* (20)	1996	26,4 mo	125	97,6%	objective
Penalver (48)	1998	18-78 mo	160	85%	objective
Lo (34)	1998	24 – 62,4 mo (mean : 25,2)	66	80,3%	objective
Colombo (10)	1998	4 – 9 y	62	73%	Objective subjective
Meschia* (39)	1999	1 – 6,8 y (mean : 3,6)	91	94% recurrence cystocele : 16% recurrence rectocele : 10% recurrence enterocele : 6%	objective
Sze (67)	1999	7 – 72 mo (mean : 24 +/- 15)	54	67% (13/18 anterior recurrence)	objective
Cespedes (8)	2000	5 – 35 mo (mean : 17)	28	89% (1 vault prolapse, 2 cystoceles)	Subjective Objective
Giberti (19)	2001	mean : 16 mo	12	91% (1 vault prolapse, no cystocele)	Objective subjective
Lantzsch* (32)	2001	6 mo – 9 y (mean : 4,8 y)	123	96,7% for vault prolapse (other recurrence : 10 cystoceles, 1 rectocele, 1 enterocele) objective	

Except for the series of which focus primarily on vaginal vault fixation, the success rate reflect all aspects of pelvic floor reconstruction.

APPENDIX IV : Sacrocolpopexy-related observed complications From Baessler et al., in preparation

Complication	Observed cases	Number of operated patients	%
Synthetic mesh erosion/infection	45	1006	4.5
Blood loss > 500ml	41	690	5.9
Obstructive ileus	11	392	2.8
Adynamic ileus/	15	552	2.7
Pelvic haematoma	3	166	1.8

APPENDIX V – Paravaginal Repair Series

Authors	Year	N° of Patients	Cystocele Cured	recurrent	Follow-up Mean (range)	Outcome measure
White (71)	1909	19	19 (100 %)	0	Up to 3 years	?
Baden and Walker (2 bis)	1987	47	NA	NA	2-15 years	Object.
Shull et al. (63)	1994	62	47 (76 %)	15 (24 %)	1.6 (0.1-5.6 years)	Object
Grody et al (19 bis)	1995	72	71 (99 %)	1 (1 %)	(0.5-3 years)	Object
Farrel and Ling (15 ter)	1997	27	22 (80 %)	5 (20 %)	Mean 8 months	Object
Nguyen and Bhatia (46 bis)	1999	10	10 (100 %)	0	Mean 12 months	Object
Elkins et al. (15 bis)	2000	25	23 (92 %)	2 (8 %)	0.5-3 years	Object

APPENDIX VI– Synthetic Mesh for Anterior Wall Prolapse

Authors	Year	Technique	No cases	Follow-up	Recurrence	Measure outcome
Julian (24)	1996	Ant colpor + paravag repair + Marlex mesh	12 12 control (no mesh)	2 years	0 (but complications :25%) 33%	Objective (2 examiner)
Flood (16)	1998	Anterior colpor. + Marlex mesh	142	3,2y (mean)	0 (cure rate SUI = 74%)	
Mage (36)	1999	Polyester mesh (sutured to vaginal angles)	46	26 mo	0 recurrence 1 exposure	Subjective and objective
Migliari (40)	1999	4-corner + mixed fiber mesh	15	23,4 mo (mean)	1 cystocele 2 enterorectoceles (dry at follow-up = 13)	Objective
Migliari (41)	2000	Prolène mesh fixed to urethropelvic and cardinal ligaments	12	20,5 mo (mean)	3 grade 1 cystocele (asymptomatic)	Objective

APPENDIX VII – Posterior Wall Repair

Author-(Year)	Technique	N	Follow-up	Anatomic results	Symptom Resolution (of those having symptom, x % improved)
Kenton (1999) 26	Rectovaginal fascia reattachment	46	1 yr	Mean Ap value of – 2cm (-3 to 2cm) 77% improved	Protrusion : 90% Difficult defecation: 54% Constipation: 43% Dyspareunia : 92% Manual evacuation : 36%
Porter (1999) 51	Defect-specific posterior colporraphy	89	Up to 6 mo	82% improved	Stooling difficulties : 55% Vaginal mass : 74% Splinting : 65% Dyspareunia : 73%
Cundiff (1998)	Defect-specific posterior colporraphy	69	Median 12 mo (3-48)	Mean Ap and Bp –2.4 (94% improved)	Dyspareunia : 33% Constipation : 72% Splinting: 44% Fecal incontinence: 55%
Kahn (1997)	Traditional posterior colporrhaphy	140, 31 phone only	Mean 42.5 mo (11-74)	76% improved	Pressure: 37% Note: Dyspareunia incr from 30 to 47/171 post op, fecal incontinence incr from 30-47/171 post op, constipation incr from 38-56/171 post op_
Mellgran (1997) 148	Traditional posterior colporrhaphy	25	Mean 1 Yr	96% improved	Constipation: 88% Note: Dyspareunia incr from 1 to 3/16 post op

REFERENCES

1. Mant J, Painter R. Vessey M. Epidemiology of genital prolapse: observations from the Oxford Family Planning Association study. Br J Obstet Gynaecol 1997;104:579-85
2. Samuelsson EC, Victor FTA, Tibblin G, Sv@rdsudd KF. Signs of genital prolapse in a Swedish population of women 20 to 59 years of age and possible related factors. Am J Obstet Gynecol 1999;180:299-305
3. Rinne KM, Kirkinen PP. What predisposes young women to genital prolapse? Eur J Obstet Gynecol Reprod Biol 1999; 84:23-5
4. Swift SE. The distribution of pelvic organ support in a population of female subjects seen for routine gynecologic health care. Am J Obstet Gynecol 2000;183:L277-85
5. Progetto Menopausa Italia Study Group. Risk factors for genital prolapse in non-hysterectomized women around menopause – results from a large cross-sectional study in menopausal clinics in Italy. Eur J Obstet Gynecol Reprod Biol 2000;93:125-40
6. Klein MC, Gauthier RJ, Robbins JM, Kaczorowski MA, Jorgensen SH, Franco ED, Johnson B, Waghorn RN et al. Relationship of episiotomy to perineal trauma and morbidity, sexual dysfunction, and pelvic floor relaxation. Am J Obstet Gynecol 1994;171:591-8
7. Taskin O, Wheeler JM, Yalcinoglu AI, Coksenim S. The effects of episiotomy and Kegel exercises on postpartum pelvic relaxation: a prospective controlled study. J Gynecol Surg 1996; 12:123-7
8. Olsen AL Smith VJ, Bergstrom JO, Colling JC, Clark AL. Epidemiology of surgically managed pelvic organ prolapse and urinary incontinence. Obstet Gynecol 1997;89:501-6
9. Snooks SJ, Swash M, Henry MM, Setchel M. Risk factors in childbirth causing damage to the pelvic floor innervation. Int J Colorectal Dis 1986;1:20-4
10. Gilpin SA, Gosling JA, Smith ARB, Warrell DW. The pathogenesis of genitourinary prolapse and stress incontinence of urine. A histological and histochemical study. Br J Obstet Gynaecol 1989;96:15-23
11. Smith ARB, Hosker GL, Warrell DW. The role of partial denervation of the pelvic floor in the aetiology of genitourinary prolapse and stress incontinence of urine. A neurophysiologic study. Br J Obstet Gynaecol 1989;96:24-8
12. Jones PN, Lubowski DZ, Swash M, Henry MM. Relation between perineal descent and pudendal nerve damage in idiopathic faecal incontinence. Int J Colorectal Dis 1987;2:93-5
13. Lubowski DZ, Swash M, Nichols J, Henry MM. Increases in

pudendal nerve terminal motor latency with defecation straining. Br J Surg 1988;75:1095-7

14. Spence-Jones C, Kamm MA, Henry MM, Hudson CN. Bowel dysfunction: a pathogenic factor in uterovaginal prolapse and urinary stress incontinence. Br J Obstet Gynaecol 1994;101: 147-52
15. Davis GD. Uterine prolapse after laparoscopic uterosacral transection in nulliparous airborne trainees: a report of three cases. J Reprod Med 1996;41:279-82
16. Jorgensen S, Hein HO, Gyntelberg F. Heavy lifting at work and risk of genital prolapse and herniated lumbar disc in assistant nurses. Occup Med 1994;44:47-9
17. Bump RC, Sugerman HJ, Fantl FA, McClish DK. Obesity and lower urinary tract function in women: effect of surgically induced weight loss. Am J Obstet Gynecol 1992;167:392-9
18. Marchionni M, Bracco GL, Checcucci V, Carabaneanu A, Coccia EM, Mecacci F, Scarselli G. True incidence of vaginal vault prolapse: thirteen years experience. J Reprod Med 1999;44:679-84
19. Wiskind AK, Creighton Sm, Stanton SL. The incidence of genital prolapse after the Burch colposuspension. Am J Obstet Gynecol 1992;167:399-404
20. Holley Rl, Varner RE, Gleason BP, Apffel LA, Scott S. Recurrent pelvic support defects after sacrospinous ligament fixation for vaginal vault prolapse. J Am Col Surg 1995;180:444-8
21. Bump RC, Hurt WG, Theofrastous JP, Addison WA, Fantl JA, Wyman JF, McClish DK, and the Continence Program for Women Research Group. Randomized prospective comparison of needle colposuspension versus endopelvic fascia plication for potential stress incontinence prophylaxis in women undergoing vaginal reconstruction for stage III or IV pelvic organ prolapse. Am J Obstet Gynecol. 1996;175:326-335
22. Benson JT, McClennan E. The effect of vaginal dissection on the pudendal nerve. Obstet Gynecol, 82:387-9, 1993
23. Benson JT, Lucente V, McClennan E. Vaginal versus abdominal reconstructive surgery for the treatment of pelvic support defects: a prospective randomized study with long-term outcome evaluation. Am J Obstet Gynecol ,175:1418-22, 1996.
24. Good MC, Copas PR, Doody MC. Uterine prolapse after laparoscopic uterosacral transection. J Reprod Med 1993;72:995-6
25. Al-Rawizs S, Al-Rawizs T. Joint hypermobility in women with genital prolapse Lancet. 26:1439-41, 1982.
26. Marshman D, Percy J, Fielding I, Delbridge L. Rectal prolapse: relationship with joint mobility. Aust NZ J Surg 1987;545:827-9
27. Norton P, Boyd C, Deak S. Collagen synthesis in women with genital prolapse or stress urinary incontinence. Neurourol Urodyn 1992;11:300-1
28. McIntosh LJ, Mallett VT, Frahm JD, Richardson DA, Evans MI. Gynecologic disorders in women with Ehlers-Danlos syndrome. J Soc Gynecol Invest 1995;2:559-64
29. Jackson SR, Avery NC, Tarlton JF, Eckford SD, Abrams P, Bailey AJ. Changes in metabolism of collagen in genitourinary prolapse. Lancet 1996;347:1658-61
30. Carley ME, Schaffer J. Urinary incontinence and pelvic organ prolapse in women with Marfan or Ehlers-Danlos syndrome. Am J Obstet Gynecol 2000;182:1021-3
31. Lind LR, Lucente V, Kohn N. Thoracic kyphosis and the prevalence of advanced uterine prolapse. Obstet Gynecol 1996; 87:605-9
32. Nguyen JK, Lind LR, Choe JY, McKindsey F, Sinow R, Bhatia NN. Lumbosacral spine and pelvic inlet changes associated with eplvic organ prolsape. Obstet Gynecol 2000;95:332-6
33. Sze EH, Kohli N, Miklos JR, Roat T, Karram MM: A retrospective comparison of Abdominal Sacrocolpopexy with Burch Colsuspension versus Sacrospinosus Fixation with Transvaginal Needle Suspension for the Management of Vaginal Vault Prolapse and Coexisting Stress Incontinence. Int Urogynecol J Pelvic Floor Dysfunct 10 (1999):390-393
34. Blakely Cr, Mills Wg. The obstetric and gynaecological compliations of bladder exstrophy and epispadias. Br J Obstet Gynaecol, 88:167-73, 1981.
35. Al-Allard P, Rochette L. The descriptive epidemiology of hysterectomy, province of Quebec. Ann Epidemiol 1991;1:541-9, 1981-1988.
36. Luoto R, Rutanen EM, Kaprio J. Five gynecologic diagnoses associated with hysterectomy – trends in incidence of hospitalizations in Finland,1971-1986. Maturitas 1994;19:141-52
37. Bland Dr, Earle Bb, Vitolins Mz, Burke G. Use of pelvic organ prolapse staging system of the International Continence Society, American Urogynecologic Society, and Society of Gynecologic Surgeons in perimenopausal women. Am J Obstet Gynecol,181:1324-8, 1999.
38. Richardson DA, Bent AE, Ostergard DR. The effect of uterovaginal prolapse on urethrovesical pressure dynamics. Am J Obstet Gynecol 1983; 146:901-5.
39. Bergman A, Koonings PP, Ballard CA. Predicting postoperative urinary incontinence development in women undergoing operation for genitourinary prolapse. Amer J Obst Gynec, 158:1171, 1988.
40. Zivkovic F, Ralph G, Tamussino K, Michelitsch L, Haas J. Urethral profilometry in women with uterovaginal prolapse. Intl Urogynecol J Pelvic Floor Dysfunc 1995;6:10-13.
41. Chaikin DC, Groutz A, Blaivas JG. Predicting the need for anti-incontinence surgery in continent women undergoing repair of severe urogenital prolapse. J Urol 2000;163:531-534.
42. Gallentine ML, Cespedes RD. Occult stress urinary incontinence and the effect of vaginal vault prolapse on abdominal leak point pressures. Urol 2001;57:40-44.
43. Versi E, Lyell DJ, Griffiths DJ. Videourodynamic diagnosis of occult genuine stress incontinence in patients with anterior vaginal wall relaxation. Journal of the Society for Gynecologic Investigation. 5(6):327-30, 1998.
44. Klutke JJ, Ramos S, Margolin ML, et al. Urodynamic outcome after surgery for severe prolapse and potential stress incontinence. Amer J Obstet Gynecol 2000;182:1378-1381.
45. Karram MM. What is the optimal anti-incontinence procedure in women with advanced prolapse and 'Potential' stress incontinence? Intl Urogynecol J Pelvic Floor Dysfunc 1999;10:1-2.
46. Coates KW, Harris RL, Cundiff GW, Bump RC. Uroflowmetry in women with urinary incontinence and pelvic organ prolapse. Br J Urol 1997;80:217-221.
47. FitzGerald MP, Kulkarni N, Fenner D, Postoperative resolution of urinary retention in patients with advanced pelvic organ prolapse. Amer J Obstet Gynecol 2000;183:1361-1364.
48. Barrington JW, Edwards G. Posthysterectomy vault prolapse. Intl Urogynecol J Pelvic Floor Dysfunc 2000;11:241-245.
49. Yanik FF, Akpolat T, Kocak I. Acute renal failure - An unusual consequence of uterine prolapse. Nephrol Dial Transplant 1998;13:2648-2650.
50. Altringer WE, Saclarides TJ, Dominguez JM, Brubaker LT, Smith CS. Four-contrast defecography: Pelvic 'floor-oscopy'. Dis Colon Rectum 1995;38:695-699.
51. Kelvin FM, Hale DS, Maglinte DDT, Patten BJ, Benson JT. Female pelvic organ prolapse: Diagnostic contribution of dynamic cystoproctography and comparison with physical examination. Amer J Roentgenol 1999;173:31-37.
52. Agachan F, Pfeifer J, Wexner DS. Defecography and proctography: Results of 744 patients. Dis Colon Rectum 1996;39:899-905

53. Fenner DE, Diagnosis and assessment of sigmoidoceles. Amer J Obstet Gynecol 1996;175:1438-1442.

54. Karasick S, Ehrlich SM. Is constipation a disorder of defecation or impaired motility?: Distinction based on defecography and colonic transit studies. Amer J Roentgenol 1996;166:63-66.

55. Van Dam JH, Hop WCJ, Schouten WR. Analysis of patients with poor outcome of rectocele repair. Dis Colon Rectum 2000;43:1556-1560

56. Karlbom U, Graf W, Nilsson S, Pahlman L. Does surgical repair of a rectocele improve rectal emptying? Dis Colon Rectum 1996;39:1296-1302

57. Mellgren A, Anzen B, Nilsson BY, et al. Results of rectocele repair: A prospective study. Dis Colon Rectum 1995;38:7-13

58. Jackson SL, Weber AM, Hull TL, Mitchinson AR, Walters MD. Fecal incontinence in women with urinary incontinence and pelvic organ prolapse. Obstet Gynecol 1997;89:423-427

59. Emge LA, Durfee RB. Pelvic organ prolapse: four thousand years of treatment. Clin Obstet Gynecol 1966; 9: 997

60. Brubaker L, Norton P. Current clinical nomenclature for description of prolapse. J Pelvic Surg, 1996;7:256-9

61. Bump RC, Mattiasson A, Bø K, Brubaker LP, DeLancey JOL, Klarskov P, Shull BL, Smith ARB. The standardisation of terminology of female pelvic organ prolapse and pelvic floor dysfunction. Am J Obstet Gynecol. 1996;175:10-17

62. Archer BD, Somers S, Stevenson GW, Contrast medium gel for marking vaginal position during defecography. Radiology, 1992. 182: p. 278-279

63. Hock D, Lombard R, Jehaes C, et al., Colpocystodefecography. Dis Colon Rectum, 1993. 36: p. 1015-1021

64. Kelvin FM, Maglinte D, Benson JT, Brubaker LP, Smith C, Dynamic cystoproctography: a technique for assessing disorders of the pelvic floor in women. Am J Roentgenol, 1994. 163: p. 368-370.

65. Mahieu P, Pringot J, Bodart P, Defecography. 1. Description of a new procedure and results in normal patients. Gastrointest Radiol, 1984. 9: p. 247-251.

66. Kelvin FM, Maglinte D, Hornback JA, Benson JT, Pelvic Prolapse: assessment with evacuation proctography (defecography). Radiology, 1992. 2: p. 136-140.

67. Shorvon PJ, McHugh S, Diamant NE, Somers S, Stevenson GW., Defecography in normal volunteers: results and implications. Gut, 1989. 30: p. 1737-1749.

68. Creighton, S.M., Pearce, J.M. and Stanton, S.L. (1992) Perineal video-ultrasonography in the assessment of vaginal prolapse: early observations. Br J Obstet Gynaecol 99, 310-313.

69. Wise, B.G., Khullar, V. and Cardozo, L.D. (1992b) Bladder neck movement during pelvic floor contraction and intravaginal electrical stimulation in women with and without genuine stress incontinence. Neurourol Urodyn 11, 309-311 (Abstract).

70. Clark, A., Creighton, S.M., Pearce, M. and Stanton, S.L. (1990) Localisation of the bladder neck by perineal ultrasound: methodology and applications. Neurourol Urodyn 9, 394-395(Abstract).

71. Karaus M, Neuhaus P, Wiedenmann TB. Diagnosis of enteroceles by dynamic anorectal endosonography. Dis Colon Rectum 2000; 43(12): 1683-8.

72. Bhatia, N.N., Ostergard, D.R. and McQuown, D. (1987) Ultrasonography in Urinary Incontinence. Urology 29, 90-94.

73. Boos, K., Athanasiou, S., Toozs-Hobson, P., Cardozo, L., Khullar, V. and Hextall, A. (1997) The dynamics of the pelvic floor extrinsic continence mechanism before and after Burch colposuspension. Neurourol Urodyn 16, 411-412 (Abstract).

74. Peschers, U., Schaer, G., Anthuber, C., Delancey, J.O. and Schuessler, B. (1996) Changes in vesical neck mobility following vaginal delivery. Obstet Gynecol 88, 1001-1006.

75. Bernstein, I., Juul, N., Gronvall, S., Bonde, B. and Klarskov, P. (1991) Pelvic floor muscle thickness measured by perineal ultrasonography. Scand J Urol Nephrol 137S, 131-133.

76. Bernstein, I.T. (1997) The pelvic floor muscles: muscle thickness in healthy and urinary-incontinent women measured by perineal ultrasonography with reference to the effect of pelvic floor training. Estrogen receptor studies. Neurourol Urodyn 16, 237-275.

77. Athanasiou, S., Boos, K., Khullar, V., Anders, K. and Cardozo, L. (1996) Pathogenesis of genuine stress incontinence and urogenital prolapse. Neurourol Urodyn 15, 339-340 (Abstract).

78. Nguyen JK, Hall CD, Taber E and Bhatia NN. Sonographic diagnosis of paravaginal defects: a standardization technique. Int Urogynecol 2000; 11: 341-345.

79. Delancey, J.O. and Hurd, W.W. (1998) Size of the urogenital hiatus in the levator ani muscles in normal women and women with pelvic organ prolapse. Obstet Gynecol 91, 364-368.

80. Hricak H. MRI of the female pelvis: a review. AJR 1986: 146: 1115-1122.

81. Tan IL, Stokker J, Zwamborn AW, Entius KA, Calame JJ, Lameris JS. Female pelvic floor: endovaginal MR imaging of normal anatomy. Radiology, 1998:206:777-783.

82. Nurenberg P, Forte T, Zimmern PE. Normative female urethral and supportive structural measurements determined by body coil and endorectal coil MRI. Progres en Urologie, 2000: 10: 224-230.

83. Lamb GM, deJode MG, Gould SW, Spouse E, Birnie K, Darzi A, Gedroyc WMW. Upright dynamic MR defecaeting proctography in an open configuration system. British Journal of Radiology, 2000:73:152-155.

84. Goodrich MA, Webb MJ, King BF, Bampton AEH, Compeau NG, Riederer SJ. Magnetic resonance imaging of pelvic floor relaxation: dynamic analysis and evaluation of patients before and after surgical repair. Obstet Gynecol 1993: 82:883-891.

85. Yang A, Mostwin JL, Rosenshein NB, Zerhouni EA. Pelvic floor descent in women: Dynamic evaluation with fast MR imaging and cinematic display. Radiology, 1991:19:25-33.

86. Comiter CV, Vasavada SP, Barbaric ZL, Gousse AE, and Raz, S. Grading pelvic prolapse and pelvic floor relaxation using dynamic magnetic resonance imaging. Urology, 1999: 54:454-457.

87. Fielding JR, Dumanli H, Schreyer AG, Okuda S, Gering DT, Zou KH, Kikinis R, Jolesz FA. MR-based three dimensional modeling of the normal pelvic floor in women: quantification of muscle mass. AJR, 2000:174:657-660.

88. Healy JC, Halligan S, Reznck RH, Watson S, Phillips RKS, Armstrong P. Patterns of prolapse in women with symptoms of pelvic floor weakness: assessment with MR imaging. Radiology 1997:203:77-81.

89. Goh V, Halligan S, Kaplan G, Healy JC, Bartram CI. Dynamic MR Imaging of the pelvic floor in asymptomatic subjects. AJR 2000:174:661-666.

90. Bo K, Lilleas F, Talseth T, Hedland H. Dynamic MRI of the pelvic floor muscles in an upright sitting position. NeuroUrol and Urodyn., 2001:20: 167-174.

91. Gousse AE, Barbaric ZL, Safir MH, Madjar S, Marumoto AK, and Raz, S. Dynamic half Fourier acquisition, single shot turbo spin-echo magnetic resonance imaging for evaluating the female pelvis. J.Urol. 2000: 164:1606-1613.

92. Tunn R, Paris St, Taupitz M, Hamm B, Fischer W. MR Imaging in posthysterectomy vaginal prolapse. International Urogynecology, 2000: 11:87-97.

93. Lamb GM, deJode MG, Gould SW, Spouse E, Birnie K, Darzi

A, Gedroyc WMW. Upright dynamic MR defecaeting proctography in an open configuration system. British Journal of Radiology, 2000:73:152-155.

94. Mattox TF, Bhatia NN. Urodynamic effects of reducing devices in women with genital prolapse. Int Urogynecol J 1994;5:283-6.

95. Bhatia NN, Bergman A, Gunning JE> Urodynamic effects of a vaginal pessary in women with stress urinary incontinence. Am J Obstet Gynecol 1983; 147:876-84.

96. Bump RC, Fantl JA, Hurt WG. The mechanism of urinary incontinence in women with severe uterovaginal prolapse: results of barrier studies. Obstet Gynecol 1988; 72:291-5.

97. Ramahi AJ, Richardson DA. Urodynamic changes in women using diaphragms. Neurourol Urodynam, 9: 569, 1990.

98. Hextall A, Boos K, Cardozo L, Toozs-Hobson P, Anders K, Khullar V. Videocystourethrography with a ring pessary in situ. A clinically useful preoperative investigation for continent women with urogenital prolapse? International Urogynecology Journal & Pelvic Floor Dysfunction. 9(4):205-9, 1998.

99. Sulak PJ, Kuehl TJ, Shull BL. Vaginal pessaries and their use in pelvic relaxation. J Reprod Med 1993; 38:919-23.

100. Veronikis DF, Nichols DH, Wakamatsu MM. The incidence of low-pressure urethra as a function of prolapse-reducing technique in patients with massive pelvic organ prolapse (maximum descent at all vaginal sites). American Journal of Obstetrics & Gynecology. 177(6):1305-13; discussion 1313-4, 1997.

101. Richardson DA, Bent AE, Ostergard DR. The effect of uterovaginal prolapse on urethrovesical pressure dynamics. Am J Obstet Gynecol 1983; 146:901-5.

102. Romanzi LJ, Chaikin DC, Blaivas JG. The effect of genital prolapse on voiding. Journal of Urology. 161(2):581-6, 1999.

103. Versi E, Lyell DJ, Griffiths DJ. Videourodynamic diagnosis of occult genuine stress incontinence in patients with anterior vaginal wall relaxation. Journal of the Society for Gynecologic Investigation. 5(6):327-30, 1998.

104. Fianu S, Kjaeldgaard A, Larsson B. Preoperative screening for latent stress incontinence in women with cystocele. Neurourol Urodyn 1985:4:3-8.

105. Borstad E, Rud T. The risk of developing urinary stress incontinence after vaginal repair in continent women: a clinical and urodynamic follow up study. Acta Obstet Gynecol Scand 1989; 68:545-9.

106. Bergman A, Koonings PP, Ballard CA. Predicting postoperative urinary incontinence development in women undergoing operation for genitourinary prolapse. Amer J Obst Gynec, 158: 1171, 1988.

107. Bump RC, Hurt WG, Theofrastous JP, Addison WA, Fantl JA, Wyman JF, et al. Randomized prospective comparison of needle colposuspension versus endopelvic fascia plication for potential stress incontinence prophylaxis in women undergoing vaginal reconstruction for stage III or IV pelvic organ prolapse. Am J Obstet Gynecol 1966; 175:326-35.

108. Weber AM, Abrams P, Brubaker L. The Standardization of Terminology for Researchers in Female Pelvic Floor Disorders. Int Urogynecol J 2001; 12:178-186

109. Marana HR, Andrade JM, Marana RR, Matheus de Sala M, Philbert PM, Rodriguez R. Vaginal hysterectomy for correcting genital prolapse. Long-term evaluation. J Reprod Med, 1999 ; 44 : 529-534

110. Benson JT, Lucente V, McClellan E. Vaginal versus abdominal reconstructive surgery for the treatment of pelvic support defects : a prospective randomized study with long-term outcome evaluation. Am J Obstet Gynecol, 1996 ; 175 : 1418-1421

111. Brown WE, Hoffman MS, Bouis PJ, Ingram JM, Hopes JL. Management of vaginal vault prolapse : retrospective comparison of abdominal versus vaginal approach. J Fla Med Assoc, 1989 ; 76 : 249-252

112. Hardimann PJ, Drutz HP. Sacrospinous vault suspension and abdominal colposacropexy : success rates and complications. Am J Obstet Gynecol, 1996 ;175: 612-616

113. Lo TS, Wang AC. Abdominal colposacropexy and sacrospinous ligament suspension for severe uterovaginal prolapse : a comparison. J Gynecol Surg, 1998 ; 14 : 59-64

114. Sze EHM, Kohli N, Miklos JR, Roat T, Karram MM. A retrospective comparison of abdominal sacrocolpopexy with Burch colposuspension versus sacrospinous fixation with transvaginal needle suspension for the management of vaginal prolapse and coexisting stress incontinence. Int Urogynecol J, 1999 ; 10 : 390-393

115. Given FT, Muhlendorf IK, Browing GM: Vaginal length and sexual funktion after colpopexy for uterovaginal eversion. Obstet. Gynecol 169 (1993):284-288

116. Anthuber C, Schüssler B, Hepp H: Die operative Therapie des Scheidenblindsackvorfalls. Der Gynäkologe 29 (1996):652-658

117. Colombo M, Vitobello D, Proietti F, Milani R. Randomised comparison of Burch colposuspension versus anterior colporraphy in women with stress urinary incontinence and anterior vaginal wall prolapse. BJOG, 2000 ; 107 : 544-551

118. Schettini M, Fortunato P, Gallucci M: Abdominal Sacral Colpopexy with Prolene Mesh. Int Urogynecol J Pelvic Floor Dysfunct 10 (1999): 295-299

119. Pilsgaard K, Mouritsen L:. Follow–up after repair of vaginal vault prolapse with abdominal colposacropexy. Acta Obstet Gynecol Scand 78 (1999):66-70

120. Fox SD, Stanton SL: Vault prolapse and rectocele: Assessement of repair using sacrocolpopexy with mesh interposition. BJ Obstet Gynecol;107 (2000): 1371-1375

121. Iglesia CB, Fenner DE, Brubaker L: The Use of Mesh in Gynecologic Surgery. Int. Urogynecol J 8 (1997):105-115

122. Baessler K, Schuessler B: Abdominal Sacropopexy and Anatomy and Function of the Posterior Compartment. Obstet Gynecol 97 (2001): 678-84

123. Visco AG, Weidner AC, Barber MD, Myers ER, Cundiff GW, Bump RC, Addison AW: Vaginal mesh erosion after abdominal sacral colpopexy. J Obstet Gynecol 184, (2001):297-302

124. Weidner AC, Geoffrey WC, Harris RL, Addison A: Sacral osteomyelitis: An unusual complication of abdominal sacral colopexy. Obstet Gynecol 90 (1997):689-691

125. Weber AM, Walters MD. Anterior vaginal prolapse : review of anatomy and techniques of surgical repair. Obstet Gynecol, 1997 ; 89 : 311-318

126. Kohli N, Sze EHM, Roat TW, Karram MM. Incidence of recurrent cystocele after anterior colporrhaphy with and without concomitant transvaginal needle suspension. Am J Obstet Gynecol, 1996 ; 175 : 1476-1482

127. White GR. Cystocele : a radical cure by suturing lateral sulci of vagina to white line of pelvic fascia. JAMA, 1909; 21 : 1707-1710

128. Shull BL, Baden WF. A six-year experience with paravaginal defect repair for stress urinary incontinence. Am J Obstet Gynecol, 1989 ; 160 : 1432 – 1440

129. Scotti RJ, Garely AD, Greston WM, Flora RF, Olson TR. Paravaginal repair ol lateral vaginal wall defects by fixation to the ischial periosteum and obturator membrane. Am J Obstet Gynecol, 1998 ; 179 : 1436-1445

130. NguyenJK, Bhatia NN. Transvaginal repair of paravaginal defects using the Capio suturing device: A preliminary experience. J. Gynecol Tech 1999;5:51-54

131. Baden WF, Walker T. Urinary stress incontinence: Evolution of paravaginal repair. Female Patient 1987;12:89-105

132. Grody MHT, Nyirjesy P. Kelley LM et al. Paraurethral fascial sling urethropexy and vaginal paravaginal defects cystopexy in the correction of urethrovesical prolapse. Int Urogynecol J Pelvic Floor Dysfunct 1995;6:80-85

133. Farrell SA, Ling C. Currycombs for the vaginal paravaginal defect repair.

134. Obstet Gynecol 1997;90:845-847

135. Miyazaki FS, Miyazaki DW. Raz four-corner suspension for severe cystocele : poor results. Int Urogynecol J, 1994 ; 5 : 94-97

136. Raz S, Klutke CG, Golomb J. Four-corner bladder and urethral suspension for moderate cystocele. J Urol, 1989 ; 142 : 712-715

137. Zimmern PE, Leach GE, Sirls L. Four-corner bladder neck suspension.

138. Atlas of urologic clinics of North America, 1994 ; 2 (1) : 29-36

139. Julian T. The effacacy of Marlex mesh in the repair of severe, recurrnt vaginal prolapse of the anterior midvaginal wall. Am J Obstet Gynecol, 1996 ; 175 : 1472-1475

140. Flood CG, Drutz HP, Waja L. Anterior colporraphy reinforced with Marlex mesh for the treatment of cystocèles. Int Urogynecol J Pelvic Floor Dysfunct, 1998 ; 9 : 200-204

141. Mage P. Interposition of a synthetic mesh by vaginal approach in the cure of genital prolapse. J Gynecol Obstet Biol Reprod (Paris), 1999 ; 28 : 825-829

142. Migliari R, Usai E. Treatment results using a mixed fiber mesh in patients with grade IV cystocele. J Urol, 1999 ; 161 : 1255-1258

143. Migliari R, De Angelis M, Madeddu G, Verdacchi T. Tension-free vaginal mesh repair for anterior vaginal wall prolapse. Eur Urol, 2000 ; 38 : 151-155

144. Kenton K, Shott S, Brubaker L. Outcome after rectovaginal fascia reattachement for rectocele repair. Am J Obstet Gynecol, 1999 ; 181 : 1360-1364

145. Porter WE, Steele A, Walsh P, Kohli N, Karram MM. The anatomic and functional outcomes of defect-specific rectocele repair. Am J Obstet Gynecol, 1999 ; 181 : 1352-1359

146. Cundiff GW, AC Weidner, AG Visco, WA Addison , BumpRC. An anatomical and functional assessment of the discrete defect rectocele repair. Am J Obstet Gynecol 1998;179:1451-7

147. Kahn MA, Stanton SL. Posterior colporrhaphy: its effects on bowel and sexual function. Br J Obstet Gynaecol 1997;104:82-86

148. Mellgren A, Anzen B, Nilsson BY, Johansson C, Dolk A, Gillgren P, Bremmer S, Holmstrom Results of rectocele repair; a prospective study. Dis Colon Rectum 1995;38:7-13

149. Black, NA Downs, SH. The effectiveness of surgery for stress incontinence in women: a systematic review. Br J Urol 1996; 78:497-510.

150. Wall LL, Versi E, Norton P, Bump R. Evaluating the outcome of surgery for pelvic organ prolapse. Amer J Obstet Gynecol 1998; 178:877-879.

151. Schulz KF, Chalmers I, Hayes RJ, et al. Empirical evidence of bias: dimensions of methodological quality associated with estimates of treatment effects in controlled trials. JAMA 1995;273:408-12.